Grade 12 NTI Day #9 Anatomy

Assignment: Please read the excerpt below as an independent reading assignment. Then read and answer the questions below the excerpt.

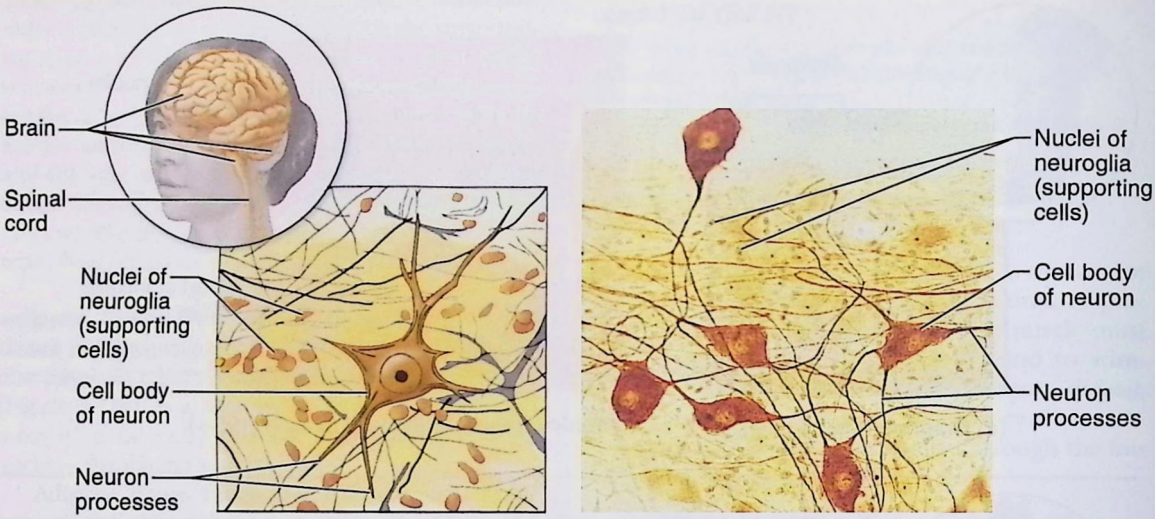

Diagram: Nervous tissue **Photomicrograph:** Neurons (320×)

Figure 3.21 Nervous tissue. Neurons and supporting cells form the brain, spinal cord, and nerves.

START HERE (READ 3.7 and 3.8)

3.7 Nervous Tissue

When we think of **nervous tissue**, we think of cells called **neurons**. All neurons receive and send electrochemical impulses from one part of the body to another; thus, *irritability* and *conductivity* are their two major functional characteristics. The structure of neurons is unique (Figure 3.21). Their cytoplasm is drawn out into long processes (extensions), as long as 3 feet or more in the leg, which allows a single neuron to conduct an impulse to distant body locations.

However, the nervous system is more than just neurons. A special group of supporting cells called **neuroglia** insulate, support, and protect the delicate neurons in the structures of the nervous system—the brain, spinal cord, and nerves. (We consider nervous tissue in detail in Chapter 7.)

Figure 3.22 summarizes the tissue types, including their hallmarks and functions in the body.

3.8 Tissue Repair (Wound Healing)

The body has many techniques for protecting itself from uninvited guests or injury. Intact physical barriers such as the skin and mucous membranes, cilia, and the strong acid produced by stomach glands are just a few examples of body defenses exerted at the tissue level. When tissue injury does occur, it stimulates the body's inflammatory and immune responses, and the healing process begins almost immediately. *Inflammation* is a general (nonspecific) body response that attempts to prevent further injury. The *immune response*, in contrast, is extremely specific and mounts

