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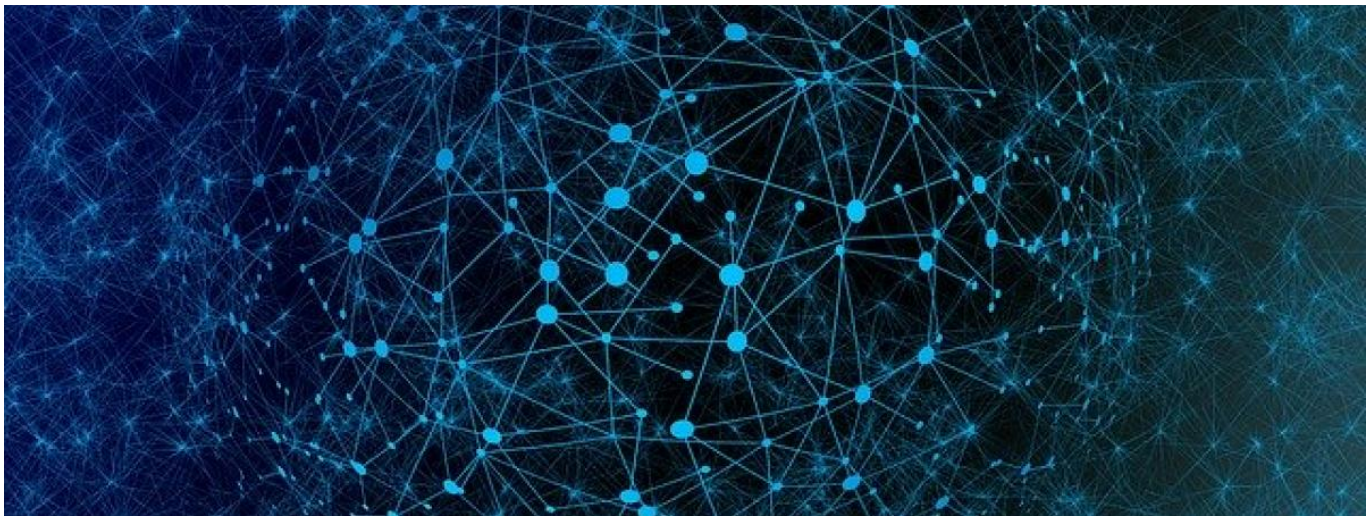
brain [2] wonder [3]



Waking and walking, movement and memory, hearing and heartbeat, dreams, digestion, touch, taste and thought—just some of the reasons to be thankful for the wonderful web of neurons that is your nervous system.

Awesome

Described as a “chemical machine able to control functions across timescales ranging from milliseconds (like returning a tennis serve at 100mph) to years (like remembering how to ride a bicycle),” the human nervous system is arguably the most amazing, incredible, complex thing in the universe.

Brain

The brain [4] is the chief executive of the nervous system, responding to as many as one quadrillion (1,000,000,000,000,000) pieces of information in a lifetime. At 1.3kg in weight it is uninspiring to look at, being creamy coloured and wrinkled, with the consistency of a raw egg.

Central nervous system

Consists of the brain and spinal cord—with the spinal cord, weighing just 42g, acting as a link between the brain and the nerves in the rest of the body.

Divisions

The other major division is the peripheral nervous system, which carries sensory information to the central nervous system and transmits instructions out to the rest of the body.

Enteric nervous system

You've got a *second* brain [5]—in your gut. Consisting of more than 100 million nerve cells, the "enteric" nervous system helps with digestion. It's likely that the two brains "talk" to each other, with some digestive disorders triggering mood changes; therapies for the mind might then treat the gut too.

Feelings

The Greek [6] for almond is "amygdala" and deep in your brain are two almond-shaped structures, called amygdalae. They play a central role in emotional responses such as fear, pleasure, anxiety and anger.

Glial cells

More numerous than the neurons in your brain, glial cells [7] get their name from the Greek for "glue" since they fix neurons in place, whilst also providing support and protection.

Henry Molaison (1926-2008)

This young man famously had part of his brain removed to control his epilepsy and became unable to form new memories. His misfortune has taught us much about how memories are made.

Information processing

The nervous system has been likened to everything from a seat of government to a court of justice, a parliament, a marketplace, a police station, a telephone exchange, a temple, an art gallery, a library, a central filing system and a computer—such are its information processing abilities.

Junctions

Ever wondered what it is that makes you, you? Sir Tim Berners-Lee, inventor of the World Wide Web, says: "All that we know, all that we are, comes *from the way our neurons are connected*." The connections are called synapses (from the Greek to "join together") and are reminiscent of the tiny space between the extended hands of God and Adam in Michelangelo's magnificent painting on the ceiling of the Sistine chapel.

Each of the 86 billion neurons in the brain forms thousands of synapses and, as you learn, specific connections are strengthened, new connections formed and memories made [8].

Kilometres

There are 170,000 kilometres of nerve fibres in your brain: stretched out, they would wrap four times around the globe.

