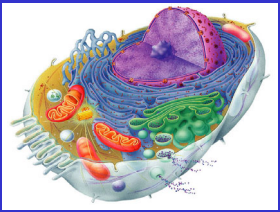


NURSING

Science Lectures



Prof Peter O'Donoghue

1

LEARNING OBJECTIVES

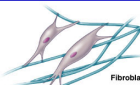
Lecture 4: Overview of Tissues (Histology)

- compare types and organization of epithelial layers
- identify markedly different types of connective tissues
- differentiate types of muscular and nervous tissues


cells organized into tissues

2


**CELL DIVERSITY
(form and function)**



Fibroblasts




Erythrocytes




Fat cell

(c) Cell that stores nutrients



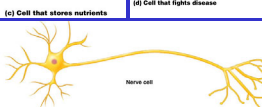
Macrophage

(d) Cell that fights disease



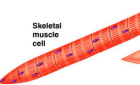
Epithelial cells

(a) Cells that connect body parts or cover and line organs

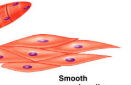


Nerve cell

(i) Cell that gathers information and controls body functions




Skeletal muscle cell



Smooth muscle cells

(b) Cells that move organs and body parts



Sperm

(f) Cell of reproduction

3

Due to differential gene expression

determination (cell committed to particular fate)

- heritable
- specific gene activation
- permanent

differentiation (maturation process)

- specific gene expression
- metabolically active
- characteristic shape
- usually terminal (do not divide further)
- triggered by external stimuli

4

CELLS

all cells derive from 4 basic types:

1. epithelia (coverings)
2. connective (matrix)
3. muscle (movement)
4. nerve (coordination)

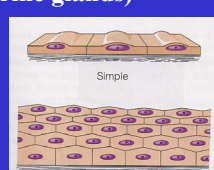
5

1. EPITHELIA

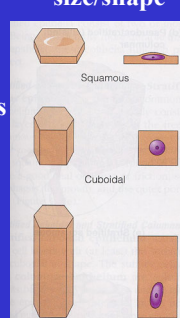
Sheets of epithelial cells:

- cover body
- line cavities
- enclose tissues
- produce most body secretions (exocrine glands)