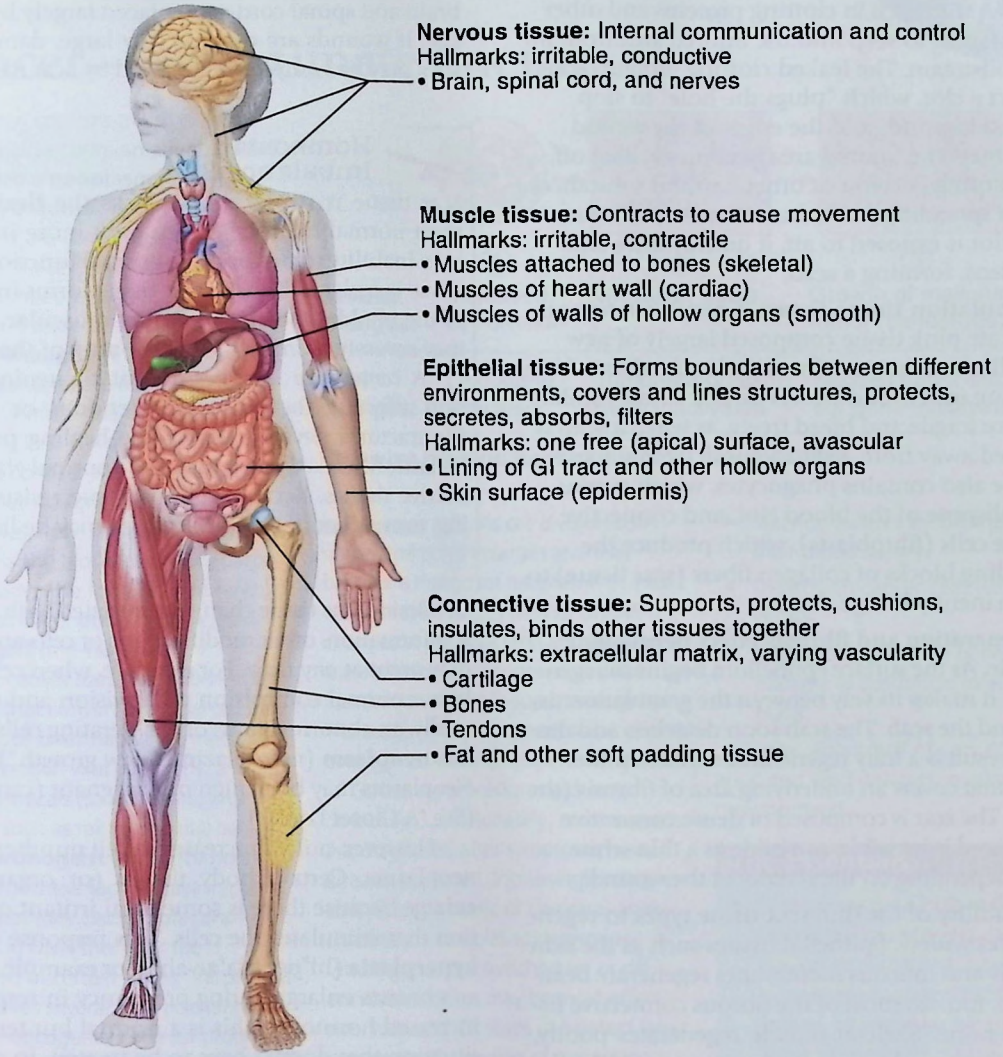

Figure 3.22 Summary of the major functions, characteristics, and body locations of the four tissue types: epithelial, connective, muscle, and nervous tissues.

a vigorous attack against recognized invaders, including bacteria, viruses, and toxins. (We consider these protective responses in detail in Chapter 12.) Here we will concentrate on the process of tissue repair itself.

Tissue repair, or wound healing, occurs in two major ways: by regeneration and by fibrosis. **Regeneration** is the replacement of destroyed tissue by the same kind of cells, whereas **fibrosis** involves repair by dense (fibrous) connective tissue, that is, by the formation of *scar tissue*. Which occurs depends on (1) the type of tissue damaged and (2) the severity of the injury. Generally speaking, clean cuts (incisions) heal much more successfully than ragged tears of the tissue.

