Monday, January 25, 2016

Cytoskeleton

8.4 Formation and Action of the Mitotic Spindle Fibre

Introduction

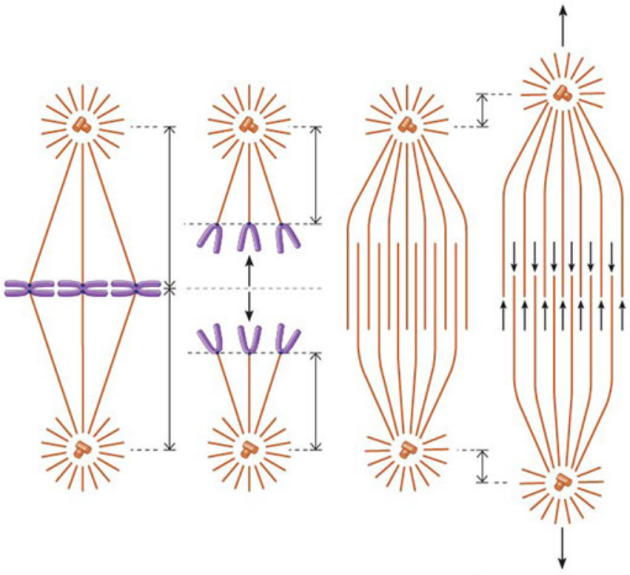
- mitotic spindle fibres are central to both mitosis and cytokinesis
- made up of microtubules and proteins
- activities depend of changing patterns of organization during the cell cycle

Animal Cells

- centrosome: organize microtubule cytoskeleton during interphase and positions cytoplasmic organelles; is the main microtubule organizing centre
- contain a pair centrioles arranged at right angle
- primary function is to generate microtubules needed for flagella or cilia
- when DNA replicates during s-phase, centrioles duplicate
- during early prophase, centrioles separate and move to opposite ends of the nucleus
- microtubules between them begin to lengthen and increase in number
- during late prophase, centrosomes are fully separated and microtubules that are around one side of the nucleus are called early spindle
- once nuclear envelope dissolves, spindle moves in and continues to grow until cytoplasm is filled
- in angiosperms and gymnosperms, spindle forms from microtubules that assemble in all directions from multiple MTOC's surrounding the entire nucleus
    - no centrosomes

Two mechanisms for moving chromosomes

- in eukaryotes, microtubules are surrounded into two groups
    - kinetochore microtubules: connect chromosomes to spindle poles
    - nonkinetochore: microtubules: extend between spindle without connecting to chromosomes; overlap at the midpoint



a. The kinetochore microtubules connected to the kinetochores of the chromosomes become shorter, lessening the distance from the chromosomes to the poles.

b. Sliding of the nonkinetochore microtubules in the zone of overlap at the spindle midpoint pushes poles farther apart and increases the total length of the spindle.

- separation of chromosomes at anaphase appears to result from a combination of separate but coordinated movements produced by the two types of microtubules
- mechanism by which chromosomes move is still uncertain
  - a proposed mechanism is hand over hand - “walking” using motor proteins along microtubules while microtubules become shorter by dissembling at the end

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39.2 Animal Tissues

- cells are classified into four tissue groups: epithelial, connective, muscle and nervous
- structures of cell determines its function
  - depends on …
    - organization of cytoskeleton within the cell
    - type and organization of extracellular matrix (non-living; support and protects cells and provides mechanical linkages) surrounding the cell
    - junctions holding the cells together

