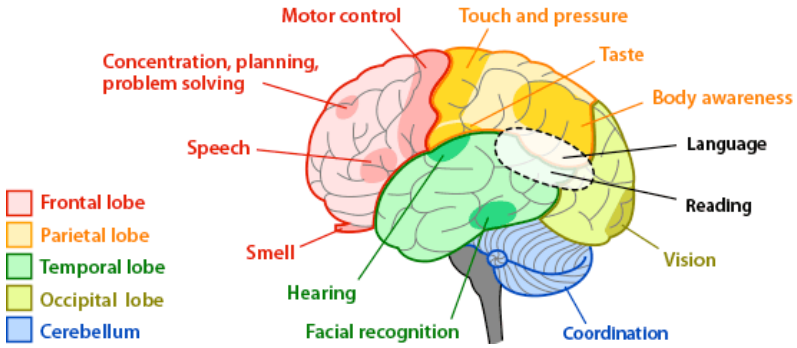
Introduction to the Brain and the Nerves

The nervous system is the command center of the body. It is **a network that relays messages** from the brain to the rest of the body, and from the rest of the body to the brain. It controls the body's response to what's happening both inside and outside the body.

Our nervous system regulates our:

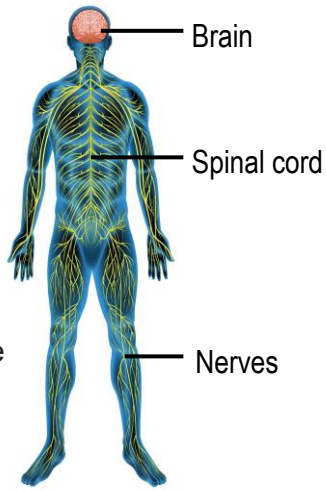
- Thinking, memory, learning
- Movement, balance
- Vision, hearing, smelling, tasting, touching
- Wound healing
- Sleeping and waking
- Breathing and heart-related functions
- Digestion and use of energy
- Stress response



Parts of the Nervous System

1. Central Nervous System

- **Brain**
  - Complex organ in the head
  - Regulates everything that the body does
  - Different parts of the brain deal with different processes
- **Spinal cord**
  - A compact collection of nerves and nerve cells that run inside the backbone from the base of the brain down to the lower back
  - Signals go from the brain to the rest of the body and back



2. Peripheral Nervous System

The spinal cord branches out into **nerves**, which are "cables" that carry "messages" throughout the body.

Reflex Reaction

If we touch something hot, the sensory nerve cells in our hand send a quick message to the spinal cord. Although the spinal cord sends that message up to the brain as usual, it also sends a message to the muscles to tell them to move the hand away quickly. This fast response is an example of a reflex, which is our body's automatic way of protecting us from harm.

Somatic Nervous System

- The network that connects the brain to muscles and to sensory organs
- Gathers clues from the environment based on what we see, hear, smell, taste, and touch
- Controls muscles to help us react to the environment

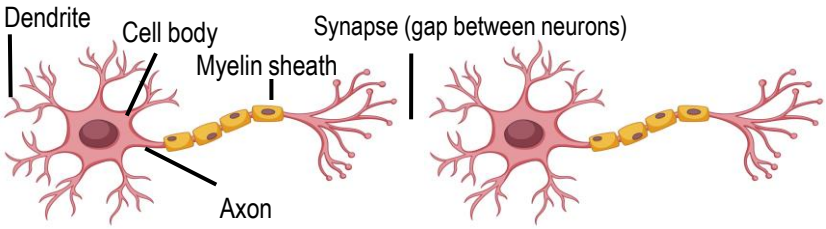
Autonomic Nervous System

- The network that connects the brain to internal organs
- Regulates internal body processes
  - E.g. heart rate, blood pressure, breathing, digestion, sleeping etc.
- Works automatically without us having to think about it

Introduction to the Brain and the Nerves (continued)

Neurons (Nerve Cells)

- The nervous system is made of nerve cells called **neurons**, separated by gaps called **synapses**.
- Signals (electric impulses) pass from the neuron's **dendrite**, through the cell body, to the **axon**, and jump towards the next nerve cell through the synapse
- The **myelin sheath** wraps around the axon, allowing signals to travel quickly through the axon.



At the **synapse**, an **electrical pulse** allows the first neuron to pass a **neurotransmitter** (chemical messenger) onto the dendrite of the next neuron. This is how a neuron gives instructions (e.g. "Pass on the message!") to the next neuron. The passing of neurotransmitters also happens between neurons and muscle cells (e.g. "Contract!"), and between neurons and cells in glands (e.g. "Release the hormone!").

Neurotransmitters

Neurotransmitters are chemical messages that are produced by neurons and other cells. They travel along the various networks to pass on messages. Below is a list of some of the known neurotransmitters. The imbalance of the levels of these neurotransmitters play a role in some disorders that are common in individuals with 22q differences. For a more detailed list, see Neurotransmitters from the Cleveland Clinic.

- **Glutamate** – Seizures
- **Gamma-aminobutyric acid (GABA)** – Anxiety, irritability, concentration, sleep, seizures, depression
- **Serotonin** – Anxiety, depression
- **Histamine** – Sleep/wake issues, feeding behavior, motivation
- **Dopamine** – Parkinson's disease, schizophrenia, restless legs syndrome, attention deficit hyperactive disorder (ADHD)
- **Epinephrine (Adrenaline)** – Too much can cause hypertension, diabetes, and heart issues.
- **Norepinephrin**e (Noradrenaline) – Alertness, arousal, decision-making, attention, focus
- **Acetylcholine** – Memory, motivation, sleep, learning, seizures

Taking Care of Our Nervous System

A medical doctor who diagnoses and treats diseases of the nervous system is called a **neurologist**. A medical doctor who performs surgery on the nervous system is called a **neurosurgeon**.

Although our brain and spine are protected by bones, they can get hurt badly in different ways (strong force, severe infections, etc.) Since our **nervous system rarely gets repaired or renewed** if damaged, it is best to avoid injuring our brain and spine. E.g., **Wear a protective helmet** when biking, skiing, skating, or playing any contact sports.

Resources

- Nervous System – Cleveland Clinic
- Nervous System – Nemours Kids Health
- Brain – Cleveland Clinic
- Spinal Cord – Cleveland Clinic
- Nerves – Cleveland Clinic
- Neurotransmitters – Cleveland Clinic
- Autonomic Nervous System – Cleveland Clinic
- What Are the Regions of the Brain and What Do They Do? – Ask a Biologist, Arizona State University
- Nervous System (video) – PBS Learning Media

❖ Brain graphic from Ask a Biologist, Arizona State University
❖ Nervous system and neuron graphics from Freepik.com

International 22q11.2 Foundation

The mission of the International 22q11.2 Foundation is to improve the quality of life for individuals affected by chromosome 22q11.2 differences through family and professional partnerships.
This information is brought to you by the Foundation for educational purposes only. It is not intended to be taken as medical advice. If you have concerns, please talk to your healthcare provider.

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