Tissues of vertabrates

Premedical 22
Tissues
= cells of specific structure and of the same function

Four basic (primary) types of tissue:

1. Epithelia – ectoderm, mesoderm, endoderm
2. Connective tissue - mesoderm
3. Muscular tissue - mesoderm
4. Nervous tissue - ectoderm
1. Epithelia

form sheets of cells that **cover the outer surface** of the body
and **line the interior surface** of the body cavities and of
hollow body organs.

The cells fits very closely together. Their plasma membranes
are fused by **tight junctions**

The epithelia are among the most rapidly dividing cell types.

The epithelia cells are supported by connective tissue = **basement membrane**, to which are cells attached.
**Basement membrane** - thin sheet of fibers that underlies the epithelium, or the endothelium, which lines the interior surface of blood vessels

1. fusion of **endothelial and epithelial cells** - in kidneys and alveoli

2. **epithelial cells with fibrous tissue**

http://www.thefullwiki.org/Basement_membrane
Single layer of squamous flat cells – flat and thin
Single layer of cuboidal cells - sweat glands and outlets of digestive glands
Single layer of columnar cells
Single layer of columnar cells with microvilli
Stratified e. of cuboidal cells
Stratified Squamous Epithelium (non-keratinized)
Stratified Squamous Epithelium (keratinized)
Transitional e. with cells in a stretched or relaxed state
Pseudostratified Ciliated Columnar Epithelial Tissue
Simple squamous epithel - capillary
Simple columnar epithel – gal gladder

Vesica fellea
Hematoxylin-Eozin
Single layer of columnar cells (2) with microvilli (3) - oviduct

1 - lamina propria, 4 – gland cells
Stratified e. of cuboidal cells with microvilli (2) - trachea

1 - submucosa
Stratified Squamous Epithelium (1) (non-keratinized)

Vagina, ectocervix uterus: 2 - submucosa
Stratified Squamous Epithelium (keratinized) – Cutis - Skin
Transitional Epithelium (2) (urinary bladder)

1 – lumen of vesica urinaria, 3 - Lamina propria mucosae
Function of epithelial tissue

- **protection and cover** - the skin - protect from mechanical injury, harmful chemicals, invading bacteria and from excessive loss of water

- **sensation** - specialized epithelial cells containing sensory nerve endings for the reception of stimuli are found in the skin, eyes, ears, nose and on the tongue

- **secretion** – glands - epithelial tissue is specialized to synthetize and secrete specific chemical substances such as enzymes, hormones and lubricating fluids
Glands

- **Exocrine** secrete enzymes through ducts, outlets to the surface mammary, oil and sweat g.

- **Endocrine** secrete hormones directly to body fluids, ductless
pancreas

lacteal gland

sebaceous gland
• **resorption, absorption** - microvilli - certain epithelial cells line the small intestine absorb nutrients from the digestion of food

• **respiratory, diffusion** - simple epithelium mediates the diffusion of gases, liquids and nutrients. Because they form such a thin layer, they are ideal for the diffusion of gases (eg. walls of capillaries and lungs).

Specializations: cilia, microvilli, goblet cells
2. Connective tissue

binds, supports, protects and repairs of almost every tissue and organ

Consists of a few cells and intercellular substance with fibers: Collagenous - strong and flexible
Elastic - resilient, and can be stretched
Reticular – form extensive network

Cells: Fibroblasts – fibrous and amorphous material
Cartilage cells, (chondrocytes)
Bone cells (osteoblasts and osteocytes)
Fat cells (adipocytes)
Mast cells, Macrophages, Leucocytes, Plasma cells
Fibroblasts with dark nuclei [A] are seen here along with thick collagen fibers [B], thin elastic fibers [C] and very fine reticular fibers [D].
Connective tissue

**Loose conn. tissue** soft, pliable

**Areolar** loosely organized fibers, abundant of blood vessels and empty space, associated with muscles and epithelia, pack and bind the material in the body