layers

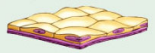


size/shape



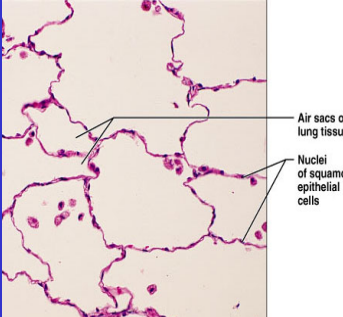
6

Simple squamous epithelium




- fluid uptake
- gas exchange

- lung alveoli
- kidney glomerulus
- endothelia
- serosae



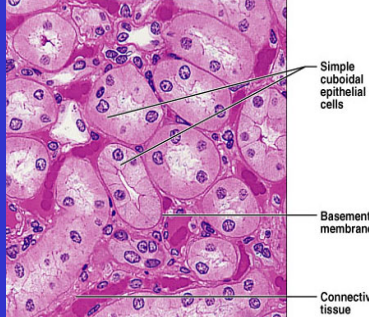
7

Simple cuboidal epithelium



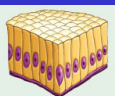
- secretion
- absorption

- kidney tubules
- secretory glands
- gland ducts
- ovary surface



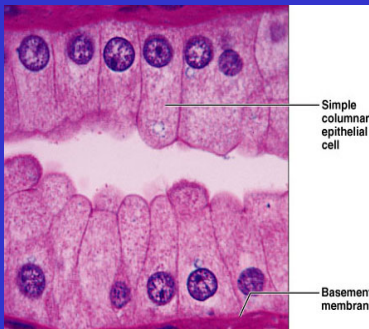
8

Simple columnar epithelium




- absorption
- secrete mucus, ..
- maybe ciliated

- digestive tract
- small bronchi
- uterine tubes



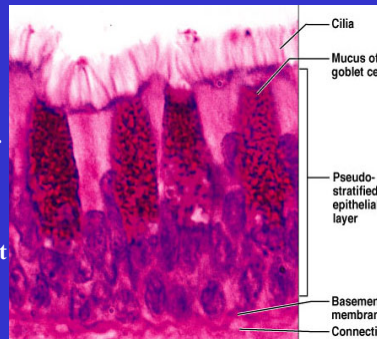
9

Pseudostratified columnar epithelium



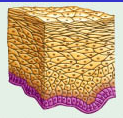
- secrete mucus, ..
- maybe ciliated

- upper resp. tract
- sperm ducts



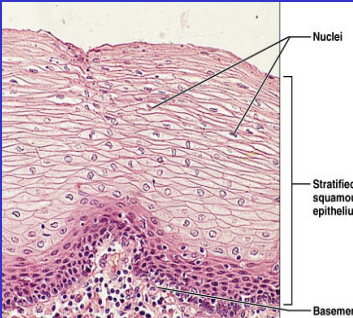
10

Stratified squamous epithelium



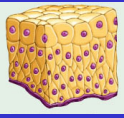
- protection
- maybe keratinized

- moist membranes
- skin



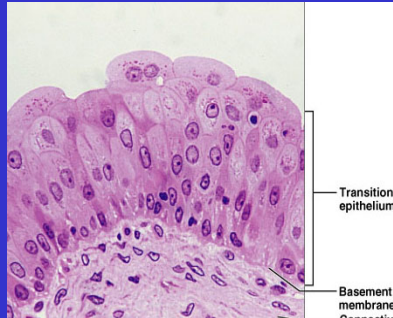
11

Transitional epithelium



- elasticity

- bladder
- ureters



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Glands

Exocrine glands

- ducted glands
- secrete chemicals onto body surface or cavities
- diverse (mucous/sweat/oil/salivary glands, liver...)
- epithelial derivatives

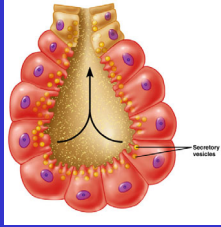
Endocrine glands (in detail later in course)

- ductless glands
- secrete chemicals (hormones) into extracellular space
- diffuse (cells scattered in digestive mucosa and brain)
- not all epithelial derivatives

13

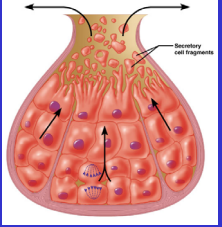
Exocrine glands

merocrine
(cells release products)



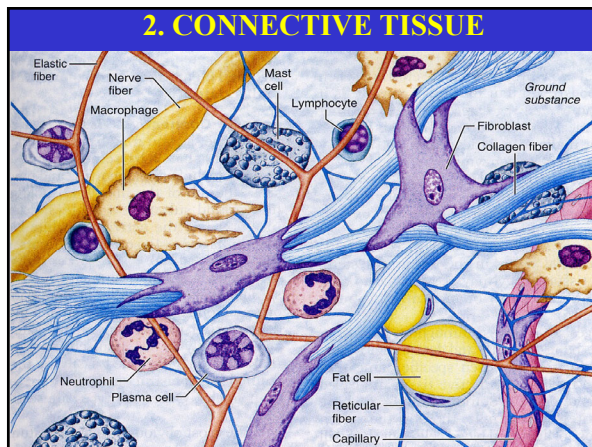
pancreas
salivary glands
sweat glands

holocrine
(cells rupture)



sebaceous glands

14



15

Composition

made up of extracellular matrix

- ground substance (fluid, proteins, proteoglycans)
- fibres (collagen, elastin, reticulin)

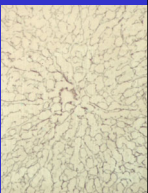
plus connective tissue cells

- fibroblasts → connective tissue proper
 - loose ct (areolar, adipose, reticular)
 - dense ct (regular, irregular, elastic)
- chondroblasts → cartilage (hyaline, elastic, fibro)
- osteoblasts → bone
- haemopoietic stem cells → blood

