10.22: VISUAL_PROCESSING

Visual signals are processed in the brain through several different pathways.

LEARNING OBJECTIVES

- Describe the complexity of visual processing in the brain

KEY POINTS

- The magnocellular pathway carries information about form, movement, depth, and differences in brightness; the parvocellular pathway carries information on color and fine detail.
- The optic chiasma allows us to coordinate information between both eyes and is produced by crossing optical information across the brain.
- Visual signals move from the visual cortex to either the parietal lobe or the temporal lobe.
- Some signals move to the thalamus, which sends the visual signals to the primary cortex.
- Visual signals can also travel from the retina to the superior colliculus, where eye movements are coordinated with auditory information.
- Visual signals can move from the retina to the suprachiasmatic nucleus (SCN), the body's internal clock, which is involved in sleep/wake patterns and annual cycles.

KEY TERMS

- **superior colliculus**: the primary area of the brain where eye movements are coordinated and integrated with auditory information
- **optic chiasma**: found at the base of the brain and coordinates information from both eyes
- **suprachiasmatic nucleus**: cluster of cells that is considered to be the body's internal clock, which controls our circadian (day-long) cycle

HIGHER PROCESSING

The myelinated axons of ganglion cells make up the optic nerves. Within the nerves, different axons carry different parts of the visual signal. Some axons constitute the magnocellular (big cell) pathway, which carries information about form, movement, depth, and differences in brightness. Other axons constitute the parvocellular (small cell) pathway, which carries information on color and fine detail. Some visual information projects directly back into the brain, while other information crosses to the opposite side of the brain. This crossing of optical pathways produces the distinctive optic chiasma (Greek, for "crossing") found at the base of the brain and allows us to coordinate information from both eyes.

Once in the brain, visual information is processed in several places. Its routes reflect the complexity and importance of visual information to humans and other animals. One route takes the signals to the thalamus, which serves as the routing station for all incoming sensory impulses except smell. In the thalamus, the magnocellular and parvocellular distinctions remain intact; there are different layers of the thalamus dedicated to each. When visual signals leave the thalamus, they travel to the primary visual cortex at the rear of the brain. From the visual cortex, the visual signals travel in two directions. One stream that projects to the parietal lobe, in the side of the brain, carries magnocellular ("where") information. A second stream projects to the temporal lobe and carries both magnocellular ("where") and parvocellular ("what") information.

Another important visual route is a pathway from the retina to the superior colliculus in the midbrain, where eye movements are coordinated and integrated with auditory information. Finally, there is the pathway from the retina to the suprachiasmatic nucleus (SCN) of the hypothalamus. The SCN is a cluster of cells that is considered to be the body's internal clock, which controls our circadian (day-long) cycle. The SCN sends information to the pineal gland, which is important in sleep/wake patterns and annual cycles.

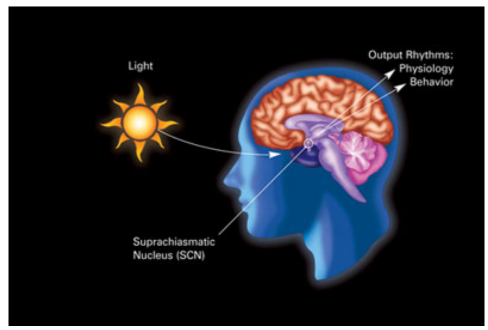

Figure 10.22.1: The suprachiasmatic nucleus (SNC): The presence of light and darkness influences circadian rhythms and related physiology and behavior through the SCN.

CONTRIBUTIONS AND ATTRIBUTIONS

- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_03.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Biology. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...ol11448/latest. **License**: ***CC BY: Attribution***
- transduction. **Provided by**: Wiktionary. **Located at**: **en.wiktionary.org/wiki/transduction**. **License**: ***CC BY-SA: Attribution-ShareAlike***
- Boundless. **Provided by**: Boundless Learning. **Located at**: **www.boundless.com//biology/de...tonic-activity**. **License**: ***CC BY-SA: Attribution-ShareAlike***
- rhodopsin. **Provided by**: Wiktionary. **Located at**: **en.wiktionary.org/wiki/rhodopsin**. **License**: ***CC BY-SA: Attribution-ShareAlike***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_01.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_02.png. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_03.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_06.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_04.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_05.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Biology. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...ol11448/latest. **License**: ***CC BY: Attribution***
- Boundless. **Provided by**: Boundless Learning. **Located at**: **www.boundless.com//biology/de.../optic-chiasma**. **License**: ***CC BY-SA: Attribution-ShareAlike***
- Boundless. **Provided by**: Boundless Learning. **Located at**: **www.boundless.com//biology/de...smatic-nucleus**. **License**: ***CC BY-SA: Attribution-ShareAlike***
- Boundless. **Provided by**: Boundless Learning. **Located at**: **www.boundless.com//biology/de...ior-colliculus**. **License**: ***CC BY-SA: Attribution-ShareAlike***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_01.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_02.png. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_03.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_06.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_04.jpg. **License**: ***CC BY: Attribution***
- OpenStax College, Vision. October 17, 2013. **Provided by**: OpenStax CNX. **Located at**: http://cnx.org/content/m44761/latest...e_36_05_05.jpg. **License**: ***CC BY: Attribution***
- Suprachiasmatic nucleus. **Provided by**: Wikipedia. **Located at**: **http://en.Wikipedia.org/wiki/Suprachiasmatic_nucleus**. **License**: ***Public Domain: No Known Copyright***