

SYSTEMS OF HUMAN BODY

INTEGUMENTARY SYSTEM or Exocrine system

- The human body's **largest organ** is the integumentary system, which includes the skin, hair, nails, glands and nerve receptors.
- **Protection:** It protects against UV light, mechanical, thermal and chemical stresses, dehydration and invasion by microorganisms.
- **Sensation:** skin has receptors that sense touch, pressure, pain and temperature.
- **Thermoregulation:** Various features of the skin are involved in regulating temperature of the body. For example sweat glands, hair, and adipose tissue.
- **Metabolic functions:** subcutaneous adipose tissue is involved in production of vitamin D, and triglycerides. (Subcutaneous fat is fat that you can pinch. It's found just under your skin. Subcutaneous fat: Pads your muscles and bones to protect you from bumps and falls. Helps your blood vessels and nerves get from your skin to your muscles. Controls your body temperature, making sure you don't get too warm or too cold.)

Skin

It is composed of **epidermis, dermis, hypodermis or subcutis.**

Epidermis

- It is the outermost layer of the skin.
- It contains squamous cells or keratinocytes, which synthesize a tough protein called keratin. Keratin is a major component of skin, hair and nails.

- It contains Langerhans cells that signal the immune system of an infection.

The epidermis is composed of five sub-layers.

1. **Stratum Corneum** - top layer of dead, extremely flat cells.
2. **Stratum Lucidum** - thin, flattened layer of dead cells.
3. **Stratum granulosum** - rectangular-shaped cells that become increasingly flattened.
4. **Stratum Spinosum** - polyhedral-shaped cells.
5. **Stratum Basale** - innermost layer of elongated columnar (column-shaped) cells.

Dermis

- The layer beneath the epidermis is the dermis.
- It is the **thickest layer** of skin.
- It contains specialized cells that help regulate temperature, fight infection, store water and supply blood and nutrients to the skin.
- It also helps in the detection of sensations and gives strength and flexibility to the skin.

Components of the Dermis include:

1. **Blood vessels** - These vessels also transport vitamin D from the skin to the body.
2. **Lymph vessels** - supply lymph to skin tissue to fight microbes.
3. **Sweat glands**
4. **Sebaceous (oil) glands** - secrete oil that helps to waterproof the skin and protect against microbe build-up.
5. **Hair follicles**
6. **Sensory receptors** -

7. **Collagen** - tough structural protein that holds muscles and organs in place and gives strength and form to body tissues.
8. **Elastin** - rubbery protein that provides elasticity and makes the skin stretchable.

Hypodermis (Subcutis)

- The **innermost layer** of the skin is the hypodermis.
- It mainly contains adipose tissue and sweat glands.
- The adipose tissue has metabolic functions: it is responsible for production of vitamin D, and triglycerides.

NERVOUS SYSTEM

- It consists of the **brain, spinal cord, sensory organs**, and all of the **nerves** that connect these organs with the rest of the body.
- Together, these organs are responsible for the control of the body and communication among its parts.
- The brain and spinal cord form the control center known as the **Central Nervous System (CNS)**, where information is evaluated and decisions made.
- The sensory nerves and sense organs of the Peripheral Nervous System (PNS) monitor conditions inside and outside of the body and send this information to the CNS.
- Different nerves in the PNS carry signals from the control center to the muscles, glands, and organs to regulate their functions.

