Lecture 1: Terminology, Tissues, Skin and Body Landmarks

Orientational Terminology of the Gut Tube (GI Tract)

- **Oral:** towards the mouth
- **Aboral:** away from mouth
- **Luminal/Adluminal:** towards the lumen
- **Abluminal:** basal, away from the lumen

Twelve Major Organ Systems

- Skeletal, Muscular, Nervous, Cardiovascular, Lymphoid, Respiratory, Digestive, Endocrine, Urinary, Female/Male Reproductive and Integumentary (skin)
- Each organ **system** is a coordinated group of organs which produce a **defined function**

Levels of Body Organisation

- **Atoms** form **molecules** which form **protein filaments** which form **cells**.
- **Similar cells** unite to form **tissues**
- **Different tissues** form **organs**
- **Organs** unite to form **systems**
- **Organ systems** unite to form the **organism**

Some functions and the relevant cells

- Covering + Lining
- Storage
- Movement
- Connection
- Defence
- Communication
- Reproduction
- Skin; Stomach lining
- Fat cells
- Muscle cells
- Fibroblasts making tendon
- White blood cells
- Nerve cells
- Sperm and oocytes

The Cell

- Smallest living thing, autonomous self-replicating unit

Tissues

- **Tissue**: collection of cells showing structural/functional similarities with a common origin
    - **Epithelial tissue**: epithelium; covers body surface and some organs
    - **Connective tissue**: supports body
    - **Muscle tissue**: movement of body parts
    - **Nerve tissue**: communication and control of body parts
- **All organs** are composed of **all four tissue types**

Epithelium

- Epithelial tissue covers body surface (**skin**), body cavities and internal organs
- Cancers arising from epithelium are called **carcinomas –** high frequency
- Functions of epithelial (surface cells) include:
    - **Protection:** physical protection (against mechanical/chemical/biological agents)
    - **Resorption:** any substance that enters/leaves body has to cross epithelium
    - **Secretion:** produces secretions (all glands are epithelial)
    - **Reception:** involved in sensory perception (touch receptors in skin)

Epithelial (body) Membranes

1. **Cutaneous membrane** (**skin**/**cutis**): epidermis of skin covering entire outer body surface
2. **Mucous membrane** (**mucosa**): lines body surfaces exposed to external environment (from mouth to anus, and airways)
    - **Skin** is continuous with **mucosa** of body orifices (lips, nostril, anus)
    - **Airways** and **digestive tract**
3. **Serous membrane** (**serosa**): mesothelium covers body cavities (blocked off from external environment) including **pleural**, **pericardial** and **peritoneal** cavities
4. **Endothelium** covers lumen of blood and lymphatic vessels

Epithelial Classification

- **Simple** – single layer; **Stratified** – multiple layers; **Pseudostratified** – stratified appearance
    a. **Squamous** = flat/thin;
    b. **Cuboidal** = cube;
    c. **Columnar** = rectangular (column)
    d. **Transitional** = ability to change shape
- Epithelial cells **closely packed** (almost **lack** intercellular space), **lack** blood vessels (avascular)
- **Basement membrane** is a thin sheet of fibres that underlies epithelium

Connective Tissue

- Primarily derived from **mesoderm**

1. **<u>Connective Tissue Proper</u>**
    - **Loose**: Areolar and Fat Tissues – **adipocytes** (store fat)
    - **Dense**: Ligaments + Tendons - **fibrocytes**
2. **<u>Fluid Connective Tissue</u>**
    - **Blood** – **macrophages**, **granulocytes**
    - **Lymph – lymphocytes** (form part of immune system)
3. **<u>Supporting Connective Tissue</u>**: supports other connective tissue
    - **Cartilages**: Hyaline, elastic, fibrous - **chondrocytes**
    - **Bone** - **osteocytes**

- Functions include:
    - **Connecting** and **Support**: tendons and ligaments
    - **Protection**: skull for brain, ribs for lungs/heart, pelvis for urogenital organs
    - **Transportation**: blood and lymph
    - **Storage**: calcium in bones, fat in fat tissues
- Cancers arising from connective tissue – **sarcomas** (e.g. chondrosarcoma, liposarcoma)
- Fibre holds water and provides bulk in the GIT

- Connective tissue cells maintain large intercellular space occupied by ECM – cells not close together
- **Fibroblasts** – synthesise and maintain ECM
- Components of ECM:
    - **Fibres** of connective tissue – **fibrous** component – composed of **collagen**, **elastic** and **reticular** fibres
    - **Ground substance** of connective tissue (no definite form = amorphous) – **non-fibrous** component – composed of **macromolecules** (GAGs and proteoglycans) and **water** and **minerals**
    - More fibres and less ground substance = **dense connective tissue**
    - Less fibres and more ground substance = **loose connective tissue**

ECM

- Allows cartilage to bear mechanical stress
- Generally, ECM in different tissues determine tissue's physical characteristics
- Note large gaps between cells in connective tissues
- **Cartilage** gaps contain **fibres** and **GAGs**
- **Bone** gaps contain **fibres** and **minerals**
- **Tendon** gaps contain **fibres**
- **Blood** gaps contain **fluid** (**plasma) –** biggest space – fewest fibres

Muscle Tissue

- Derived from **mesoderm**
- **Cardiac**: pumps blood through body
- **Skeletal**: regulates temperature (heat production; facilitates body movement and manipulating ext. environment
- **Smooth**: move food, urine, repro tract secretion (peristalsis); regulate calibre of airways/blood vessels
- **Myosarcomas** are muscle cancers (smooth = leiomyosarcoma, striated = rhabdomyosarcoma)

