Cells

The smallest living units of the body

- There are dozens of different cell types in the body, each with its own structure and function
- The cells are arranged into higher levels of organization (tissues, organs, and organ systems)

Fig 1.3

Tissue

A group of cells of the same type performing a function together

Fig 1.3

Organ

A body part (made of several tissues working together) that performs a function

Fig 1.3

Organ system

A group of organs that work together to perform a function

Fig 1.3

Tissue types

There are four major types of tissue:

- Epithelial tissue
- Muscle tissue
- Nervous tissue
- Connective tissue

Fig 4.2

Epithelial tissue

Sheets of tightly-packed cells that form protective linings. Some epithelial tissues also absorb and secrete of materials.

Examples:

- The skin
- The inner lining of all tubes, hollow organs, and cavities in the body
    - √ Ex: The inner lining of blood vessels, the stomach, the lungs

Basement membrane

Extracellular "glue" material that attaches epithelial cells to the surface below them

Epithelial tissue types are classified by layers and cell shape:

Layers of cells in tissue:

- Simple (one layer of cells)
- Stratified (more than one layer)
- Pseudostratified (one layer that looks like two)

Figs 4.6 and 4.8

Shape of cells:

- Cuboidal (dice shaped)
- Columnar (brick shaped)
- Squamous (floor-tile shaped)

Figs 4.6 and 4.8

Muscle tissue

Tissue that causes movement by contracting (shortening) its cells

- Some muscles move body parts, other muscles move substances inside the body

The mechanism of muscle cell contraction:

- Muscle cells contain actin (thin) and myosin (thick) protein filaments
- In the muscle's long (relaxed) state, these filaments overlap very little
- The muscle cell shortens by sliding the actin filaments over the myosin filaments, increasing the amount of overlapped.

√ The sliding action shortens the muscle cell

There are three types of muscle tissue: skeletal, smooth, and cardiac

- Each type has unique traits and functions

	Skeletal	Smooth	Cardiac
Location	Attached to bone (by tendons)	Hollow organ walls	Heart
Function:	Moves body parts by applying forces on the skeleton	Moves substances through hollow organs by squeezing on the substance in the organ	Pumps blood by squeezing on blood in the heart
Voluntary:	Yes	No	No
Cell shape	Long, cigar-shaped	Short, pointed ends	Branched
Cell features	Striations Multiple nuclei	No striations	Striations Intercalated discs

Table 4.2 and Figs 4.18 and 10.2

Nervous tissue

Nerve cells (neurons) that sense stimuli and transmit signals rapidly between body parts

- Dendrites = Tree-like parts of the neuron, where it detects stimulation

- Axon = A long thin part of the neuron, where the signal passes through

Fig 4.19

Connective tissue

Tissues that surround, support, or protect other tissues

- The cells of connective tissues do not usually touch each other
- The cells are separated from each other by extracellular matrix
- There are 6 major types of connective tissue

Table 4.1

Extracellular matrix

The material between the cells of connective tissue

- Made by the cells themselves
- The matrix contains a "ground" substance that can be a solid, gel, or liquid (depending on the type of connective tissue)
  - √ The ground substance that takes up most of the space between the cells
- The matrix also contains protein fibers
  - √ Collagen = A strong rope-like protein; strengthens tissues
  - √ Elastin = A rubber band-like protein; adds elasticity to tissue

Loose (areolar) connective tissue

A soft flexible jelly-like connective tissue

• The matrix has some collagen and elastin proteins but many open spaces filled with a jelly-like ground substance. This gives the tissue its flexible characteristic.

• Cells = Fibroblasts

• Loose connective tissue provides a jelly-like support for many organs and tissues that are required to flex and bend

Dense connective tissue

A strong leathery connective tissue

• The matrix is almost entirely collagen protein (with very few open spaces for ground substance). The collagen gives the tissue its rope-like characteristic

• Cells = Fibroblasts

• Dense connective tissue provides strong connections between organs and tissues that require firm non-tearing reinforcement

√ Examples: Ligaments (which connect bone to bone) and tendons (which connect muscle to bone) are made of dense connective tissue

Fig 4.15

Bone

A rock-like connective tissue to protect and anchor organs

- The matrix is collagen fibers in a solid calcium phosphate ground substance
- Cell = Osteocyte

Fig 6.8

Cartilage

A rubbery connective tissue that forms solid yet flexible body parts

- The matrix is collagen fibers in chondrin (a rubbery ground substance)
- Cells = Chondrocytes
- Hyaline cartilage = A glossy and firm cartilage type
  - √ Forms a protective covering at the tips of bones in joints
- Elastic cartilage = The most flexible and rubbery cartilage type
  - √ Ears are formed from elastic cartilage
- Fibrocartilage = The toughest and most leathery cartilage type
  - √ Fibrocartilage serves as a shock absorber between bones that carry a lot of weight, such as vertebrae and knees

Fig 4.16

Adipose tissue

A connective tissue that specializes in storing fat for energy storage and insulation

- Cells = adipocytes
- There is very little matrix in adipose tissue; the adipocytes are packed closely together

Fig 4.13

Blood

A liquid connective tissue that transports materials throughout the body

- The matrix is called plasma (a liquid ground substance composed of water with ions, nutrients, proteins, and other solutes)
- Cells = There are three formed elements (blood cell types)
  - √ Red blood cells (RBCs, erythrocytes) = Carry O_2
  - √ White blood cells (WBCs, leukocytes) = Fight invaders (bacteria, viruses, etc.)
  - √ Platelets = Start the clotting process when we are cut

Fig 4.17