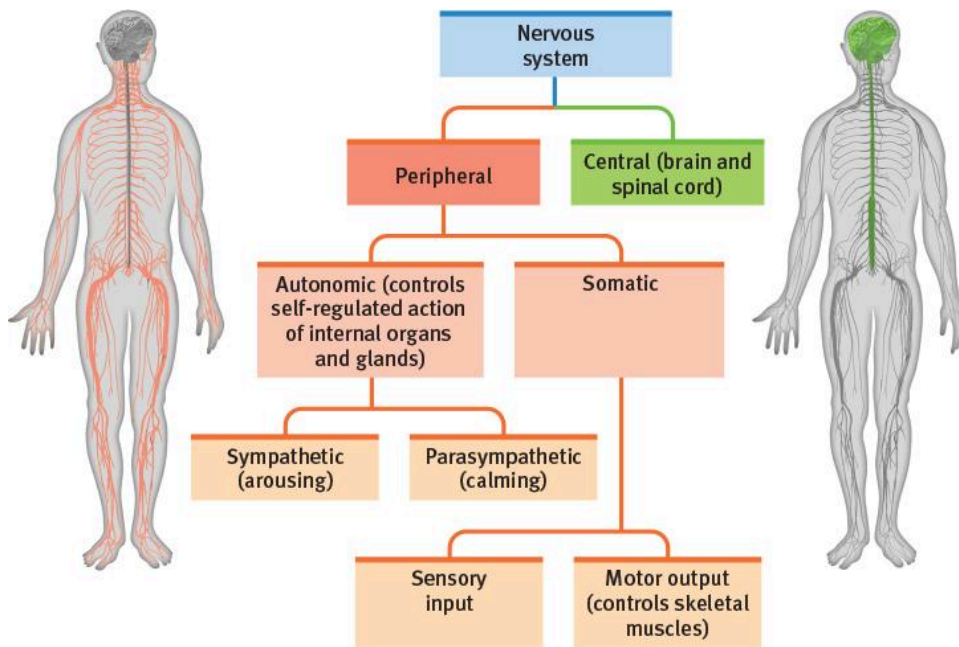
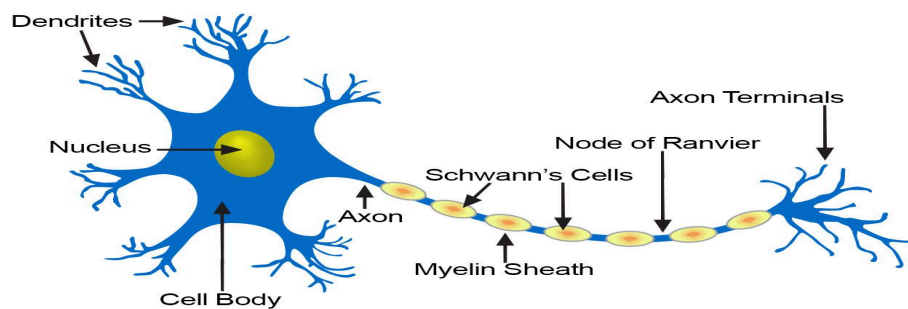


Figure 2.5

Myers/DeWall, *Psychology in Everyday Life*, 4e, © 2017 Worth Publishers

Nervous Tissue

Structure of a Typical Neuron



The majority of the nervous system is tissue made up of two classes of cells:

- Neurons and
- Neuroglia.

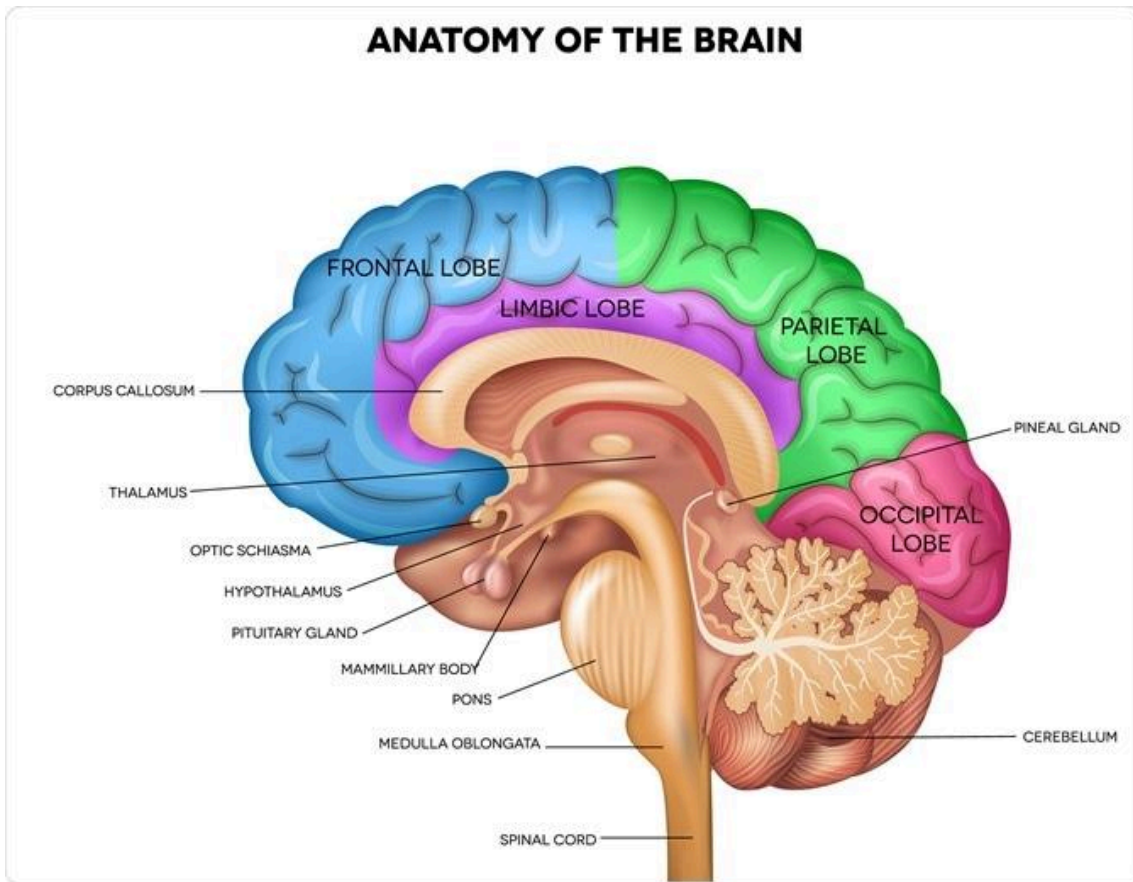
Neurons: Neurons, also known as nerve cells, communicate within the body by transmitting electrochemical signals. Neurons look quite different from other cells in the body due to the many long cellular processes that extend from their central cell body.