Tissue injury sets the following series of events into motion:

- **Inflammation sets the stage.** Injured tissue cells and others release inflammatory chemicals that make the capillaries very permeable. This

allows fluid rich in clotting proteins and other substances to seep into the injured area from the bloodstream. The leaked clotting proteins construct a clot, which "plugs the hole" to stop blood loss and hold the edges of the wound together. The injured area becomes walled off, preventing bacteria or other harmful substances from spreading to surrounding tissues. Where the clot is exposed to air, it quickly dries and hardens, forming a scab.

- **Granulation tissue forms.** *Granulation tissue* is delicate pink tissue composed largely of new capillaries that grow into the damaged area from undamaged blood vessels nearby. These capillaries are fragile and bleed freely, as when a scab is picked away from a skin wound. Granulation tissue also contains phagocytes, which eventually dispose of the blood clot, and connective tissue cells (fibroblasts), which produce the building blocks of collagen fibers (scar tissue) to permanently bridge the gap.
- **Regeneration and fibrosis effect permanent repair.** As the surface epithelium begins to regenerate, it makes its way between the granulation tissue and the scab. The scab soon detaches, and the final result is a fully regenerated surface epithelium that covers an underlying area of fibrosis (the scar). The scar is composed of dense connective tissue and is invisible, or visible as a thin white line, depending on the severity of the wound.

The ability of the different tissue types to regenerate varies widely. Epithelial tissues such as the skin epidermis and mucous membranes regenerate beautifully. So, too, do most of the fibrous connective tissues and bone. Skeletal muscle regenerates poorly, and cardiac muscle and nervous tissue within the brain and spinal cord are replaced largely by scar tissue. If wounds are deep or very large, damaged tissues may be completely replaced by scar tissue.

Photo showing post-burn contracture scars on the neck.

Homeostatic Imbalance 3.3

Scar tissue is strong, but it lacks the flexibility of most normal tissues. Perhaps even more important is its inability to perform the normal functions of the tissue it replaces. Thus, if scar tissue forms in the wall of the bladder, heart, or another muscular organ, it may severely hamper the functioning of that organ.

A *contracture* is a permanent tightening of the skin affecting the underlying tendons or muscles. Contractures develop during the healing process as inelastic fibrous tissue replaces the normal elastic connective tissues. Because fibrous tissue resists stretching, movement of the affected area may be limited.

Besides the tissue changes associated with repair or scar formation, other modifications of cells and tissues may occur at any time. For example, when cells fail to honor normal controls on cell division and multiply wildly, an abnormal mass of proliferating cells, known as a **neoplasm** (ne'o-plazm"; "new growth"), results. Neoplasms may be benign or malignant (cancerous). (See "A Closer Look".)

However, not all increases in cell number involve neoplasms. Certain body tissues (or organs) may enlarge because there is some local irritant or condition that stimulates the cells. This response is called **hyperplasia** (hi"per-pla'ze-ah). For example, a woman's breasts enlarge during pregnancy in response to increased hormones; this is a normal but temporary situation that doesn't have to be treated. In contrast, **atrophy** (at'ro-fe), or decrease in size, can occur in an organ or body area that loses its normal stimulation. For example, the muscles of a broken leg atrophy while in a cast during the healing period.

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Anatomy NTI Day #9 Questions

Multiple Choice Questions

1. **Which of the following is a key function of neurons in nervous tissue?**
   a) Secretion and absorption
   b) Providing elasticity
   c) Conducting electrochemical impulses
   d) Producing collagen fibers
2. **What is the term for the group of cells that support, protect, and insulate neurons?**
   a) Fibroblasts
   b) Osteocytes
   c) Neuroglia
   d) Chondrocytes
3. **What does hyperplasia refer to?**
   a) A decrease in cell size due to lack of stimulation
   b) The formation of scar tissue
   c) An abnormal increase in cell number due to stimulation
   d) The replacement of damaged tissue by the same kind of cells

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Short Answer Question

4. **Explain the difference between hyperplasia and atrophy, and give an example of each.**
