Anatomy: (Greek) *anatome*

- *ana* = “up” ; *tome* = “cut”
- *Study of body structure & their physical relationships*
A. Chemical Level (atomic/molecular structure):

- **Atoms**: Hydrogen, Oxygen, Carbon, & Nitrogen
  - 99% of human body

![Atom Diagram]

- **Molecules**: Water, Carbohydrate, Protein, Lipid
  - Water: 67%
  - Protein: 20%
  - Lipid: 10%
  - Carbohydrates: 3%

![Molecule Diagram]

b. Cellular Level:

- **Basic structural & functional** living units

![Cell Diagram]
c. Tissue Level:

- Groups of *similar cells* organized to perform *specialized functions*

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4 Primary Tissues:

1. Epithelial
2. Connective
3. Nervous
4. Muscle

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d. Organ Level:

- *Tissues* organized to perform *specialized functions*
  
  ⇒ *Recognizable & distinct structures*
e. System Level:
  › Related organs organized to perform whole body functions

11 Organ Systems:

Cytology: *cyto* = "cell"; *logos* = “study of”
  › Study of: Individual cell structure & function
Cell:
- Basic structural & functional unit of life
- ~30–40 trillion cells comprise the body
  - 200 different cell lines

Cell Structure: “Typical”
- All cells share a similar structure: “Generalized” cell structure

Cellular Attachments:
- Bind cells to:
  1. Each other: Intercellular Attachment
    - *Inter* = “Between”
  2. Surrounding tissues
2 Adhering Substances:

1. Cell Adhesion Molecules (CAMs)
   - Trans-membrane Proteins
     - Bind membranes to:
       a. Each other
       b. Extra-cellular materials

Bone

Marrow (EM)
2. **Intercellular Cement:**
   - **Glycosaminoglycan:**
     - “Sticky” carbohydrate
     - *Intercellular “Goo”*
   - **Hyaluronan (Hyaluronic Acid):** Most prevalent

3 Primary cell Junctions:
1. **Tight**
2. **Communicating**
3. **Anchoring**

1. **Tight Junctions:** *Zonula Occludens*
   - Structure: Interlocking transmembrane proteins “sew” together membranes
     - Knit adjacent membranes together
   - Most common: *Occludin & Claudin*
Function: Inhibit unregulated passage between cells

- Digestive Tract, Bladder & Kidney tubules

Substances must pass through cells

- No tight junction = Loss of absorption control

Tight Junction: Clinical Significance
2. Communicating Junctions: Gap Junctions

- **Structure:** Interlocking transmembrane proteins form **channels between cells**.

- **Proteins:** Connexons

- **Function:** Permit intercellular exchange of molecules & fluid, i.e., **Cardiac & Smooth Muscle**.
3. Anchoring Junctions:

- Structure: CAMs (various) & Glycosaminoglycans
  - Form: Dense area at junction location
- Function: Resist strong twisting and stretching
  ➞ Membrane “rivets”

a. Zonula Adherens: Belt desmosomes

  - Continuous band adhesion
    - Surrounds cell and holds strongly to its neighbor
    - i.e. Intestine, liver, brain coverings
Reinforced spot cell adhesion

- Provides strongest cellular attachment
- I.e. Skin, heart

b. Macula Adherens: (Desmosomes): Localized spot adhesion

- Reinforced spot cell adhesion

- Provides strongest cellular attachment

- I.e. Skin, heart
c. Hemidesmosome: *Modified macula adherens*

- Function: Attach cell to underlying tissue
- I.e: skin

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Cell Junctions

- A. Tight junctions
- B. Adherens junctions
- C. Desmosomes
- D. Hemidesmosomes
- E. Gap junctions

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Identify the cell junction

1. Tight Junction
2. Zonula Adherens

3. Tight Junction
4. Zonula Adherens
5. Macula Adherens