There are 3 basic types of neurons:

- **Afferent neurons:** Also known as sensory neurons, afferent neurons transmit sensory signals to the central nervous system from receptors in the body.
- **Efferent neurons :** . Also known as motor neurons, efferent neurons transmit signals from the central nervous system to effectors in the body such as muscles and glands.
- **Interneurons :** Interneurons form complex networks within the central nervous system to
- Integrate the information received from afferent neurons and to direct the function of the body through efferent neurons.

Neuroglia: also known as glial cells, act as the “helper” cells of the nervous system. Each neuron in the body is surrounded by anywhere from 6 to 60 neuroglia that protect, feed, and insulate the neuron.

Brain



- The brain, a soft, wrinkled organ that weighs about **1.36 kg**, is located inside the **cranial cavity**, where the bones of the skull surround and protect it.
- **Glucose** is the primary source of energy for the brain, providing the fuel necessary for its proper functioning.
- The approximately **100 billion neurons** of the brain form the main control center of the body.
- The brain and spinal cord together form the central nervous system (CNS), where information is processed and responses originate.
- The brain, the seat of higher mental functions such as consciousness, memory, planning, and voluntary actions, also controls lower body

functions such as the maintenance of respiration, heart rate, blood pressure, and digestion.'

Following are the major parts of the human brain:

→ **Forebrain:** Largest part of the brain.

- ◆ **Cerebrum:** The largest among the forebrain parts is the cerebrum. It is also the largest part of all vertebrate brains.
- ◆ **Thalamus:** This limbic system is mainly responsible for the formation of new memories and storing past experiences.
- ◆ **Hypothalamus:** The hypothalamus is a small and essential part of the brain, located precisely below the thalamus. The hypothalamus is an area of the brain that produces hormones that control: Body temperature, Heart rate, Hunger, Controls the mood and emotions, Controls the sense of taste and smell

Controls the reproductive functions, body temperature, emotions, hunger and sleep.

→ **Midbrain:** Smallest and central part of the brain.

→ **Hindbrain:** The lower part of the brain.

