Epithelial Tissue

Terms that help us understand what kinds of tissues we are identifying:

Terms referring to the layers

Simple = one layer

Stratified = more than one layer

Pseudostratified = false layered (appears to be more than one layer, but only one); *ciliated* = with cilia

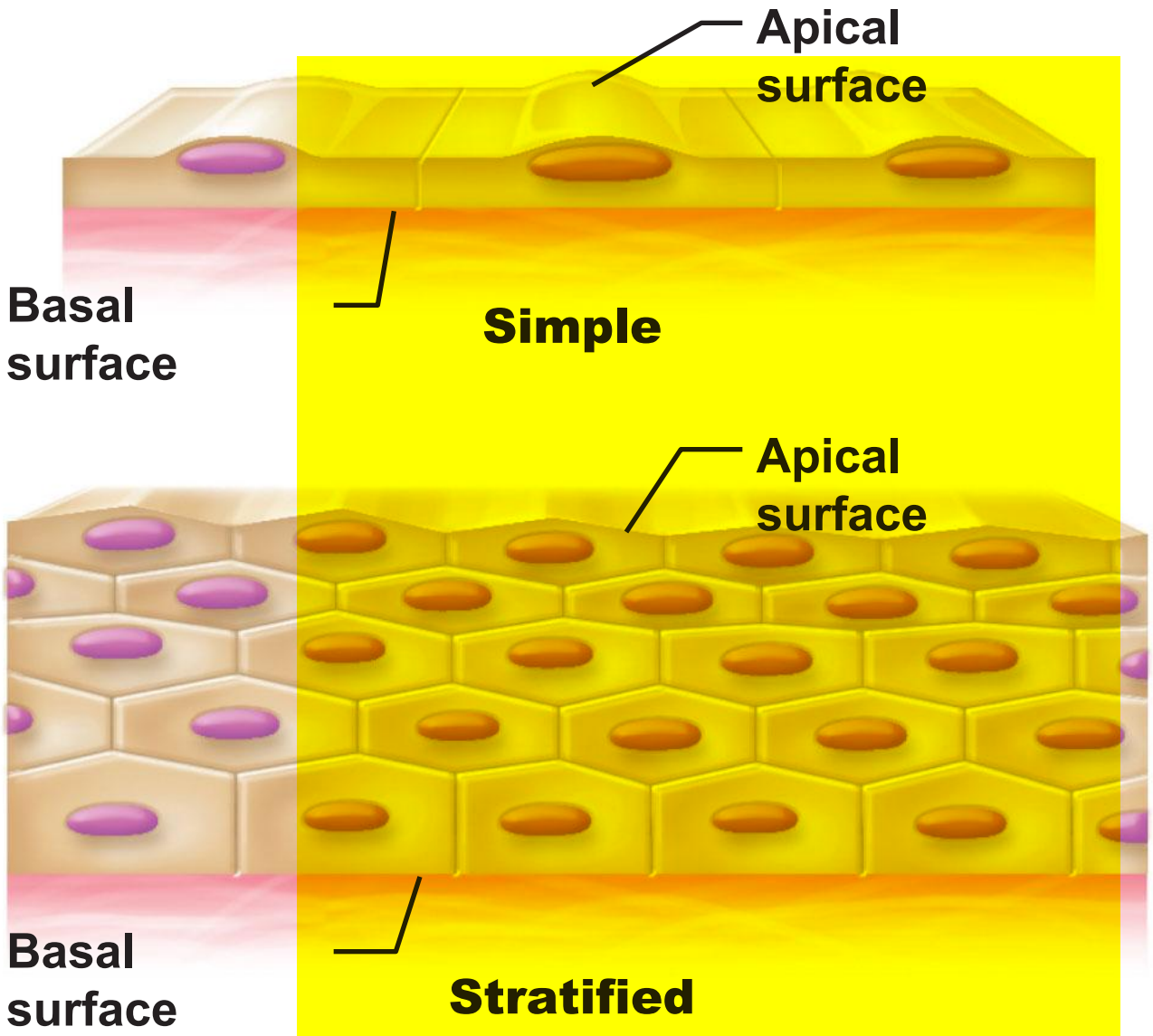
Terms referring to the cell shapes

Squamous = flat

Cuboidal = cube

Columnar = rectangular (column)

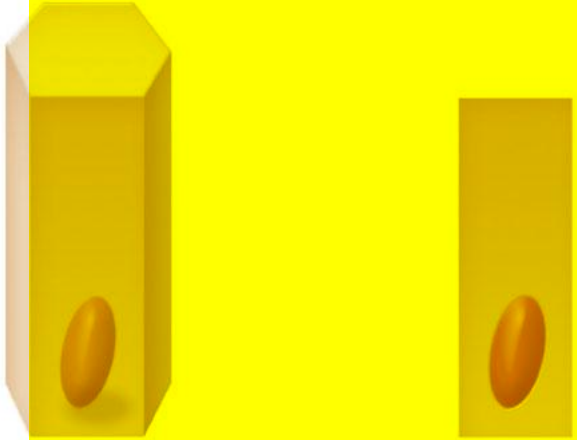
Transitional = ability to change shape



Classification based on number of cell layers.

Squamous

Cuboidal



Columnar

Classification based on cell shape.

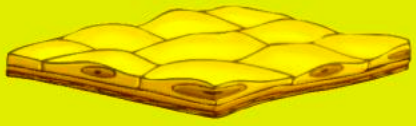
The following types of **epithelial tissues** are covered in this activity:

1. Simple squamous epithelial tissue (lungs)
2. Simple cuboidal epithelial tissue (kidneys)
3. Simple columnar epithelial tissue
   a. Ciliated (bronchioles)
   b. Non Ciliated (digestive tract)
4. Pseudostratified columnar epithelial tissue
   a. Ciliated (trachea lining)
   b. Non Ciliated (male reproductive tract)
5. Stratified squamous epithelial tissue
   a. Keritinized (skin)
   b. Non Keritinized (oral cavity)
6. Stratified cuboidal epithelial tissue (salivary glands, sweat glands)
7. Stratified columnar epithelial tissue (male reproductive tract)
8 Transitional epithelial tissue (bladder)
   a. Relaxed (empty bladder)
   b. Stretched (full bladder)

Figure 4.3a Epithelial tissues.

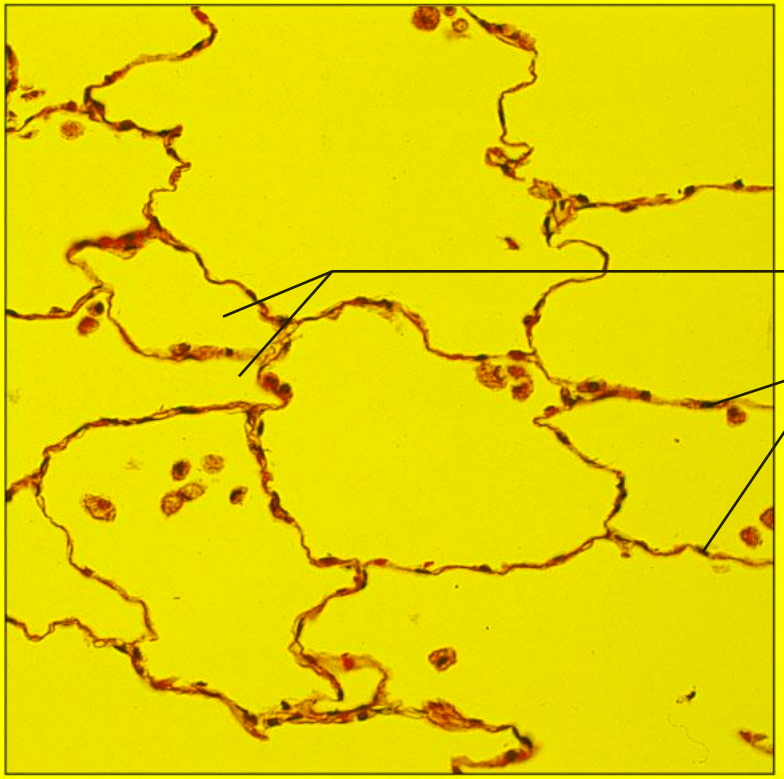
(a) Simple squamous epithelium

Description: Single layer of flattened cells with disc-shaped central nuclei and sparse cytoplasm; the simplest of the epithelia.



Function: Allows passage of materials by diffusion and filtration in sites where protection is not important; secretes lubricating substances in serosae.

Location: Kidney glomeruli; air sacs of lungs; lining of heart, blood vessels, and lymphatic vessels; lining of ventral body cavity (serosae).



Photomicrograph: Simple squamous epithelium forming part of the alveolar (air sac) walls (125x).

