• What type of epithelium is this?
• What do you think might be the function of the epithelium at this site?
• If you could see these cells at very high magnification, what might you observe on the luminal surface of the epithelium
• What type of epithelium is this? **Simple columnar epithelium**
• What do you think might be the function of the epithelium at this site? **Has an absorptive function, enabling water and nutrients to be absorbed from food**
• If you could see these cells at very high magnification, what might you observe on the luminal surface of the epithelium? **Numerous tiny finger-like projections called microvilli. These greatly increase the surface area available for absorption.**

EM of microvilli
• What is this type of epithelium called?
• What is present on the luminal surface of the cells? What is its function?
• What is this type of epithelium called? **Pseudostratified columnar epithelium.**

• What is present on the luminal surface of the cells? What is its function? **The luminal surface of the cells bears cilia. The function of cilia is to propel surface films of mucus or fluid in a consistent direction over the epithelial surface.**
• What type of epithelium is this?
• What is the difference between the nuclei in the basal layer and those close to the surface?
• How does this epithelium derive its nutrients?
• At what sites in the body is this type of epithelium found?
• What type of epithelium is this? *Stratified squamous epithelium (nonkeratinized)*

• What is the difference between the nuclei in the basal layer and those close to the surface? The nuclei in the basal layer are round and show mitoses, those at the surface are pyknotic and degenerate.

• How does this epithelium derive its nutrients? Like all epithelia, nutrients are derived from the underlying connective tissue as blood vessels do not penetrate the basement membrane; the reason why squamous epithelial cells degenerate at the surface is because they become increasingly distant from their source of nutrition.

• At what other sites in the body is this type of epithelium found? *Stratified squamous epithelium is found in the oropharynx, oesophagus, anal canal, vagina*
• Name this type of epithelium.
• How does this epithelium differ from that of the cervix?
• What is the reason for this difference?
• Name this type of epithelium. **Keratinized stratified squamous epithelium**

• How does this epithelium differ from that of the cervix? **The surface of the epithelium bears a layer of pink acellular material called keratin**

• What is the reason for this difference? **Keratin enables skin to withstand the constant abrasion and dessication to which it is exposed; non-keratinising stratified squamous epithelium, such as that in the oral cavity, can become keratinised if it is exposed to excessive abrasion or dessication**
• What type of epithelium is this?
• What is special about this type of epithelium?
• What type of epithelium is this? **Transitional cell epithelium**

• What is special about this type of epithelium? **It is specialized to withstand the toxicity of urine and to accommodate a high degree of stretching**
This electron micrograph shows 2 adjacent surface epithelial cells in the duodenum. The cell membranes traverse the micrograph from left to right. A, B and C are junctions between the two membranes.

Name the cell junctions at A, B, and C and structures of D, E, and F.
This electron micrograph shows 2 adjacent surface epithelial cells in the duodenum. The cell membranes traverse the micrograph from left to right. A, B and C are junctions between the two membranes.

Name the cell junctions at A, B, and C and structures of D, E, and F.

A. Tight Junction

B. Intermediate junction (zonula adherens)

C. Desmosome

D. Plasma membrane

E. Mitochondrion

F. Microvilli
• Where is the lamina propria found?
• What type of connective tissue is the lamina propria?
• What separates the epithelia of the duodenum from the lamina propria?
• What types of cells are found here? What types of cells are indicated by A and B? What is the significance of their large numbers?
• Where is the lamina propria found? The lamina propria underlies the epithelia of mucous membranes.
• What type of connective tissue is the lamina propria? Loose or areolar connective tissue
• What separates the epithelia of the duodenum from the lamina propria? The basement membrane
• What types of cells are found here? What types of cells are indicated by A and B? What is the significance of their large numbers? Predominantly various defence and immune cells and a few fibroblasts. 
  A- lymphocytes
  B- plasma cells (antibody-producing cells derived from B lymphocytes) This is a site which is often under threat from pathogens in ingested material.
• What type of connective tissue is this? How can you tell?
• What types of cells do you see here?
• What type of connective tissue is this? How can you tell? Dense irregular connective tissue. Collagen bundles are densely packed and orientated in many directions.

• What types of cells do you see here? Fibroblasts can be identified by their elongated nuclei, some lymphocytes surround the blood vessels at the bottom of the photomicrograph
• Name the specific tissue type.
• What is the major constituent of the pink staining material and how is it organised?
• Cell nuclei are indicated by arrows. What type of cells are these? How are they organized in this tissue?
• Are blood vessels obvious?
• Name the specific tissue type. Dense regular CT

• What is the major constituent of the pink staining material and how is it organized? Collagen arranged in bundles and orientated in one direction (parallel to each other and in the same direction as the stress).