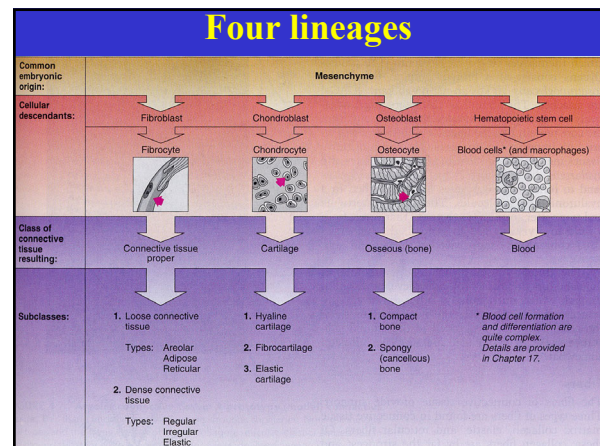
16

Support functions

- loose ct provide reticular framework for organs
- fibrous ct such as tendons provides elasticity
- cartilage provide flexible support
- bones support weight and provide framework for muscle action
- fat provides padding and energy store
- blood provides oxygen and nutrients



17



18

i. Connective tissue (loose)

<p>1. Loose connective tissue</p> <p>Types: Areolar, Adipose, Reticular</p> <p>2. Dense connective tissue</p> <p>Types: Regular, Irregular, Elastic</p>	<p>areolar (lamina propria)</p>	<p>reticular (lymph nodes, spleen, marrow)</p>	<p>adipose (subcutaneous, breasts)</p>
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i. Connective tissue (dense)

<p>1. Loose connective tissue</p> <p>Types: Areolar, Adipose, Reticular</p> <p>2. Dense connective tissue</p> <p>Types: Regular, Irregular, Elastic</p>	<p>dense regular (tendon, ligaments)</p>	<p>dense irregular (dermis, submucosa, fibrous capsules)</p>
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ii. Cartilage

<p>1. Hyaline cartilage</p> <p>2. Fibrocartilage</p> <p>3. Elastic cartilage</p>	<p>hyaline (ribs, nose, trachea)</p>	<p>fibro- (vertebral discs, pubis, knees)</p>	<p>elastic (ear, epiglottis)</p>
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21

iii. Bone

compact and spongy bone (skeleton)

<p>1. Compact bone</p> <p>2. Spongy (cancellous) bone</p>	<p>Compact bone</p>	<p>Spongy bone (trabeculae)</p> <p>Osteocytes in lacunae</p>
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22

iv. Blood

red and white blood cells (marrow, vasculature)

<p>* Blood cell formation and differentiation are quite complex. Details are provided in Chapter 17.</p>	<p>Neutrophil</p> <p>Red blood cells</p> <p>Lymphocyte</p>
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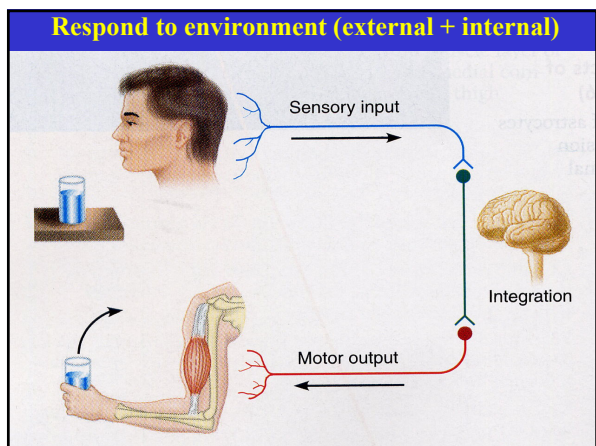
23

3. NERVES

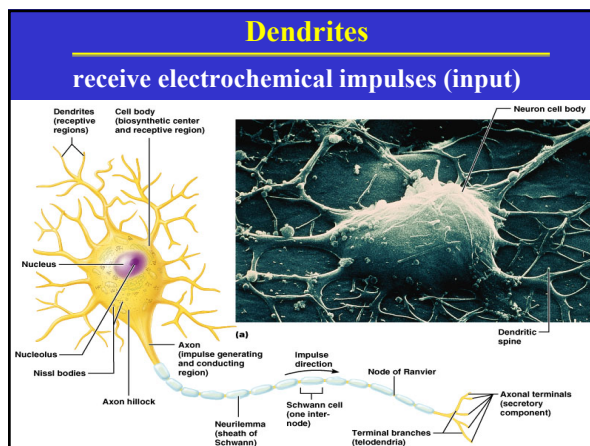
- large cells with elongate branching processes
- transmit electro-chemical signals
- brain
- spinal cord
- peripheral nerves