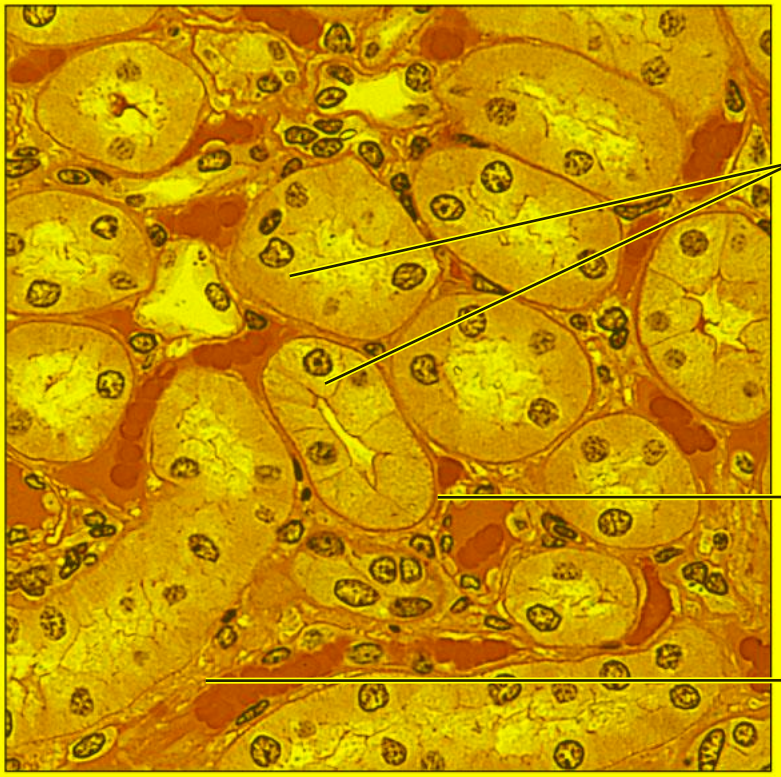
Figure 4.3b Epithelial tissues.

(b) Simple cuboidal epithelium

Description: Single layer of cubelike cells with large, spherical central nuclei.

Function: Secretion and absorption.

Location: Kidney tubules; ducts and secretory portions of small glands; ovary surface.

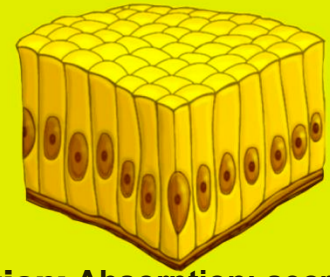


Photomicrograph: Simple cuboidal epithelium in kidney tubules (430x).

Figure 4.3c Epithelial tissues.

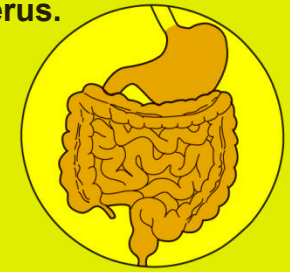
(c) Simple columnar epithelium

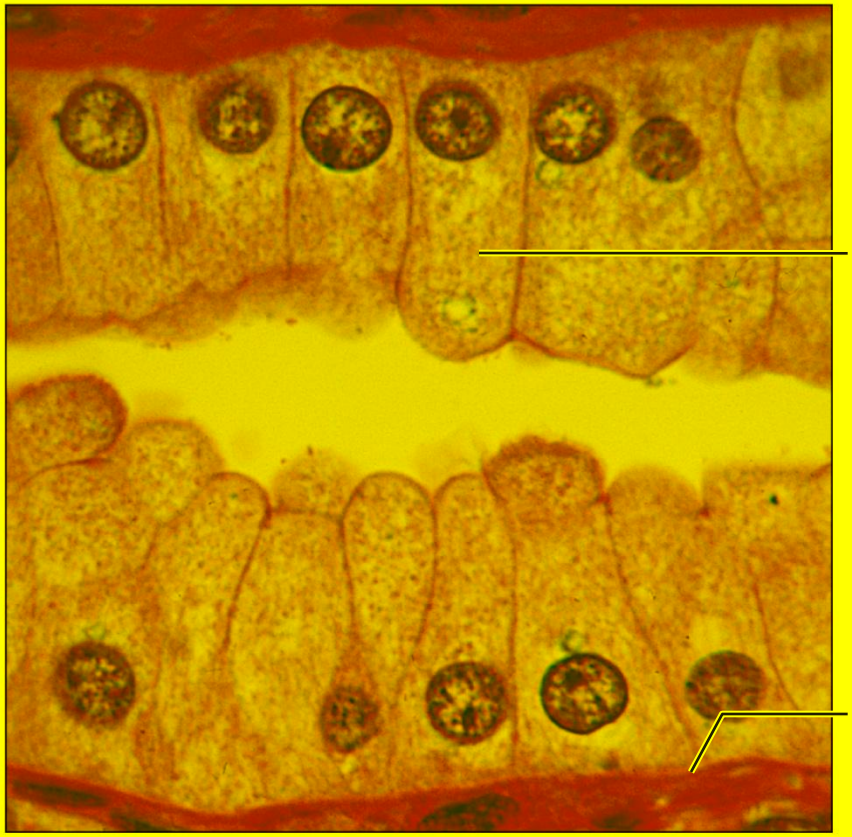
Description: Single layer of tall cells with *round* to *oval* nuclei; some cells bear cilia; layer may contain mucus-secreting unicellular glands (goblet cells).



Function: Absorption; secretion of mucus, enzymes, and other substances; ciliated type propels mucus (or reproductive cells) by ciliary action.

Location: Nonciliated type lines most of the digestive tract (stomach to anal canal), gallbladder, and excretory ducts of some glands; ciliated variety lines small bronchi, uterine tubes, and some regions of the uterus.





Photomicrograph: Simple columnar epithelium of the stomach mucosa (860X).

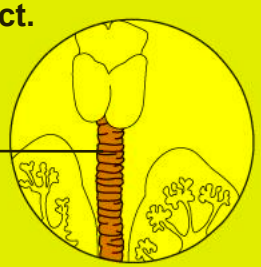
Figure 4.3d Epithelial tissues.

(d) Pseudostratified columnar epithelium

Description: Single layer of cells of differing heights, some not reaching the free surface; nuclei seen at different levels; may contain mucus-secreting cells and bear cilia.

Function: Secretion, particularly of mucus; propulsion of mucus by ciliary action.

Location: Nonciliated type in male's sperm-carrying ducts and ducts of large glands; ciliated variety lines the trachea, most of the upper respiratory tract.

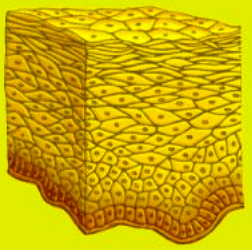


Photomicrograph: Pseudostratified ciliated columnar epithelium lining the human trachea (570x).

Figure 4.3e Epithelial tissues.

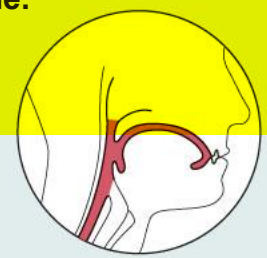
(e) Stratified squamous epithelium

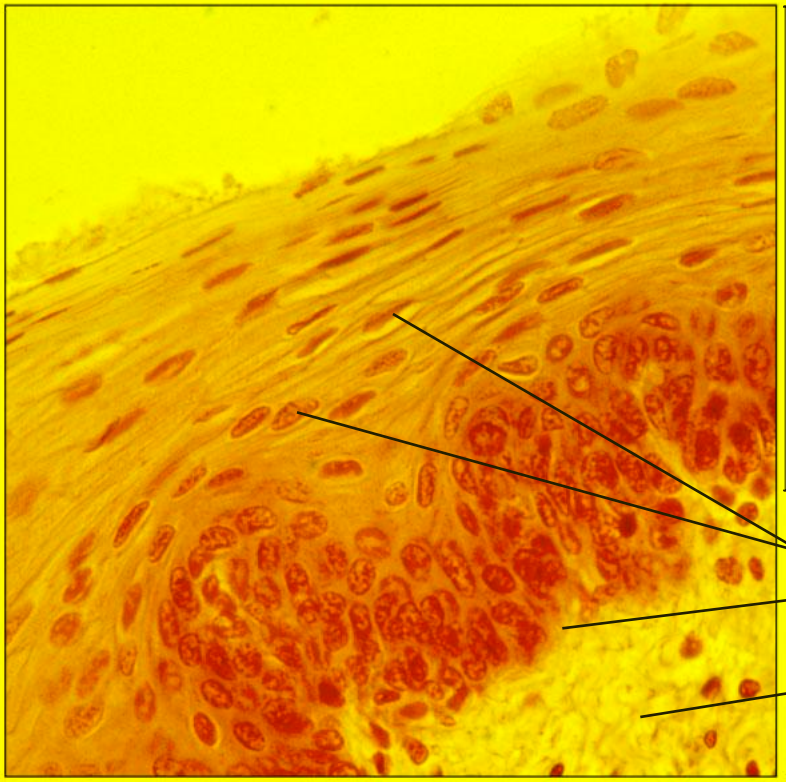
Description: Thick membrane composed of several cell layers; basal cells are cuboidal or columnar and metabolically active; surface cells are flattened (squamous); in the keratinized type, the surface cells are full of keratin and dead; basal cells are active in mitosis and produce the cells of the more superficial layers.