**Adipose** white, brown – food supply, protection, heat loss

**Dense conn. tissue** - strong, supporting

**Cartilage**

**Bone**

**Dense regular fibrous tissue** - Ligament, Tendon, Aponeurosis

**irregular fibrous tissue** - deep fascia - capsules

**Blood and lymph an hemopoietic tissue**
Vertical section of duodenum: 1 - Tunica mucosa, 2 - Tunica submucosa, 3 – Brunner gland

white, brown adipose tissue

tendon
**Cartilage**

**Chondrocytes** - network of collagen fibers (elastin) embedded in proteoglycans

Strong, flexible and firm, without blood vessels

Perichondrium

**hyaline cartilage** – the most abundant, surfaces of long bones and joints (knee, elbow), rib cartilages, respiratory sys.

**fibrous cartilage** - intervertebral discs, pelvic bones fuse

**elastic cartilage** – coll. fibers in network of elastic fibers epiglottis, outer ear
hyaline cartilage

elastic cartilage - epiglottis
1 – elastic cartilage, 2 - perichondrium, 3 – seromucin glands, 4 - Tunica mucosa
Bone

Produce red and white blood cells – **red** and yellow **marrow**

Bone store minerals and most notably **calcium and phosphorus** (*calcium phosphate 2/3, calcium hydroxiapatit 1/3*), substances for hardness and rigidness

**Osteocytes** - collagen

**Ossification** (or **osteogenesis**)

**Intramembranous ossification** is the direct formation and healing of bone from primitive connective tissue (mesenchyme)

**Endochondral ossification** involves cartilage as a precursor
1. periosteum
2. compact bone
3. spongy bone
4. bone marrow – medulla

- Diaphysis
- Epiphysis

3. Muscle tissue

Contractile cells, cause movement or change in the shape of some body part

**Skeletal muscle**

Contractions are rapid

Control *by our will*, spinal and cerebral nerves

Bundles of fibers attached to bones or connective tissue

*Multinucleated syncytial cells* by fusion of myoblast cells,

Their *nuclei* are located peripherally adjacent to the plasma membrane (*sarcolemma*).
Skeletal muscle

Skeletal and muscles of tongue and pharynx
Smooth muscle

Walls of abdominal organs, blood vessels, digestive system, uteri, gall bladder, dermis

Slow and wavelike contractions

spindle-shaped cells

Muscle are not striated, and have a single central nucleus. Cells are interconnected by gap junctions.

Controll by autonomic [vegetative] nerves
Cardiac muscle

Wall of the heart and pulmonary veins

Composed of branching and anastomosing chains of cardiac muscle cells

They are joined to their neighbours by intercalated discs, which contain anchors and gap junctions.

The adherent junctions and desmosomes physically connect the cytoskeletons and contractile apparatuses of the neighboring cells.

Control by autonomic vegetative nerves
Muscle - structure

A. Muscle with fascia
   e. tendon
   f. bundle of fibers

B. Fiber

C. Myofibril from sarkomeres
   g. actin
   h. myosin
Myofibrils are composed of actin (thin) and myosin (thick) filaments and associated proteins. The regular repeating segments, sacromeres of myofibrils give skeletal and cardiac muscle cells transverse striations. In smooth muscle cells, actin and myosin filaments form contractile fibers, which do not appear as highly organized as myofibrils.
4. Nervous tissue

Specialized, electrically excitable cells **neurons**, which conduct **impulses** and numerous supporting cells, **glial cells**

Extensive network that receive, integrate, coordinate, interpret, and react to changes.

Cells have long projections, which may run in bundles of parallel fibers.
neuron

- Centripetal fibers - **dendrites**
- Centrifugal fibers – **neurits** – **axons**

**neuroglie**

Oligodendrocytes, Schwann cells - origin of neurolemma which cohere with **sheath myelin**

Nerves - **grey** and **white** fibers

With or without myelin sheet
Thank you for your attention