**Chapter 4**

**The Nervous system: A Basic Blueprint:**

* **Central nervous system**: receives, processes interprets, and stores incoming sensory information-information abouttastes, sounds, smells, color, pressure on the skin, the state of internal organs, and so forth.

1. **The spinal cord**, which is actually an extension of the brain.
2. **The brain**

* **The peripheral nervous system** handles the central nervous system’s input and output.

1. **The somatic nervous system**: connected to sensory receptors-celss that enable you to sense the world.
2. **The autonomic nervous system** regulates the functioning of blood vessels, gland, and interal organs such as bladder, stomach, and heart
   * + - 1. Sympathetic nervous system
         2. Parasympathetic nervous system

These two parts work together, but in opposing ways, to adjust the body to changing circumstances.

**Communication in the Nervous System**

* **Neurons**: brain’s communication specialists, transmitting information to, from, and within the central nervous system.
  + 1. Neurons are held in place by **glia**, or glial cells, which make up 90 percent of the brain’s cells
    2. Neuron has three main parts: dendrites, a cell body, and an axon.
    3. The **dendrites** look like the branches of a tree. Dendrites act like antennas, receiving messages from as many as 10000 other nerve cells and transmitting these messages toward the cell body.
    4. The **Cell Body** , which is shaped roughly like a sphere or a pyramid, contains the biochemical machinery for keeping the neuron alive.
    5. The **axon** transmits message away from the cell body to other neurons or to muscle or gland cells. Axon commonly divide at the end into branches called axon terminals.
    6. Many axons, especially the larger ones, are insulated by a surrounding layer of fatty material called the **myelin sheath.** One purpose of the myelin sheath is to prevent signals in adjacent cells from interfering with each other.
* The **stem cells** involve in learning and memory seem to divide and mature throughout adulthood.
* **Synaptic cleft**, where the axon terminal of one neuron nearly touches a dendrite or the cell body of another.
* The axon terminal, the cleft, and the covering membrane of the receiving dendrite or cell body is called a **synapse**.
* **the action potential** produces an electric current, or impulse. When the sudden, momentary inflow of positively charged sodium ions across the cell’s membrane, followed by the outflow of positively charged potassium ions.
* **Neurotransmitter** is when a neural impulse reaches the axon terminal’s buttonlike tip, synaptic vesicles, tiny sacs in the tip of the axon terminal, open and release a few thousand molecules of a chemical substance.
* **Endorphine** reduce pain and promote pleasure.
* **Hormones** are produced primarily in **endocrine glands,** they are released directly into the bloodstream, which carries them to organs and cells that maybe far from their point of origin.

1. **Melatonin** helps to regulate daily biological rhythms and promotes sleep.
2. **Oxytocin** enhance uterine contractions during childbirth and facilitates the ejection of milk during nursing.
3. **Adrenal hormones** are involved in emotion and stress.
4. **Sex hormones**
   * + - 1. *Androgens* are masculinizing hormones produced mainly in the testes but also in the ovaries and the adrenal glands(adrenal hormones) it set in motion the physical changes males experience at puberty- notably a deepened voice and facial and chest hair- and cause pubic and underarm hair to develop in both sexes.
         2. *Estrogens* are feminizing hormones that bring on physical changes in females at puberty, such as breast development and the onset of menstruation and that influence the course of the menstrual cycle.
         3. *Progesterone* contributes to the growth and maintenance of the uterine lining in preparation for a fertilized egg.

Mapping the Brain

* The **brain** can also be probed with devices called electrodes.
* A brain-wave recording is called a **electroencephpalogram (EEG)**. A standard EEG is useful but not very precise because it reflects the activities of many cells at once.
* **Transcranial magnetic stimulation (TMS)** delievers a large current through a wire coil placed on a person’s head. It causes neurons under the coil to fire. It can be used to produce motor responses and can also be used by researchers to briefly inactivate an area and observe the effects on behavior- functioning, in effect, as a virtual lesion method.
* the **PET scan (positron-emission tomography)** goes beyond anatomy to record biochemical changes in the brain as they are happening. Injection of non-harming radioactive chemical into brain.
* The **MRI (magnetic resonace imaging)**, allows the exploration of inner space without injecting chemicals. Powerful magnetic fields and radio frequencies are used to produce vibrations in the nuclei of atoms making up body organs.

A Tour through the Brain

* **Localization of function:** different brain parts perform different.
* The **brain stem** looks like a stalk rising out of the spinal cord

Pathyway to and from upper areas of the brain pass through its two main structures: the **Medulla** and the **pons**

* The **pons** is involved in sleeping, walking, and dreaming.
* The **medulla** is responsible for bodily functions that do not have to be consciously willed, such as breathing and heart rate.
* The **reticular activating system (RAS)** this dense network of neurons, which extends about the brain stem into the center of the brain and has connection with areas that are higher up, screens incoming information and arouses the higher centers when something happens that demands their attention. Without the RAS, we could not be alert or perhaps even conscious.
* The **cerebellum** contributes to a sense of balance and coordinates the muscles so that movement is smooth and precise.
* The **thalamus** directs sensory messages to higher areas. For example the sight of a sunset sends signals that the thalamus directs to a vision area, and the sound of an oboe sends signals that the thalamus sends on to an auditory area. The only sense that completely bypasses the thalamus is the sense of smell, which has its own private switching station, the olfactory bulb.
* The **hypothalamus** is involved in drives associated with the survival of both the individual and the species-hunger, thirst, emotion, sex, and reproduction. It regulates body temperature by triggering sweating or shivering, and it controls the complex operations of the autonomic nervous system.
* The **amygdala** is responsible for evaluating sensory information, quickly determining its emotional importance, and contributing to the initial decision to approach or withdraw from a person or situation
* The **hippocampus**, sea horse shape, this structure compares sensory information with what the brain has learned to expect about the world.
* The **cerebrum** is where the higher forms of thinking take place.
  + - 1. **Cerebral hemispheres** is connected by a large band of fibers called the **corpus callosum**
      2. The cerebrum is covered by several thin layers of densely packed calls known collectively as the **cerebral cortex.**
         1. The **occipital lobes** are at the lower back part of the brain. Contains visual cortex, where visual signals are processed.
         2. The **parietal lobes** are at the top of the brain. They contain the somatosensory cortex, which receives information about pressure, pain, touch , and temperature from all over the body.
         3. The **temporal lobes** are at the sides of the brain, just about the ears and behind the temples. They are involved in memory, perception, and emotion, and they contain the auditory cortex, which processes sounds.
         4. The **frontal lobes** are located toward the front of the brain, just under the skull in the area of the forehead. They contain the mortor cortex, which issues order to the 600 muscles of the body that produce voluntary movement.