

Making Neuroscience Fun



A Brain Awareness Program for All Ages
It's SPECTacular!

Science Behind the Story Team Work (🌍 A Brain Facts Story) (K – 5-6 yrs)

This story explains how the brain works with the body to let all animals (including humans) do everything that they do.

🌍 The brain and the body working together is important.

The brain, or more precisely the nervous system, and the body work together to produce all of the behaviors of an animal.

The term “brain” refers to the structure that lies within your skull (brainfacts.org).

It is part of a central system along with the spinal cord. The central system is connected to every part of your body by nerves which make up the peripheral system. Collectively, the central and peripheral systems make up the **nervous system**.

The nervous system controls behaviors and then the behaviors change the nervous system.

The nervous system has the remarkable ability to change. It adapts. Our nervous system adapts to our changing environment and allows us to survive. This is known as neuroplasticity (Fuchs, 2014; Demarin, 2014).

🌍 The body gets information from the world and tells it to the brain.

In order for the nervous system to receive information from the outside world (or basically from anything outside of the central nervous system) – it uses our sensory systems.

This includes information relating to our 5 senses: taste, touch, sound, vision, and smell – well actually 6 senses (Cao, 2019).

Gustation (1) and olfaction (2) make up our chemical senses. We then have vision (3), which obviously allows us to see. Then there are our inner ear senses, audition (4) and information from our vestibular system (5) (regarding balance and the position of our head on our body). There is then somatosensation (6) which includes pain, stretch, vibration, temperature, and proprioception – which is a muscle sense.

The sensory receptors are activated and they then send information, via the sensory pathways, to different parts of our cerebral cortex (Zhang, 2022).

🌍 Your brain then “decides” what you do with that information.

Within your cerebral cortex the sensory information is linked to internal representations (memories and context) of the sensory information and then produces adaptive responses (Rolls, 2000).

These responses typically involve the motor cortex and movements of the body (Ebbesen, 2017) and the autonomic nervous system (which is involved in controlling your internal organs – such as your heart, lungs and gastrointestinal system) (verywellmind.org). In this way, the nervous system allows you to produce a movement that allows you to respond to the sensory information.

The consequences of the behavior are then stored for future use by the nervous system.

National Education Standards:

Next Generation Science Standards

- Crosscutting Concepts:
 - **Structure & Function:** The way an object is shaped or structured determines many of its properties and functions.
 - Systems in the natural and designed world have parts that work together.
 - Objects and organisms can be described in terms of their parts.
 - **Systems and System Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
 - Systems in the natural and designed world have parts that work together.
 - Objects and organisms can be described in terms of their parts.
 - **Cause & Effect:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.
 - Events have causes that generate observable patterns.
- Related Grade Level Content
 - Structures and Processes of Organisms

National Health Education Standards (Shape America) & CDC (Centers for Disease Control and Prevention)

- **Standard 1:** Students will comprehend concepts related to health promotion and disease prevention to enhance health.
 - 1.2.2: Recognize that there are multiple dimensions of health. **(CDC)**

References:

Cao Y, Summerfield C, Park H, Giordano BL, Kayser C. Causal Inference in the Multisensory Brain. *Neuron*. 2019 Jun 5;102(5):1076-1087.e8. doi: 10.1016/j.neuron.2019.03.043. Epub 2019 Apr 29. PMID: 31047778.

Demarin, V. et al., Neuroplasticity. *210 Period Biol*, Vol 116, No 2, 2014.

Ebbesen CL, Brecht M. Motor cortex - to act or not to act? *Nat Rev Neurosci*. 2017 Oct 18;18(11):694-705. doi: 10.1038/nrn.2017.119. PMID: 29042690.

Fuchs E, Flügge G. Adult neuroplasticity: more than 40 years of research. *Neural Plast*. 2014;2014:541870. doi: 10.1155/2014/541870. Epub 2014 May 4. PMID: 24883212; PMCID: PMC4026979.

Rolls ET. Memory systems in the brain. *Annu Rev Psychol*. 2000;51:599-630. doi: 10.1146/annurev.psych.51.1.599. PMID: 10751982.

Zhang N, Xu NL. Reshaping sensory representations by task-specific brain states: Toward cortical circuit mechanisms. *Curr Opin Neurobiol.* 2022 Sep 15;77:102628. doi: 10.1016/j.conb.2022.102628. Epub ahead of print. PMID: 36116166.

<http://www.brainfacts.org/The-Brain-Facts-Book>

<https://www.verywellmind.com/what-is-the-autonomic-nervous-system-2794823>