Function: Protects underlying tissues in areas subjected to abrasion.

Location: Nonkeratinized type forms the moist linings of the esophagus, mouth, and vagina; keratinized variety forms the epidermis of the skin, a dry membrane.



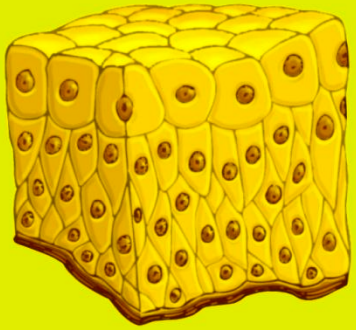


Photomicrograph: Stratified squamous epithelium lining the esophagus (285x).

Figure 4.3f Epithelial tissues.

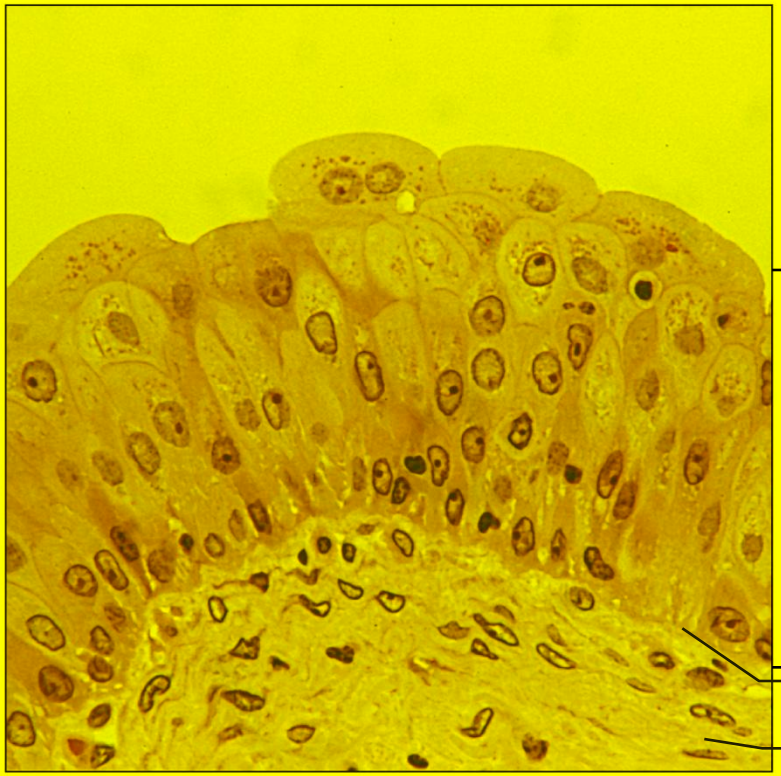
(f) Transitional epithelium

Description: Resembles both stratified squamous and stratified cuboidal; basal cells cuboidal or columnar; surface cells dome shaped or squamouslike, depending on degree of organ stretch.



Function: Stretches readily and permits distension of urinary organ by contained urine.

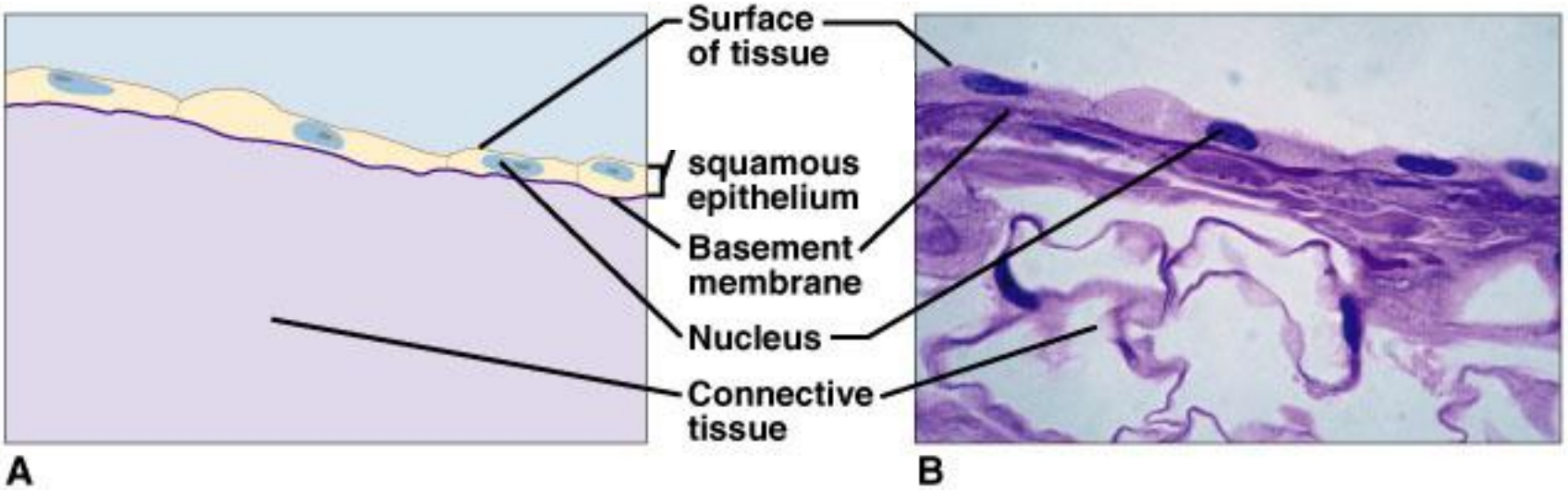
Location: Lines the ureters, urinary bladder, and part of the urethra.



Photomicrograph: Transitional epithelium lining the urinary bladder, relaxed state (360X); note the bulbous, or rounded, appearance of the cells at the surface; these cells flatten and become elongated when the bladder is filled with urine.

What kind of tissue does this represent?

Simple squamous epithelial tissue

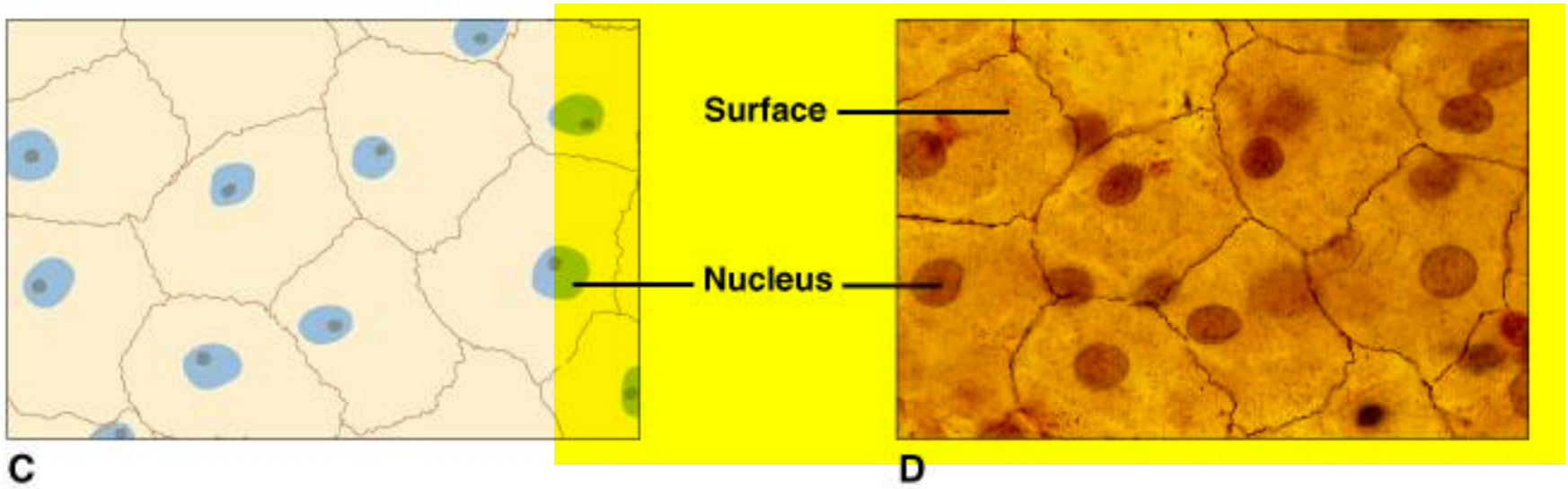


Where in the body would you find this tissue?