The hindbrain is composed of:

- ◆ **Cerebellum:** The cerebellum is the **second largest part** of the brain, located in the posterior portion of the medulla and pons. Cortex is the outer surface of the cerebellum.
- ◆ **Medulla Oblongata:** The medulla oblongata is a small structure present in the **lowest region of the brain**. It mainly controls the body's autonomic functions such as heartbeat,

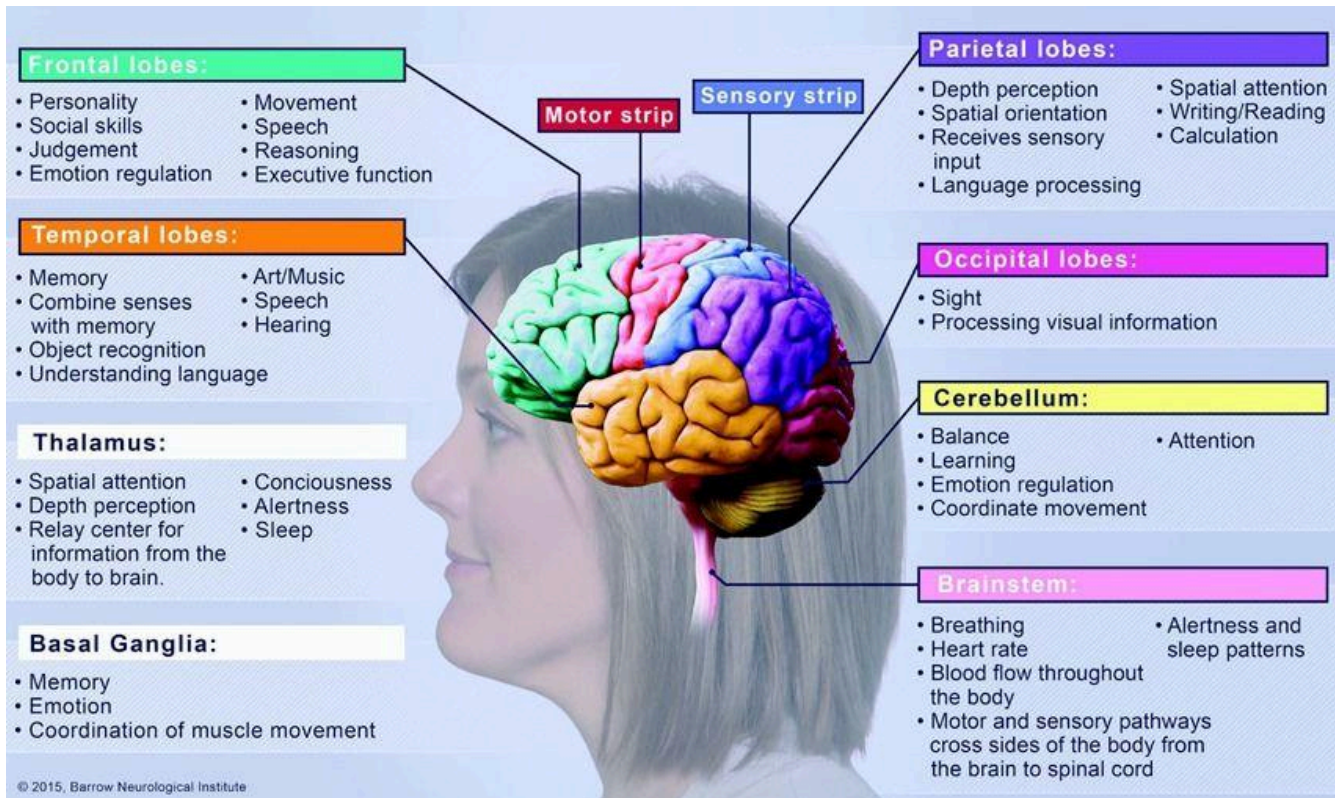
breathing, and digestion. Also, it helps us in maintaining our posture and controlling our reflexes.

It is mainly responsible for coordinating and maintaining the body balance during walking, running, riding, swimming, Coordinates eye movement and precision control of the voluntary movements.

◆ **Pons:** The pons is the primary structure of the brain stem present between the midbrain and medulla oblongata. The main functions of the pons include:

- Controlling sleep cycles.
- Regulating the magnitude and frequency of the respiration.
- Transfers information between the cerebellum and motor cortex.
- Pons is also involved in sensations, such as the sense of taste, hearing and balance.