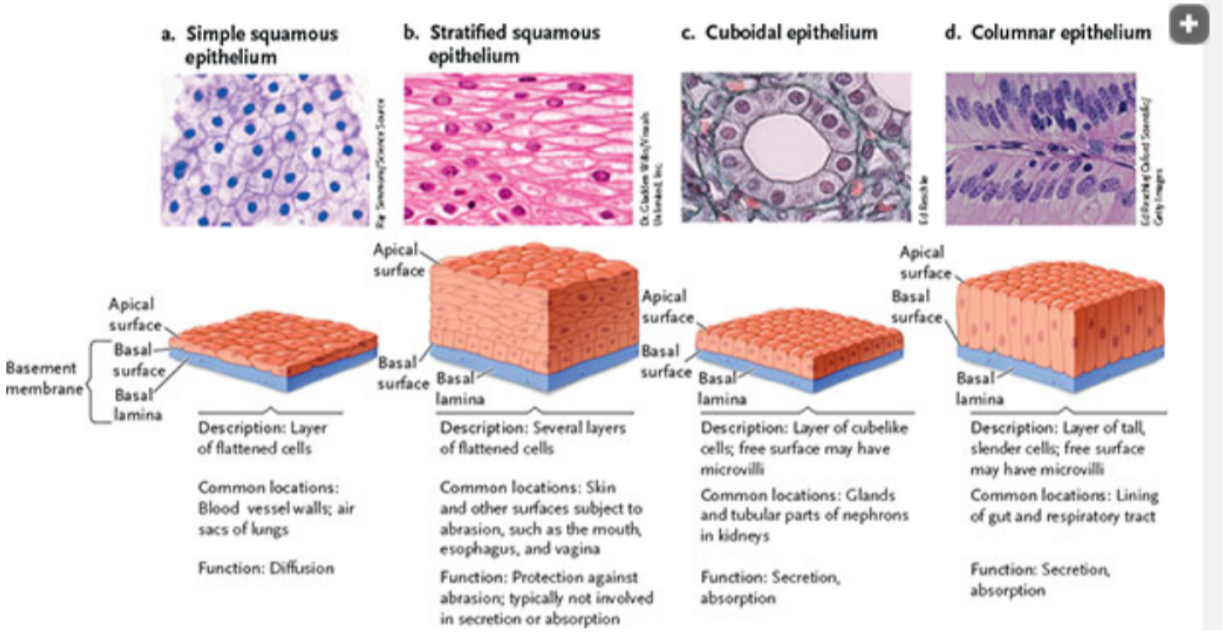
Epithelial Tissue

- formed of sheetlike layers of cells that are tightly joined (little extracellular matrix between)
- protect body surfaces from incision by bacteria and viruses
- forms protective, secretory and absorptive coverings
- cover body surfaces of internal organs and line cavities and ducts within the body
- examples: cover gills in fish and make up cuticles in insects
- some epithelia act as filters allowing ions and small molecules to leak from blood into surrounding tissues ex. capillaries
- apical surface
  - outer
  - exposed to water, air, fluids
  - often covered in cilia in internal covering epithelia - moves fluids
  - some are crowded with microvilli (fingerlike extensions of the plasma membrane that increases area available for secretion and absorption ex. small intestine
- basal surface
  - inner
  - adheres to a later of ECM secreted by epithelial cells called basal lamina
  - basement membrane: inner surface consists of basal lamina and connective tissue

Types of Epithelia

- simple: single later of cells
- stratified: multiple cell layers
- squamous (mosaic, flattened, and spread out), cuboidal (shaped roughly like dice or cubes), or columnar (elongated, with the long axis perpendicular to the epithelial layer)

Principle types of epithelia.



- some epithelia divide constantly replacing worn and dying cells (ex. skin & intestine)
- new cells are produced through the division of stem cells n the basal layer

Glands Formed by Epithelia

- derived from pockets of epithelium during embryonic development
- exocrine glands: remain connected to epithelium by a duct and empties its secretion at epithelial surface ex. mucus, saliva, digestive enzymes, sweat, earwax, oils etc.
- endocrine glands: ductless secretory organs that secrete hormones into the blood or extracellular fluid; secrete products into interstitial fluid to be picked up by blood for circulation
- some contain a combination of both ex. pancreas cells
- epithelial cells can contain a network of fibres of keratin (tough protein) ex. epidermis

Connective Tissue

- form layers in and around body structures; separated by non living cells (usually ECM)
- provide support from other body tissues
- transmit mechanical and other forces; act as filters
- mechanical properties depends type and quantity of ECM (varies from fluid to soft and firm ex. blood-tendons)

- ECM consists primarily of of collagen (fibrous glycoproteins - rich in carbohydrates - embedded in a network of proteoglycans)
- in bone, the glycoprotein network surrounding the collagen is impregnated with mineral deposits that produces hard yet somewhat elastic structure
- fibronectin: aids in the attachment of cells to the ECM and helps hold cells in position
- elastin: rubbery protein that adds elasticity to the ECM; capable of returning to original position after being stretched/compressed ex. skin
- resilin: protein related to elastin that occurs in insects and some crustacea
- six major type of connective tissue

Loose Connective Tissue

- formed of sparsely distributed cells surrounded by collagen and other glycoprotein
- fibroblasts: cells that secretes most of the collagen and other preens in LCT
- support epithelia ex. blood vessels, nerves, internal organs
- reinforce deeper layers of the skin
- mesenteries: sheets of LCT covered on both surfaces with epithelia; hold abdominal organs in place and provide lubrication for body movement (for adjacent structures)

Fibrous Connective Tissue

- fibroblasts are sparsely distributed among dense masses of collagen and elastin fibres that are lined up in highly ordered, parallel bundles, producing maximum tensile strength and elasticity ex. tendons (bones to muscles), cornea

Cartilage

- composed of sprucely distributed chondrocytes surrounded by networks of collagen fibres embedded in a tough but elastic matrix of glycoproteins
- elasticity allows the resisting of compression and resiliency
- support larynx, trachea etc
- forms discs cushioning the vertebrae in the spinal column

Bone

- dentist form of CT

- living cells secrete mineralized matrix of collagen and calcium slats that surround
- forms the skeleton
- mature bone consists of osteocytes
- osteoblasts: produce collagen and mineral of bone
- osteoclasts: remove the minerals and recycle them through the bloodstream
- bone is not a stable tissue; constantly being reshaped
- ports structures consisting of a system of microscopic spaces canals
- osteon: structural unit of bone; consist of minute central canal surrounded by osteocytes embedded in concentric laters of mineral matter
  - nerve and blood vessels can run through canals providing nutrition

Adipose Tissue

- contains large densely clustered cells called adipocytes that are specialized for fat storage
- cushions the body forms and important insulating layer under skin in mammals
- excess carbohydrates are connected into fats sorted in adipocytes
- richly supplied with blood vessels

Blood

- considered connective tissue because fluid portion is ECM
- principal transport vehicle carrying nutrients and oxygen to cells and carbon dioxide and waste away
- defends against disease
- erythrocytes: contain hemoglobin (oxygen binds to)
- leukocytes: protect body against foreign elements such as viruses and bacteria
- platelets: fragment of leukocytes; form blood clots to heal wounds