lungs

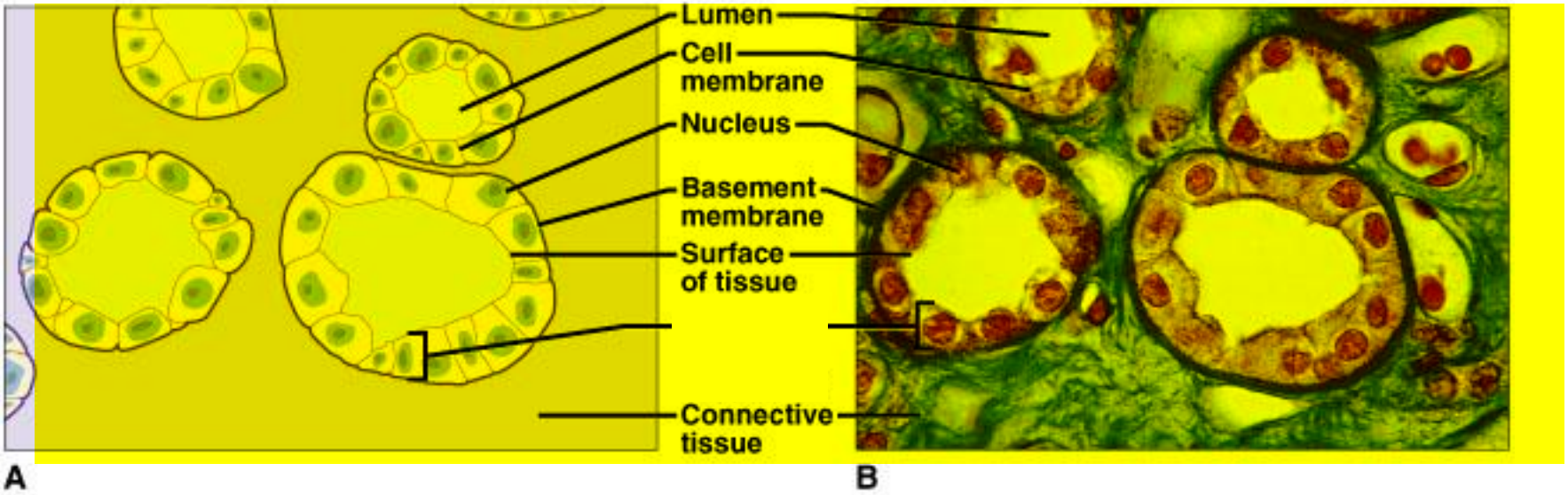
What kind of tissue does this represent?

Simple squamous epithelial tissue (superior view)



What kind of tissue does this represent?

Simple cuboidal epithelial tissue



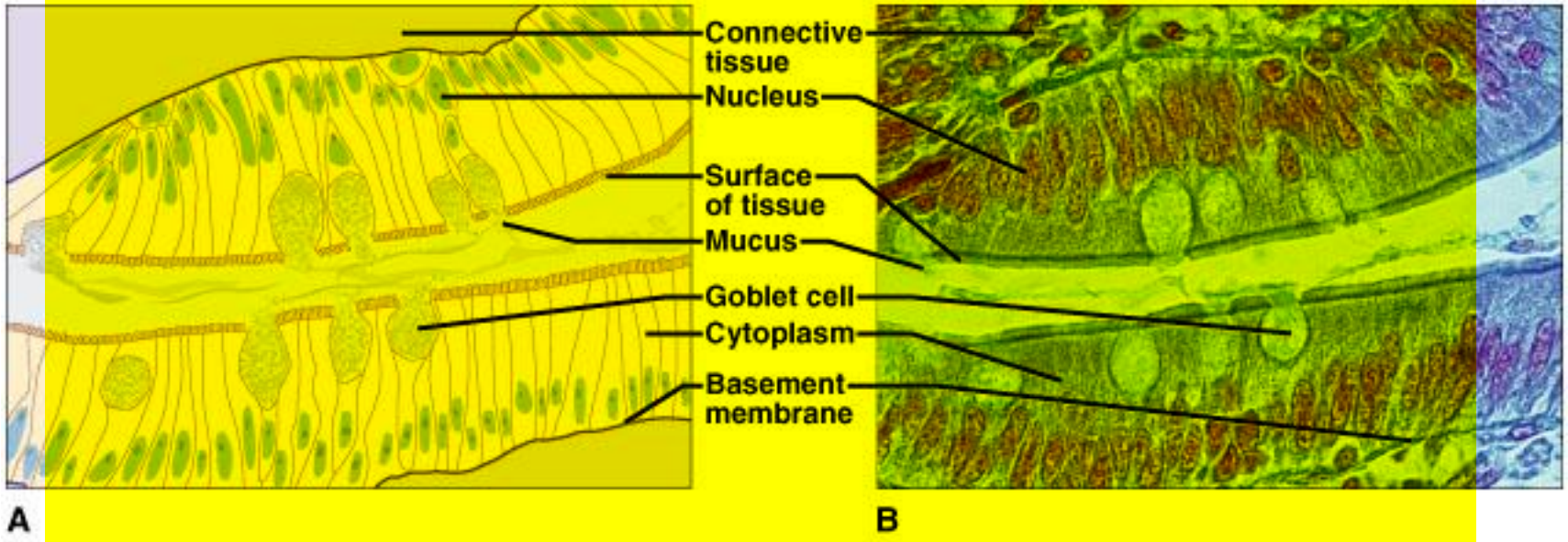
Where in the body would you find this tissue?

Kidneys (tubules)

The lining of the kidney glomerulus (sing.)/glomeruli (pl.) is simple squamous epithelial tissue

What kind of tissue does this represent?

Simple columnar epithelial tissue



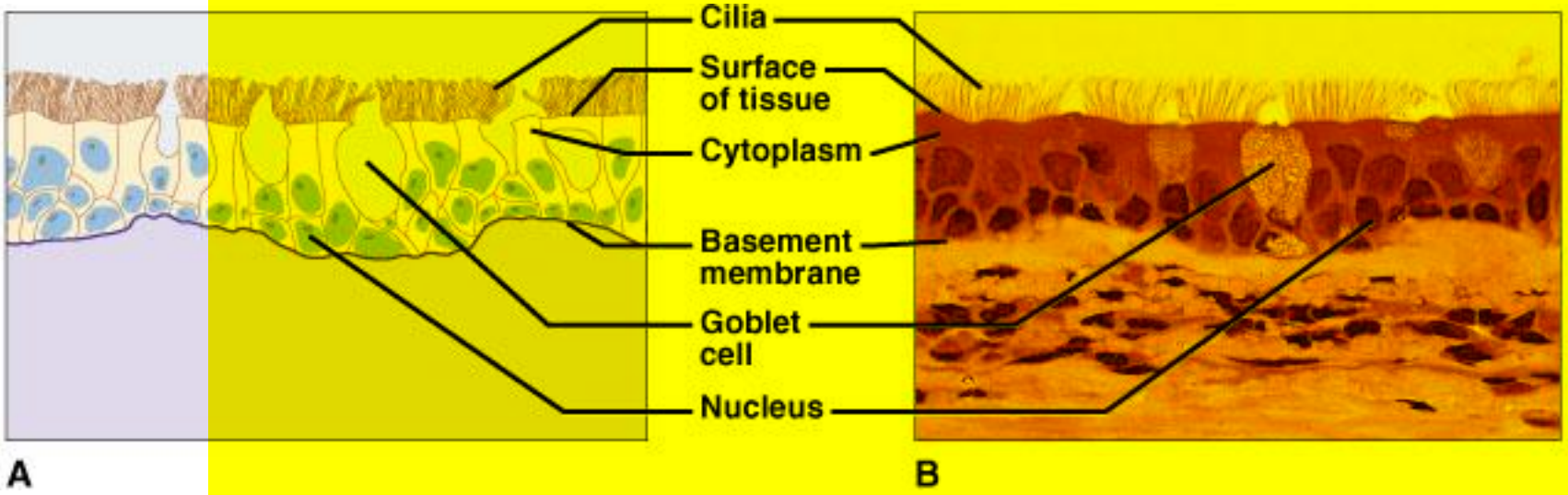
Where in the body would you find this tissue?

small intestine

What kind of tissue does this represent?

