



Science Behind the Story (SBS)
Your Tummy Helps Your Brain- REALLY? (🌈 A Physical Health Story)
(Kindergarten – 5-6 years old)

This story describes how your stomach and brain work together to keep you alive and healthy.

- 🌈 Your body and your brain “talk” to each other. When you are hungry, your stomach (gastrointestinal system) sends signals to your brain to let you know that you are hungry. Your brain then tells your body to get food.

The brain and the spinal cord, which make up the central nervous system (CNS), sends out and receives signals from the all parts of the body through nerves which are part of the peripheral nervous system (PNS) (brainfacts.org). Efferent nerves carry information from the brain to the body and afferent nerves send information from the body to the brain (Micera, 2009).

There are a number of signals that are sent from the gastrointestinal system, such as ghrelin, which tells the hypothalamus that you are hungry (Caron, 2017). The hypothalamus then sends signals to other parts of your brain, such as the cortex, limbic system, which tells your body to get and eat food (Caron, 2017).

- 🌈 Your brain needs energy to do all the things it has to do. We get energy from food.

We eat so that we can get food that we need for energy and also nutrients that our body needs for growth, maintenance, and repair of body structures (Breedlove, 2020).

Your nervous system is the most metabolically active part of your body (Karbowski, 2007). Most of the energy (30%) we need is used for our basal metabolism, this is the maintenance of our homeostatic processes (temp, fluids) and other resting processes (neural potentials) (Tomasi, 2013).

We get our energy from the nutrients that we consume which are converted into glucose, fatty acids and ketones (Randle, 1994).

- 🌈 Your brain and tummy are the perfect partners, they both need each other in order to do the work they need to do.

There are constantly signals that go between the body and the brain that regulate our feeding behaviors (Breedlove, 2020). Recently, we are learning a lot about how much of a role your gastrointestinal system plays on the functioning of your brain, especially when it comes to your brain health (Adan, 2019)

National Standards:

Next Generation Science Standards

- Crosscutting Concepts:

- **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.
- **Energy & Matter:** Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior.
- **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
 - **Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment**
 - K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.

References:

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Caron A, Richard D. Neuronal systems and circuits involved in the control of food intake and adaptive thermogenesis. *Ann N Y Acad Sci.* 2017 Mar;1391(1):35-53. doi: 10.1111/nyas.13263. Epub 2016 Oct 21. PMID: 27768821.

El Bacha, T., Luz, M. & Da Poian, A. (2010) Dynamic Adaptation of Nutrient Utilization in Humans. *Nature Education* 3(9):8.

Karbowski J. Global and regional brain metabolic scaling and its functional consequences. *BMC Biol.* 2007 May 9;5:18. doi: 10.1186/1741-7007-5-18. PMID: 17488526; PMCID: PMC1884139.

Micera S, Navarro X. Bidirectional interfaces with the peripheral nervous system. *Int Rev Neurobiol.* 2009;86:23-38. doi: 10.1016/S0074-7742(09)86002-9. PMID: 19607988.

Randle PJ, Priestman DA, Mistry SC, Halsall A. Glucose fatty acid interactions and the regulation of glucose disposal. *J Cell Biochem.* 1994;55 Suppl:1-11. doi: 10.1002/jcb.240550002. PMID: 7929613.

Tomasi D, Wang GJ, Volkow ND. Energetic cost of brain functional connectivity. *Proc Natl Acad Sci U S A.* 2013 Aug 13;110(33):13642-7. doi: 10.1073/pnas.1303346110. Epub 2013 Jul 29. PMID: 23898179; PMCID: PMC3746878.

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