Nervous Tissue

- Derived from **ectoderm**
- Composed of **nerve cells** and **glial cells**
    - **Nerve cells** receive and transmit information in the form of electrical signals
    - **Glial cells** are supporting cells that insulate and protect nerve cells

Integumentary System

- Functions of the Skin:
    1. **Protection:** mechanical (resists abrasion and penetration); blocks foreign material entry
    2. **Containment:** prevents unnecessary loss of body fluids
    3. **Thermoregulation:** maintains body temperature
    4. **Sensory organs:** receives different modalities of tactile information
    5. **Photochemical synthesis:** of vitamin D utilising UV
    6. **Excretion:** excretion of urea and sodium through sweat glands
    7. **Absorption:** absorbs substances from ext. environment (e.g. medicine from ointment/patch)

The Skin

- The **integumentary system** is composed of:
    - The **skin** and its derivatives (**hair**, **nails**, **glands** [sweat, oil and mammary])
    - Skin is largest organ – composed of **epidermis**, **dermis** and **hypodermis** (**superficial fascia**)
    - **Dermis** attached to **deep fascia** via connective tissue (**skin ligaments**)
- **Skin derivatives** originate in the **EPIDERMIS**, then translocated to **dermis**
    - **Eccrine sweat glands** not connected to hair follicle
    - **Apocrine sweat glands** connected to hair follicle
    - No oil on palms/soles as no hair – no **sebaceous glands**

Epidermis

- Derived from **ectodermal germ layer**
- Outermost skin layer (pigmented by melanin), stratified squamous epithelial tissue
- Continually renews itself every four weeks
- Doesn't contain blood and lymph vessels (O_2 and nutrients diffuse up from dermis – can dehydrate and lose water if issues)
- Thickest on palms and soles
- Fused with dermis so cannot be separated
- Cells:
    - **Keratinocytes** (95%)
    - **Melanocytes** (pigment cells)
    - **Langerhans** cells (immune cells)
    - **Merkel** cells (sensory receptors)

Dermis

- Tough layer of **connective tissue** underlying **epidermis**, derived from **mesoderm**
- Contains collagen, elastic fibres, blood vessels, nerves, muscle fibres, hair follicles and glands, sensory receptors
        - Makes up majority of skin
        - Where tattoos go
- Collagen fibres (skin ligaments) anchor dermis to underlying structures (deep fascia)
- Fibrous and fibroadipose tissue
- Two layers: Upper 1/5 **dermal papillary layer** (below epidermis) and the lower 4/5 **dermal reticular layer** (above hypodermis)
- **Dermal papillae** are finger-like dermis extensions allowing, together with **epidermal ridges**, interdigitations of both layers to allow better mechanical resistance (lots of SA and friction so closely bound to one another)
    - Allows blood vessels to get close to the epidermis
- Top layer is dead cells, then epidermis with ridges, and then dermal papillae
- Darker – epidermis and dermis, thicker at back
- Hypodermis is fatty tissue
- Marked variation in thickness
    - Thinnest on eyelid, thickest on skin of back
    - Thicker on extensors than flexors
- Rapid/excessive weight gain permanently damages dermis – develop **stretch marks**

Hypodermis/Superficial fascia

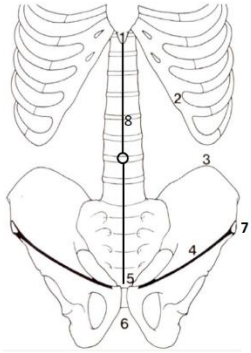
- Attaches reticular layer of dermis to underlying structures (muscle fascia or periosteum)
- Contains loose connective tissue and adipose tissue and supporting fibrous bans (skin ligaments) – bumps anchoring epidermis and dermis to structures underneath
- Major blood vessels and nerves located here – large blood vessels penetrate out to dermis with O_2 and nutrients diffusing out to epidermis
    - Thoracoepigastric and superficial epigastric veins
    - Lateral/Anterior cutaneous nerves
- Functions as an energy reservoir and thermal insulation

Attachment of Skin with Deep Fascia

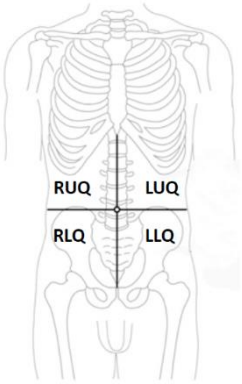
- Skin attached to deep fascia by skin ligaments which anchor skin to reduce physical damage
- Skin ligaments cut when reflecting skin in dissection
- More skin ligaments in palms, soles, face and breast tissue
- **Deep fascia** separates skin (superficial) from muscle (deep).
    - Anything below deep fascia is usually named, vessels/nerves above deep fascia (superficial) are usually not named

Landmarks of Abdomen

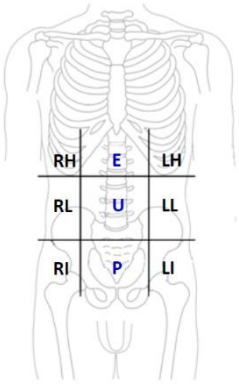
1. Xiphoid Process
2. Costal Margin
3. Iliac Crest
4. Inguinal Ligament
5. Symphysis
6. Pubic Arch
7. Anterior superior iliac spine (ASIS)
8. Linea alba



Abdominal Quadrants and regions



RUQ = Right upper quadrant
RLQ = Right lower quadrant
LUQ = left upper quadrant
LLQ = left lower quadrant



RH/LH = right/left hypochondriac
RL/LL = right/left flanks (lateral regions)
RI/LI = right/left inguinal (groin)
E = epigastric; U = umbilical, P = pubic