Pseudostratified (ciliated) columnar epithelial tissue

"false layered"; it looks like more than one layer, but it is not

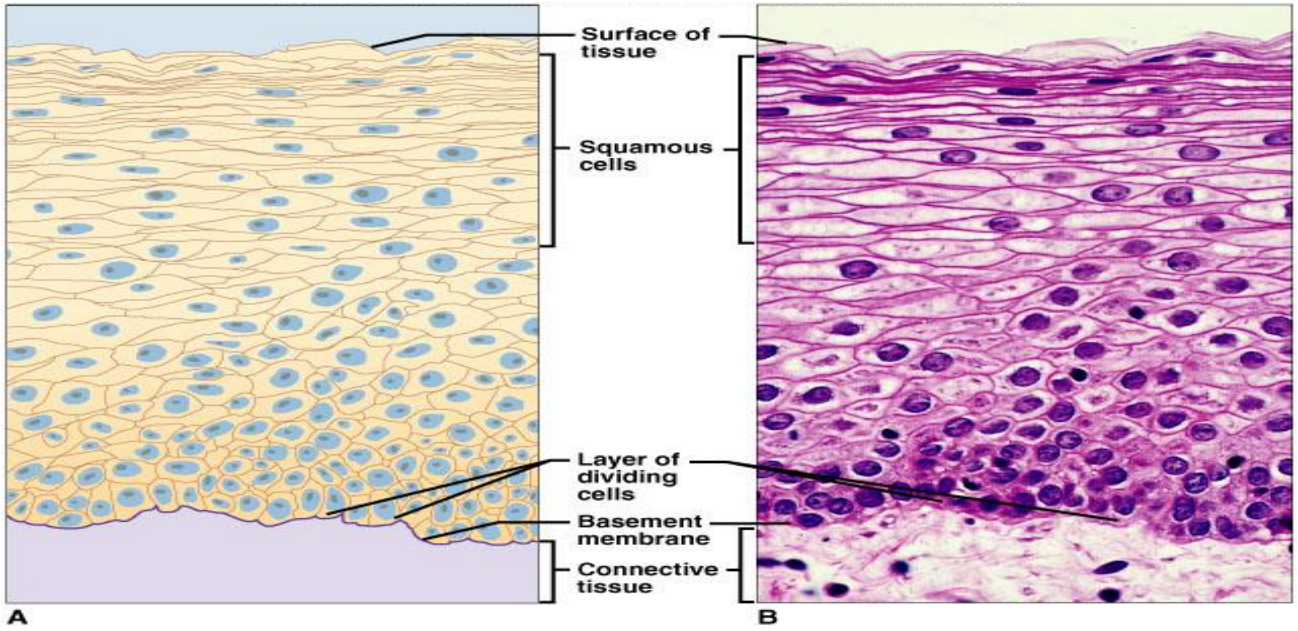


Where in the body would you find this tissue?

trachea lining

What kind of tissue does this represent?

Stratified squamous epithelial tissue

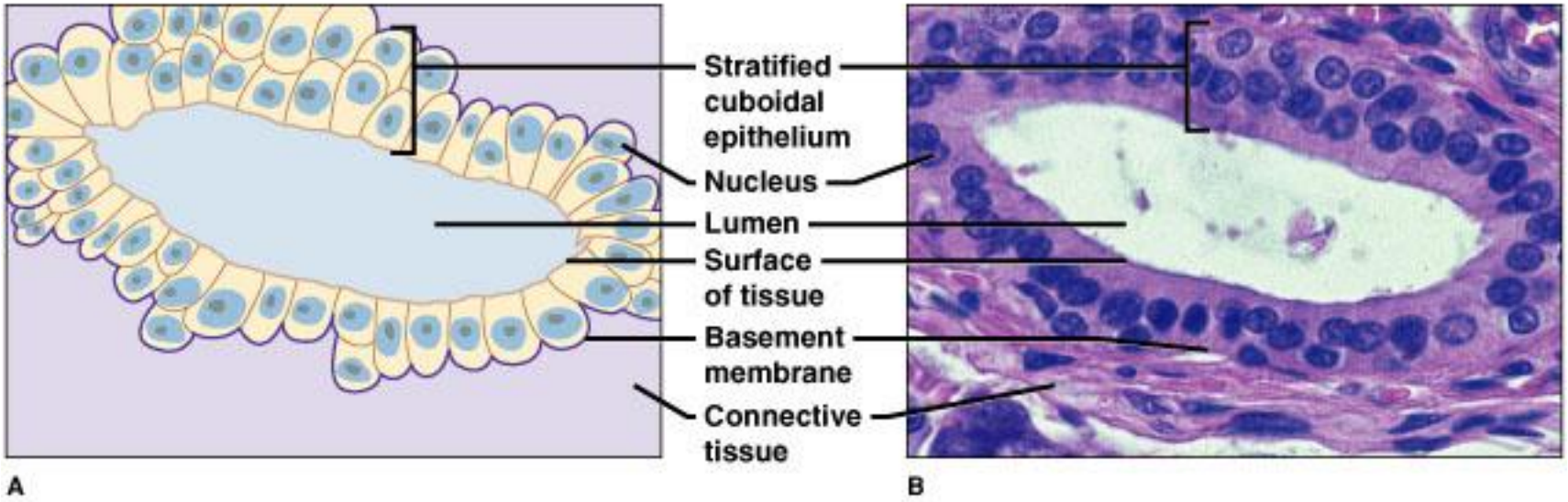


Where in the body would you find this tissue?

mouth lining

What kind of tissue does this represent?

Stratified cuboidal epithelial tissue

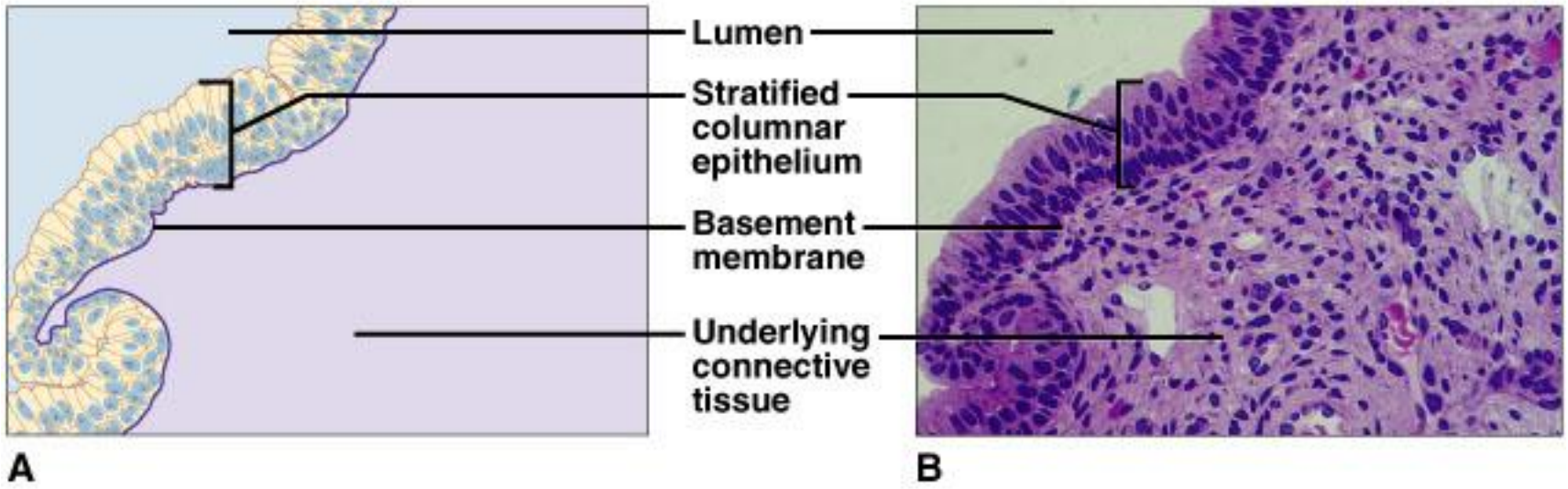


Where in the body would you find this tissue?

salivary glands, sweat glands

What kind of tissue does this represent?