Lobes

The brain is divided into four lobes [9], with, for example, the occipital lobes (at the back of the brain) being important in vision and the temporal lobes (near the ears) helping in the understanding of language.

Motor cortex

A strip-like region across the top of the brain, a little like a hairband, controlling your movements. Many brain cells in this area are specifically assigned to control body parts with fine movements (such as the hands and mouth).

Neurons

These cells are the basic building blocks of the nervous system, and communicate with each other through fast and fleeting electrical signals or more long-lasting chemical signals.

Oxygen

Neurons are more vulnerable than other cells to low oxygen levels, and can get damaged within minutes. For this reason, CPR [10] can help avoid permanent damage.

Personality

The brain's frontal lobes, just behind the forehead, are responsible for our individual personalities. Damage here, as in the famous case of Phineas Gage [11], can radically alter your reactions, from that of a cooperative and caring individual to one who is overbearing and obstinate.

Q10

Made within the body, coenzyme Q10 [12] is important for energy production. It is available as a dietary supplement but studies suggest that, despite claims to the contrary, it may not boost brain health [13], and that "the best way to get nutrients for brain health is from a healthy diet".

Reflexes

These are movements initiated more or less autonomously by the spinal cord, without control from the brain. Withdrawing your hand [14] from a hot object to protect against burns is a simple example.

Sensory neurons

Are designed to detect triggers outside the body, such as light, sound, smell, temperature and touch and even internal changes, such as blood pressure or acid levels in the blood.

Transmitters

Your brain contains more than 100 chemicals (known as neurotransmitters [15]), used to help carry messages between your brain cells. Some of these stimulate the brain, keeping us alert, engaged and focussed; others inhibit or calm brain activity. Alcohol [16] can upset the balance of brain chemicals.

Unconscious

We are not aware of much of the work going on in our nervous system. The nerves that control, for example, our breathing and heart rate, work whether or not we think about them, and that is a very good thing.

Vast

Much about the nervous system remains a mystery. Baroness Susan Greenfield, neuroscientist, writes that “it often seems that the more we learn, the more there is still to learn. It is a little like the monster of Greek mythology, the Hydra: once one head was cut off, seven grew in its place”.

She likens the number of neurons in the brain to the number of trees in the Amazon rainforest, and the number of connections between brain cells to the number of leaves on those trees.

Waves

A brain test, known as the EEG [17], records waves of electricity generated from neurons at the surface of the brain. Delta waves are the slowest, occurring during deep sleep; beta waves are seen when you are trying to concentrate; and alpha waves happen during wakeful, relaxed times.

eXtraordinary brains

Einstein's brain [18] worked out the theory of relativity, yet the secret of his genius remains a mystery. At autopsy, his brain was actually a little smaller than average. Whether the number of neurons, or glial cells, or whether particular lumps and bumps on the surface of his brain, had anything to do with his intelligence, is unclear.

Yin and yang

The brain is made of two hemispheres [19]: the left and the right. For the most part, each region is duplicated on either side, making the brain somewhat symmetrical. Some skills, such as facial recognition, use both hemispheres, whereas moving one's limbs, for example, involves brain areas on the opposite side of the body.

Zero

The number of times that neurons can be routinely replaced. Apart from rare exceptions [20] the neurons you have, once your nervous system matures, are all the neurons you will ever have. So look after them.

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Links
[1] https://www.readersdigest.co.uk/health/wellbeing/an-a-to-z-of-your-nervous-system [2] https://www.helencowan.co.uk/../tags/brain [3] https://www.helencowan.co.uk/../tags/wonder [4] https://www.readersdigest.co.uk/health/wellbeing/7-ways-to-keep-your-brain-sharp [5] https://www.hopkinsmedicine.org/health/wellness-and-prevention/the-brain-gut-connection [6] https://www.readersdigest.co.uk/inspire/life/the-magic-of-a-greek-christmas [7] https://www.cell.com/current-biology/pdf/S0960-9822(03)00404-4.pdf [8] https://www.readersdigest.co.uk/health/wellbeing/how-are-memories-made [9] https://qbi.uq.edu.au/brain/brain-anatomy/lobes-brain [10] https://www.bhf.org.uk/how-you-can-help/how-to-save-a-life/how-to-do-cpr [11] https://bigpictureeducation.com/brain-case-study-phineas-gage [12] https://www.readersdigest.co.uk/health/health-conditions/coenzyme-q10-the-miracle-cure [13] https://www.theguardian.com/science/2019/jun/29/save-your-money-no-evidence-brain-health-supplements-work-say-experts [14] https://www.kenhub.com/en/library/anatomy/the-withdrawal-reflex [15] https://www.compoundchem.com/2015/07/30/neurotransmitters/ [16] https://www.readersdigest.co.uk/food-drink/drinks/the-neuroscience-of-alcohol [17] https://www.nhs.uk/conditions/electroencephalogram/ [18] https://www.bbc.co.uk/news/magazine-32354300 [19] https://www.cogneurosociety.org/behrmann_qa/ [20] https://www.theguardian.com/science/2018/apr/05/humans-produce-new-brain-cells-throughout-their-lives-say-researchers