<p>Nuclei of supporting cells</p> <p>Cell body of a neuron</p> <p>Neuron processes</p>
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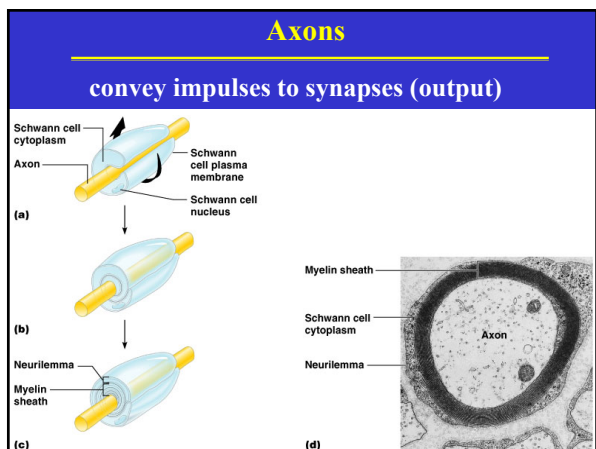
24



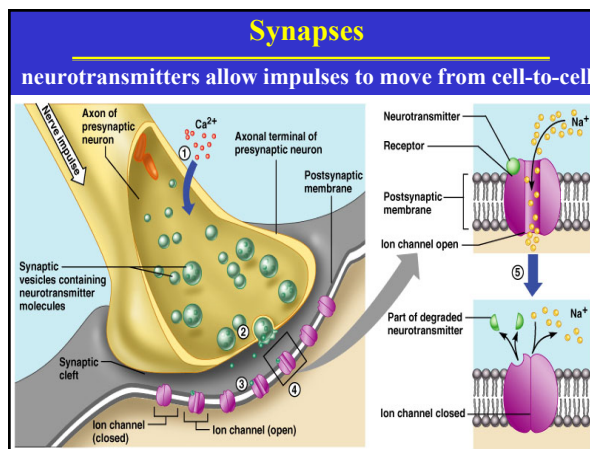
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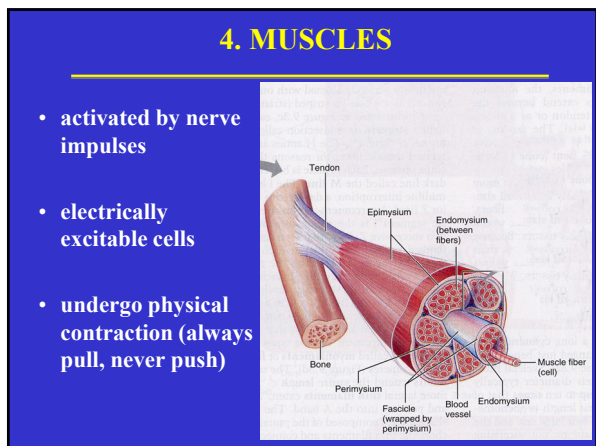
26



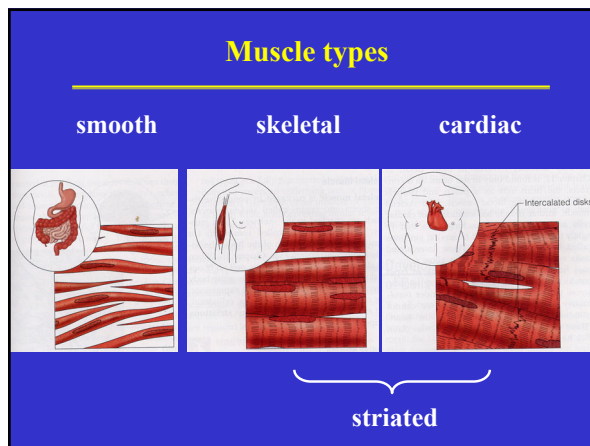
27



28



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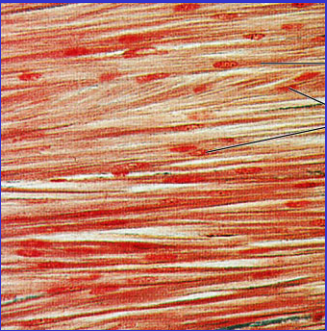