Stratified columnar epithelial tissue

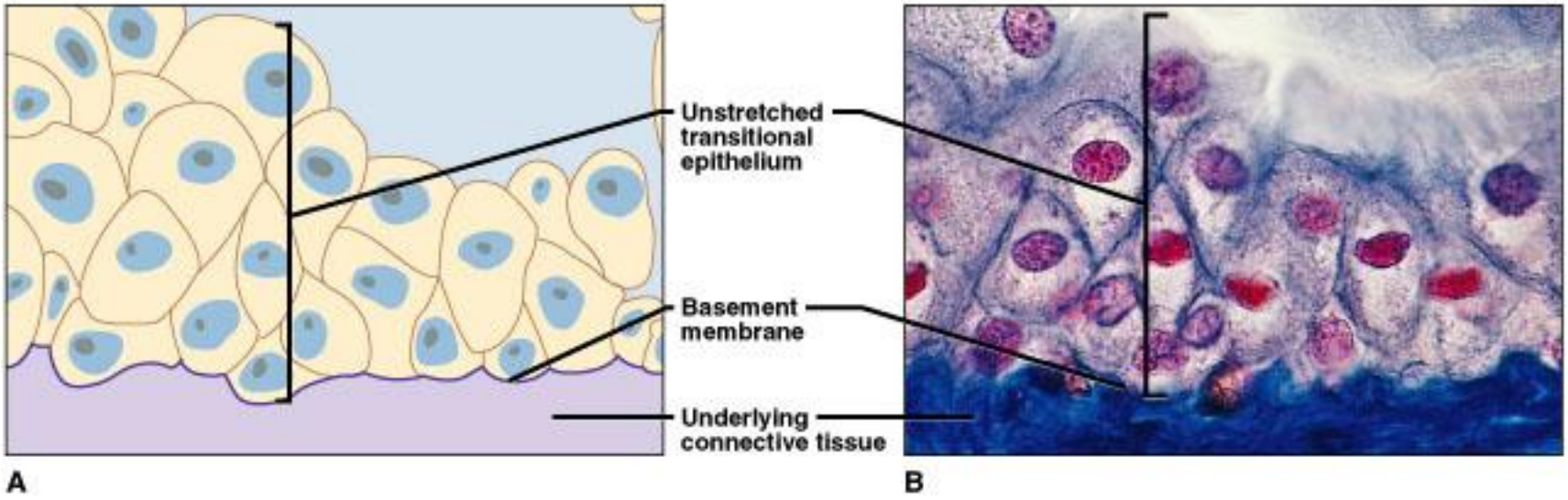


Where in the body would you find this tissue?

male reproductive tract

What kind of tissue does this represent?

Transitional epithelial tissue

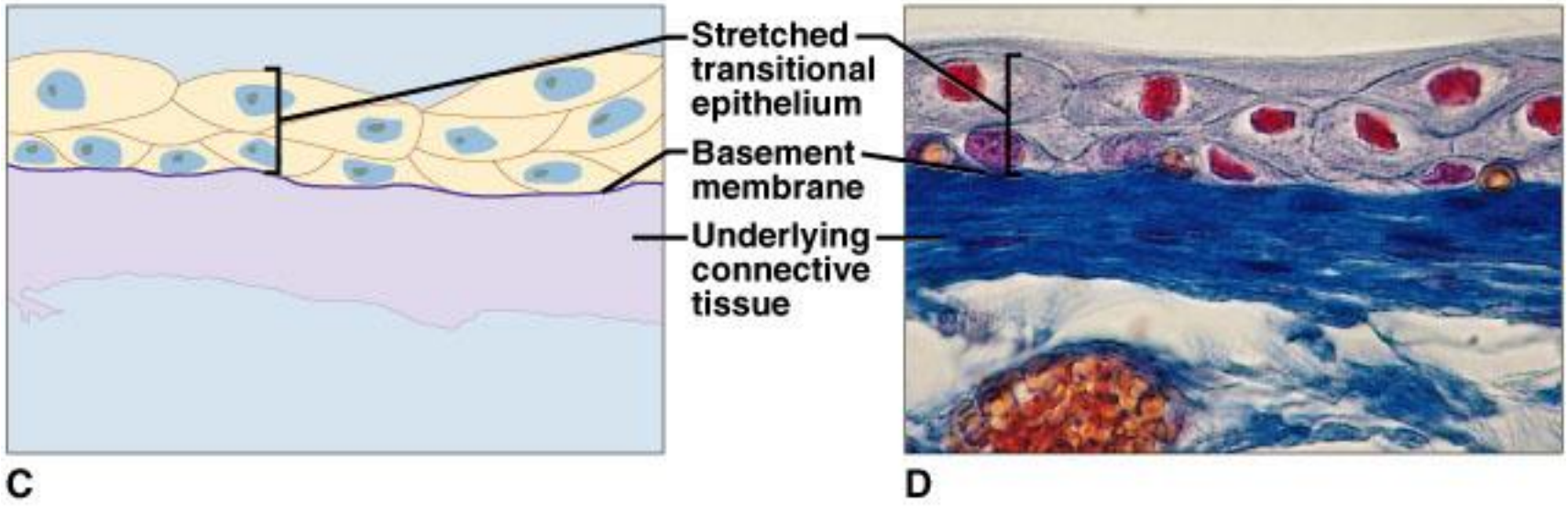


Where in the body would you find this tissue?

empty bladder

What kind of tissue does this represent?

Transitional epithelial tissue

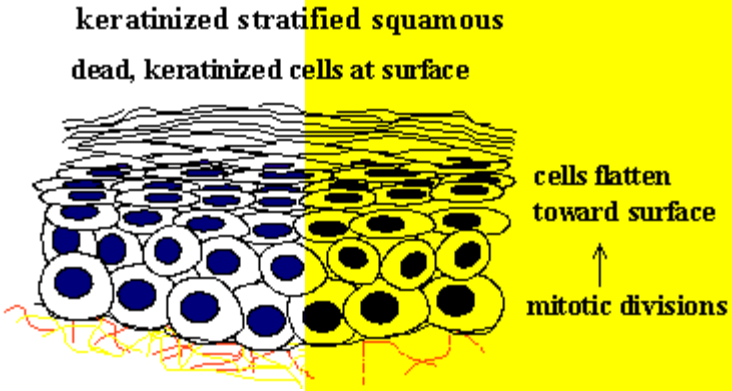


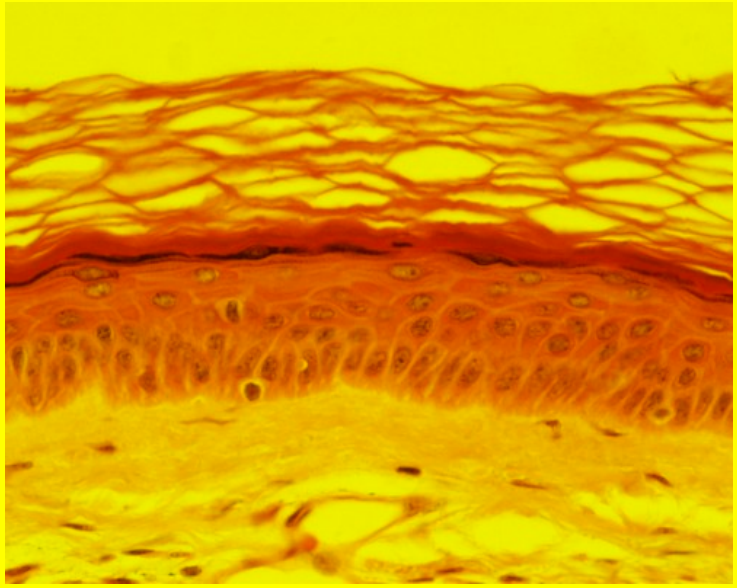
Where in the body would you find this tissue?

distended (full) bladder

What kind of tissue does this represent?