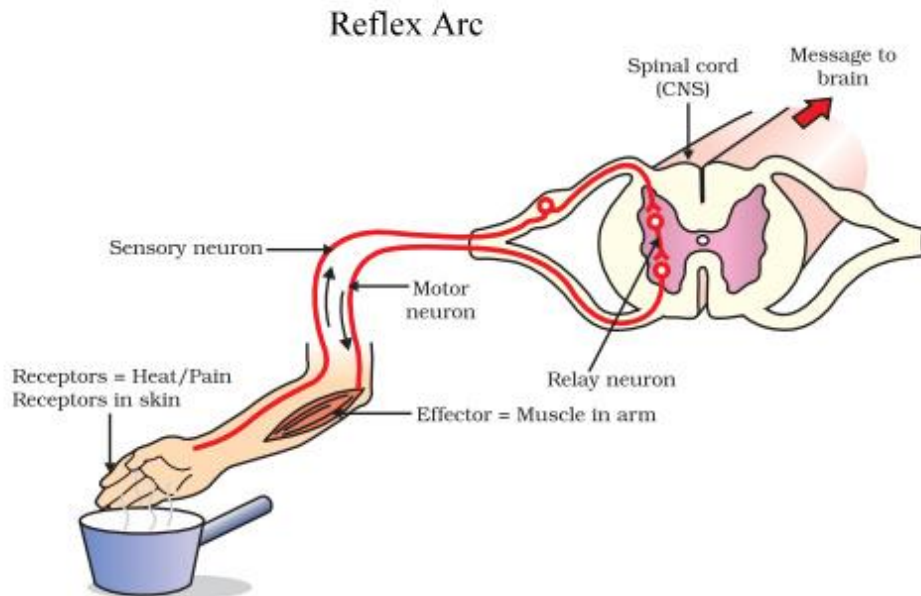
Hindbrain functions: The three regions of the hindbrain coordinate all processes necessary for survival. These induce breathing, heartbeat, sleep, wakefulness and motor learning.



Spinal Cord

- It is a long, thin mass of bundled neurons that carries information through the vertebral cavity of the spine beginning at the medulla oblongata of the brain on its superior end and continuing inferiorly to the lumbar region of the spine.
- It is around 45 cm (18 in) in men and around 43 cm (17 in) long in women.
- In the lumbar region, the spinal cord separates into a bundle of individual nerves called the cauda equina (due to its resemblance to a horse's tail) that continues inferiorly to the sacrum and coccyx.
- The white matter of the spinal cord functions as the main conduit of nerve signals to the body from the brain.

- The gray matter of the spinal cord integrates reflexes to stimuli.



Nerves

- Nerves are bundles of axons in the peripheral nervous system (PNS) that act as information highways to carry signals between the brain and spinal cord and the rest of the body.
- Each axon is wrapped in a connective tissue sheath called the endoneurium.
- Individual axons of the nerve are bundled into groups of axons called fascicles, wrapped in a sheath of connective tissue called the perineurium.
- Finally, many fascicles are wrapped together in another layer of connective tissue called the epineurium to form a whole nerve.
- The wrapping of nerves with connective tissue helps to protect the axons and to increase the speed of their communication within the body.

Axon: Axons are like long wires that carry messages away from the cell body of a neuron to other neurons, muscles, or glands.

Example: When you decide to move your hand, a special type of neuron called a motor neuron sends a message from your brain down its axon to the muscles in your hand, telling them to move.

Myelin Sheath: The myelin sheath is like the protective covering around the wires of a cable. It's a fatty substance that wraps around the axon of a neuron, acting like insulation to help speed up the electrical signals traveling along the neuron.

Example: Imagine trying to send a message through a thick foggy forest. It would take longer and be harder to get through. But if there's a clear path or a road (like the myelin sheath), the message can travel much faster and more efficiently.

Neuron: Neurons are like tiny messengers in our body that help us think, feel, and move. They are **special cells in our brain, spinal cord, and nerves** that send messages to each other using electrical signals. Think of them as tiny telephone wires in our body.

Example: When you touch something hot, special neurons called sensory neurons in your skin send a message to your brain, telling it that it's hot, so you quickly pull your hand away to avoid getting burned.

Dendrite: Dendrites are like tiny branches coming out of the main body of a neuron. They receive messages from other neurons and pass them along to the cell body. Think of them as antennas that pick up signals from other neurons.

Example: When you smell your favorite food cooking, special neurons in your nose called olfactory neurons send a message through their dendrites to your brain, letting you know that something delicious is nearby.

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Aman Srivastava



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