30

Smooth muscle

- spindle-shaped
- uni-nucleate
- not striated
- involuntary control

(walls of hollow organs)

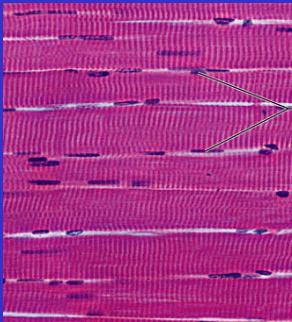


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Skeletal muscle

- cylinder-shaped
- multi-nucleate
- striated
- voluntary control

(muscles attached to skeleton)

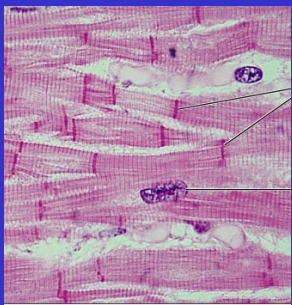


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Cardiac muscle

- tube-shaped
- uni-nucleate
- striated
- involuntary control

(heart)



33

Tissues

tissues constantly wearing out

- senescence (death of aged cells)
- apoptosis (programmed cell death)
- physical/chemical trauma (injury)

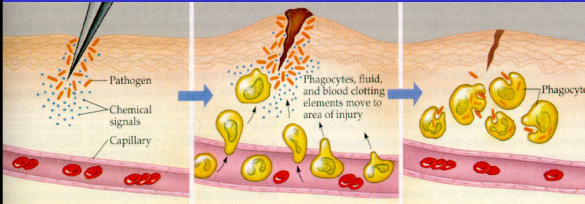
three repair mechanisms

- inflammation delivers cells
- organization restores blood supply (vascularization)
- regeneration/fibrosis replace tissue

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INFLAMMATION

“setting on fire” (rubor, calor, tumor, dolor)



tissue injury
release of
chemical
signals

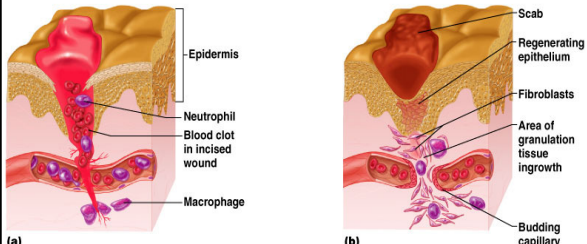
dilation and
increased
permeability of
blood vessels

phagocytosis
of pathogens

35

Vascularization

restore blood supply
(high demand for oxygen/nutrients)



(a)

Epidermis

Neutrophil

Blood clot in incised wound

Macrophage

(b)

Scab

Regenerating epithelium

Fibroblasts

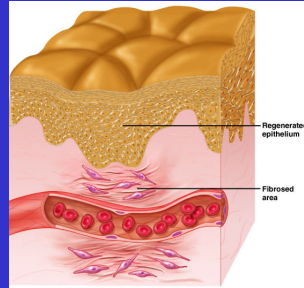
Area of granulation tissue ingrowth

Budding capillary

36

Tissue replacement

- regeneration
(replacement with same tissue)
- fibrosis
(replacement with fibrous scar tissue)



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Summary

Four basic cell types

- epithelia (squamous, cuboidal, columnar)
- connective tissue (loose, dense, cartilage, bone, blood)
- muscles (smooth, skeletal, cardiac)
- nerves (neurons, axons, dendrites, synapses)

Tissue repair

- inflammation (redness, swelling, heat, pain)
- organization (vascularization)
- regeneration (regrowth)
- fibrosis (scarring)

Pathology – structural/functional abnormalities

LEARN WHAT IS NORMAL!

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