Keratinized Stratified Squamous



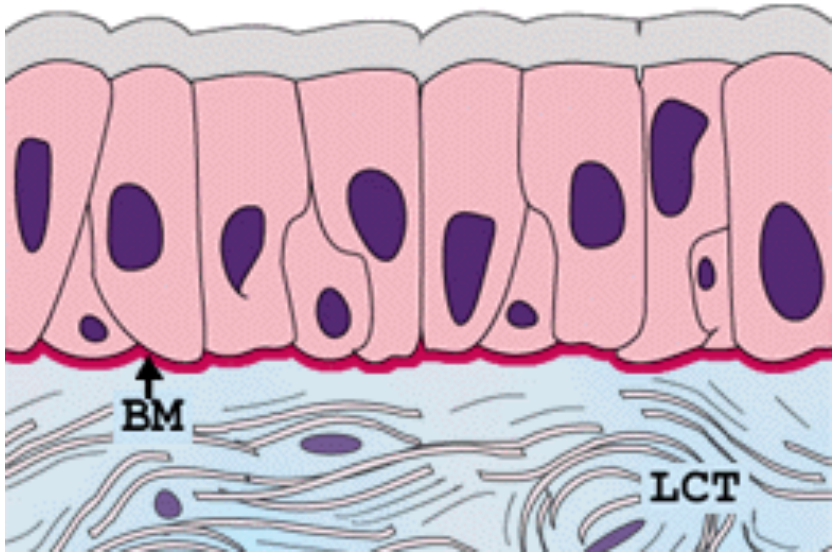


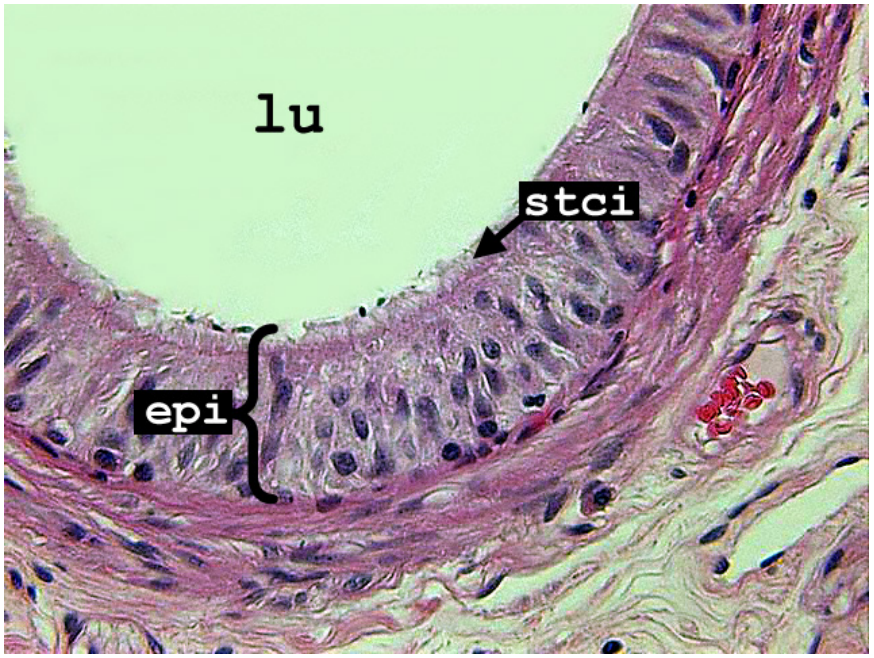
Where in the body would you find this tissue?

skin

What kind of tissue does this represent?

Psudeostratified (non ciliated columnar





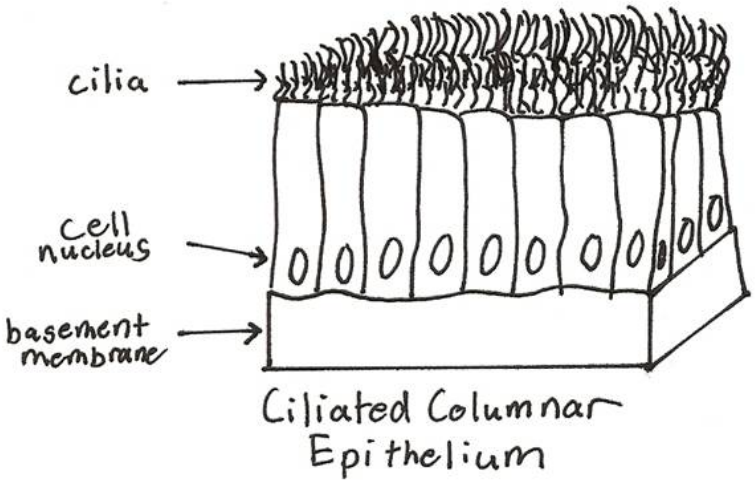
Where in the body would you find this tissue?

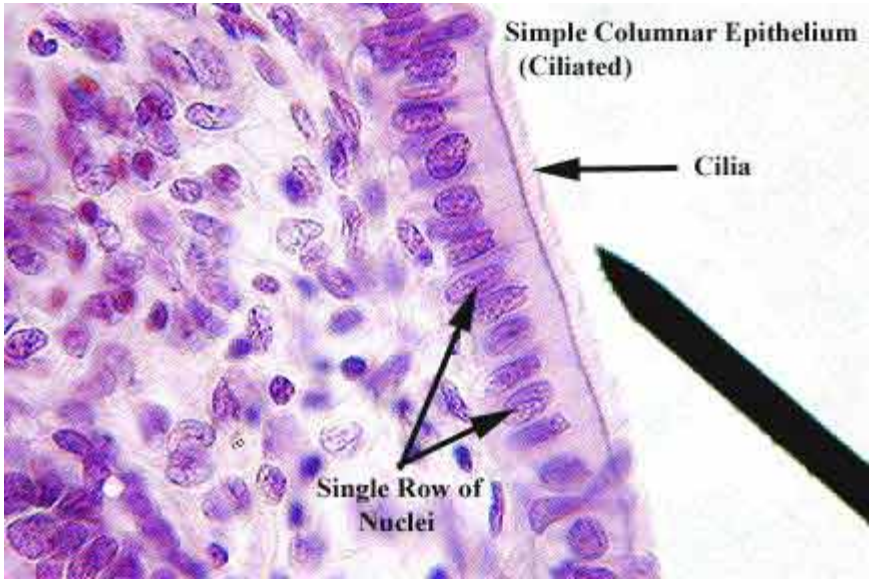
lining of male

reproductive tract

What kind of tissue does this represent?

Simple Ciliated Columnar





Where in the body would you find this tissue?

bronchioles

Epithelial Tissue

Human Anatomy - Epithelial Tissue > Location

Type	Location
simple squamous epithelium	air sacs in lungs (alveoli); lining of heart chambers and lumen of blood vessels (endothelium); serous membranes of body cavities (mesothelium)
simple cuboidal epithelium	thyroid gland follicles; kidney tubules; ducts and secretory regions of most glands; surface of ovary
nonciliated simple columnar epithelium	lining most of digestive tract (from stomach to anal canal)
ciliated simple columnar epithelium	lining of uterine tubes and larger bronchioles of respiratory tract
nonkeratinized stratified squamous epithelium	lining of oral cavity, part of pharynx (throat), esophagus, vagina, anus
keratinized stratified squamous epithelium	epidermis of skin
stratified cuboidal epithelium	relatively rare; found in large ducts in most exocrine glands and in some parts of male urethra
stratified columnar epithelium	rare; found in large ducts of some exocrine glands and in some regions of male urethra
pseudostratified ciliated columnar epithelium	lines most of respiratory tract, including nasal cavity, part of pharynx (throat), larynx, trachea, bronchi
pseudostratified nonciliated columnar epithelium	relatively rare; lines epididymis and part of male urethra
transitional epithelium	lining of urinary bladder, inner layer of ureters, and part of urethra

Functions of Epithelial Tissue

- **Protection**
  - Skin protects from sunlight & bacteria & physical damage.
- **Absorption**
  - Lining of small intestine, absorbing nutrients into blood
- **Filtration**
  - Lining of Kidney tubules filtering wastes from blood plasma
- **Secretion**
  - Different glands produce perspiration, oil, digestive enzymes an

Characteristics of Epithelial Tissue

- Form continuous sheets (fit like tiles)
  - line the cavities and surfaces of structures throughout the body.
- Apical Surface
  - All epithelial cells have a top surface that borders an open space – known as a lumen
- Basement Membrane
  - Underside of all epithelial cells which anchors them to connective tissue
- Avascularity (a = without)
  - Lacks blood vessels
  - Nourished by connective tissue
- Regenerate & repair quickly

Epithelial Surface Features

- Apical surface features
  - Microvilli – finger-like extensions of plasma membrane
    - Abundant in epithelia of small intestine and kidney
    - Maximize surface area across which small molecules enter or leave
  - Cilia – whip-like, highly motile extensions of apical surface membranes
    - Movement of cilia – in coordinated waves

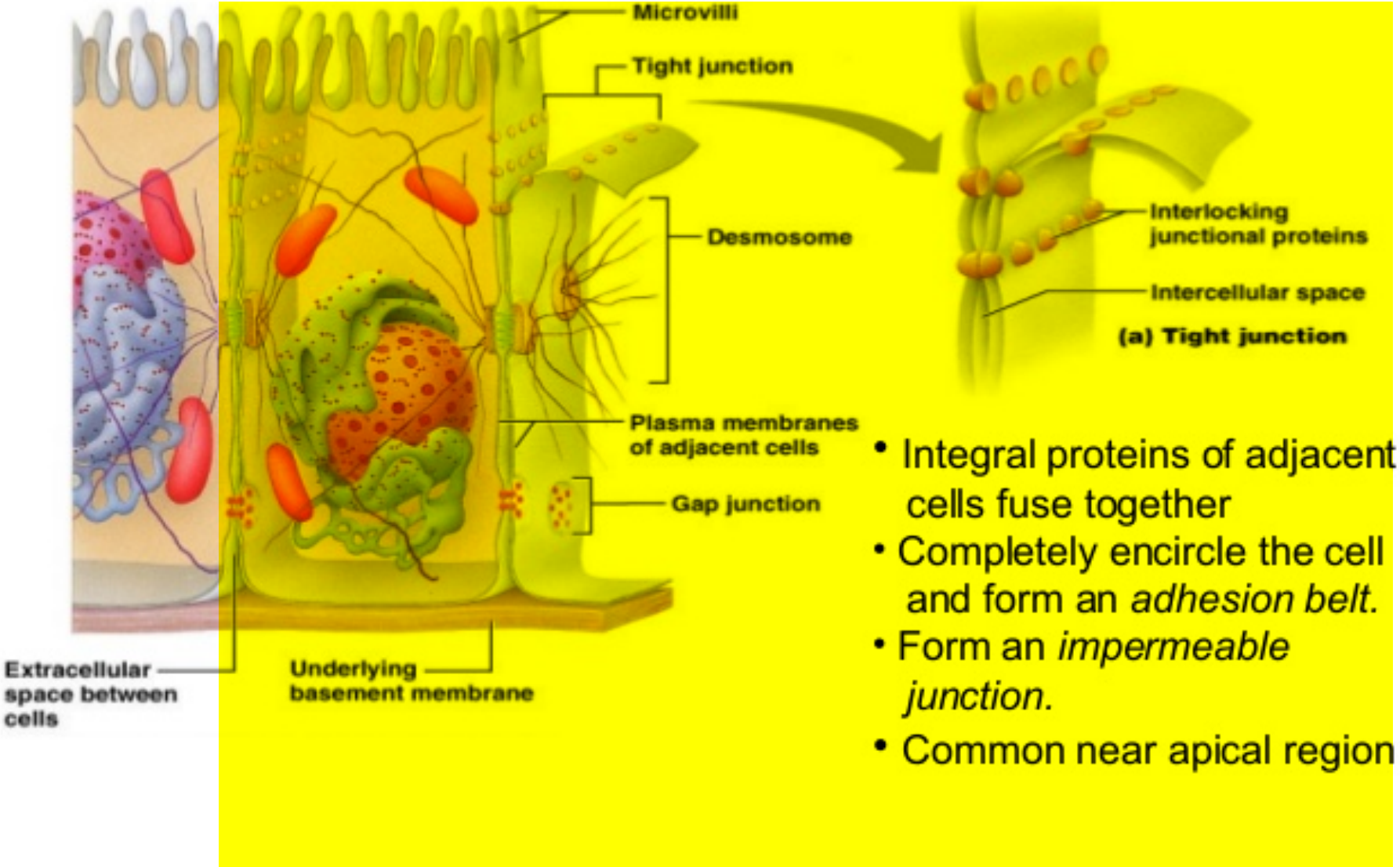
Basal Feature: The Basal Lamina

- Noncellular supporting sheet between the epithelium and the connective tissue deep to it
- Consists of proteins secreted by the epithelial cells
- Functions:
  - Acts as a selective filter, determining which molecules from capillaries enter the epithelium
  - Acts as scaffolding along which regenerating epithelial cells can migrate
- Basal lamina and reticular layers of the underlying connective tissue deep to it form the basement membrane

Lateral Surface Features

- Tight junctions
- Desmosomes

Membrane Junctions: Tight Junction

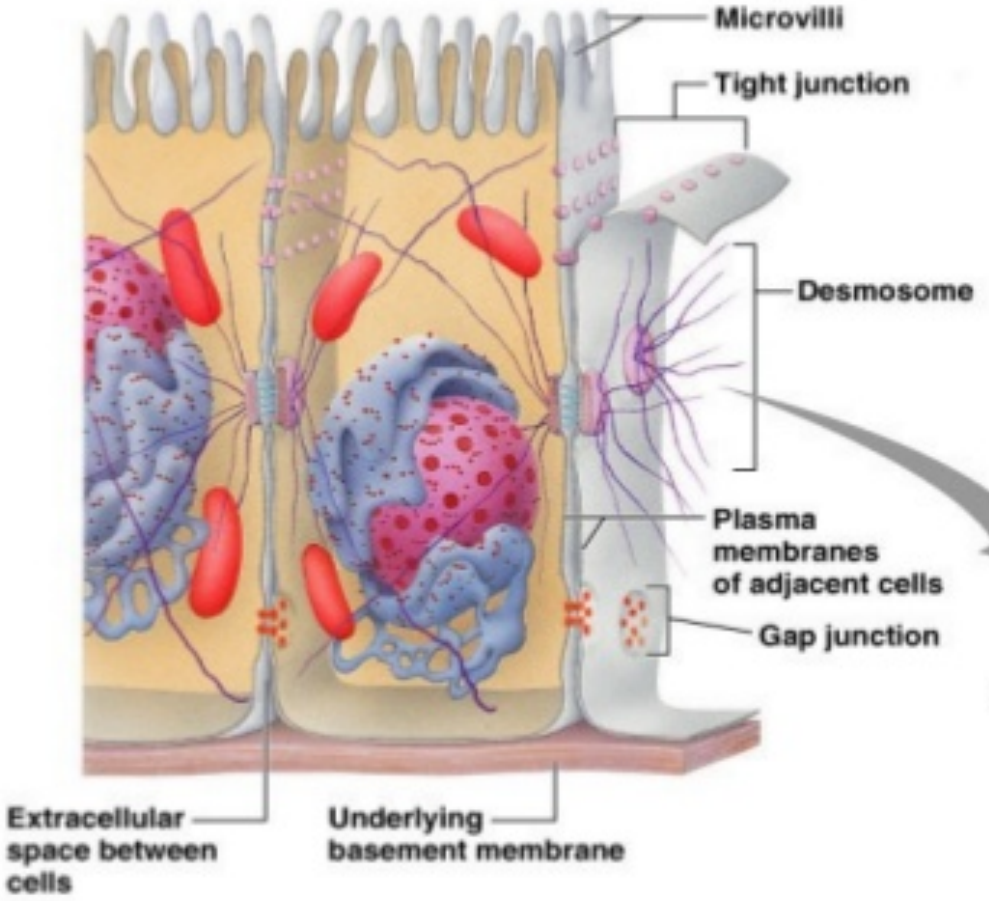


- Integral proteins of adjacent cells fuse together
- Completely encircle the cell and form an *adhesion belt.*
- Form an *impermeable junction.*
- Common near apical region

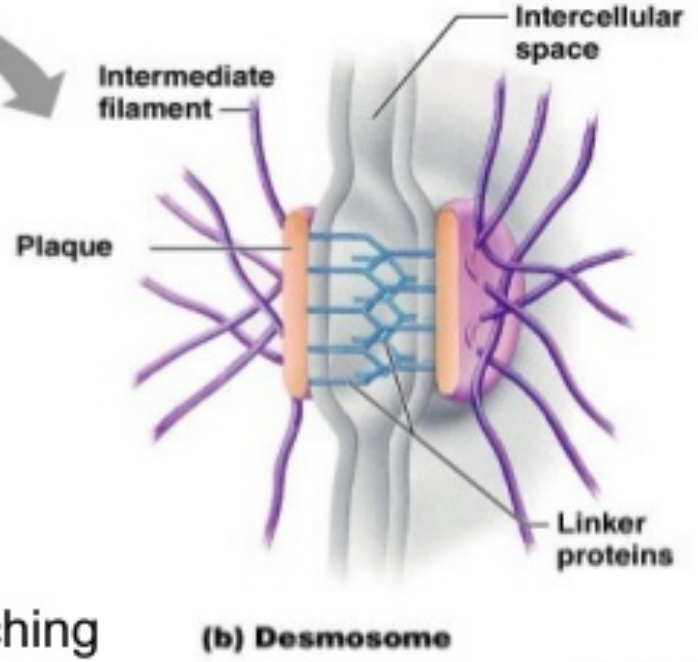
Lateral Surface Features – Cell Junctions

- Desmosomes – two disc-like plaques connected across intercellular space
  - Plaques of adjoining cells are joined by proteins called cadherins
  - Proteins interdigitate into extracellular space
  - Intermediate filaments insert into plaques from cytoplasmic side

Membrane Junctions: Desmosome



Linker proteins extend from plaque like teeth of a zipper.
Intermediate filaments extend across width of cell.



- Common in superficial layers of skin; skin *peels* after a sunburn
- Reduces chance of tearing, twisting, stretching

Figure 3.5b