• Cell nuclei are indicated by arrows. What type of cells are these? How are they organized in this tissue? There are few cells (fibroblasts). They are arranged in rows with their nuclei elongated in the same direction as the collagen fibers.

• Are blood vessels obvious? No, blood vessels are not obvious in this specimen. The scanty blood supply of the tendon enters in small amounts of slightly looser connective tissue between areas of dense tissue.
The image is of the liver - a highly cellular gland. Its predominant cells (hepatocytes - stained pink) are classed as glandular epithelium. In the center of this field is a vein.

- What type of connective tissue (dark stained fibers) is seen in this section?
- What is the role of these fibers?
The image is of the liver - a highly cellular gland. Its predominant cells (hepatocytes - stained pink) are classed as glandular epithelium. In the center of this field is a vein.

- What type of connective tissue (dark stained fibers) is seen in this section? **Reticular CT**
- What is the role of these fibers? **To support the cells within the liver and maintain its architecture**
- Name the cell type (arrowed) in this specimen.
- Why do the centers of the cells appear unstained?
- What tissue surrounds the cluster of these cells?
• Name the cell type (arrowed) in this specimen. **Adipocytes – Tissue is adipose.**

• Why do the centers of the cells appear unstained? **Routine histologic processing extracts the lipid leaving an unstained space in the cell.**

• What tissue surrounds the cluster of these cells? **Areolar connective tissue, which usually is a component of adipose tissue**
• What is this type of cartilage called?
• What is the composition of the blue / pink staining material?
• What are found in the apparent spaces indicated by the arrows?
• What is the condensed pink layer around the outside of the cartilage (asterisks)?
• What is this type of cartilage called? **Hyaline cartilage**
• What is the composition of the blue / pink staining material?
  **Extracellular matrix of collagen is stained blue in H&E sections due to its high content of ground substance.**
• What are found in the apparent spaces indicated by the arrows? **Chondrocytes. Spaces or lacunae are artifacts due to the shrinkage of these cells during processing.**
• What is the condensed pink layer around the outside of the cartilage (asterisks)? **The fibrocollagenous perichondrium.**
• What is this type of cartilage called?
• What type of fibers are stained in this preparation?
• Why do you think this type of cartilage is found in the epiglottis?
• What is this type of cartilage called? Elastic cartilage
• What type of fibers are stained in this preparation? Elastic fibers
• Why do you think this type of cartilage is found in the epiglottis? The epiglottis acts to deflect food and fluid from the airways during swallowing. Elastic cartilage is flexible allowing movement and deformation and possesses elastic recoil.
• Name this tissue
• Label important structures

These cells are anomalous, possibly filled with air?
• Name this tissue: **Simple squamous epithelium**

• Label important structures:

Top view of peritoneum, a serous membrane (an example of mesothelium, derived from mesoderm). It functions where a slick friction-free surface is required, or ready exchange across membranes is essential: lung alveoli, capillary endothelium, kidney glomerulus.

*Note that a top view of simple squamous has the appearance of tiling.*

**Cell boundaries**

**Nucleus**

**Nucleolus**

These cells are anomalous, possibly filled with air?
• Name this tissue
• Label important structures:
• Name this tissue: Simple columnar epithelium
• Label important structures:
• Name this tissue
• Label important structures:

Nuclei in lower portions of cells
• Name this tissue: **Pseudostratified ciliated columnar epithelium**

• Label important structures:
• Name this tissue:
• Label important structures:
• Name this tissue: **Areolar CT**
• Label important structures:
• Name this tissue:
• Label important structures:
• Name this tissue: **Elastic Cartilage**
• Label important structures:
• Name this type of epithelial tissue:
• Label important structures:
• Name this type of epithelial tissue: **Simple cuboidal epithelium**

• Label important structures:
• Name this type of epithelial tissue:
• Label important structures:
• Name this type of epithelial tissue: **Simple columnar epithelium**

• Label important structures:
• Name this type of tissue:
  Label important structures:
• Name this type of tissue: **Adipose Tissue**
• Label important structures:
• Name this type of tissue:
• Label important structures:
• Name this type of tissue: **Smooth muscle**
• Label important structures:
• Name this type of tissue:
• Name this type of tissue: **Skeletal Muscle**
The patient is a 35 year old woman who underwent a routine cervical smear. Photo-micrograph A shows a normal smear, photomicrograph B show the patient's smear.

- **What type of cells are present in the smears?**
- **How do the cells in A and B differ?**
- **What do you think the diagnosis might be?**
The patient is a 35 year old woman who underwent a routine cervical smear. Photo-micrograph A shows a normal smear, photomicrograph B show the patient's smear.

- What type of cells are present in the smears? **Superficial squamous cells which have been scraped from the mucosal surface of the cervix**

- How do the cells in A and B differ? The cells in A have small regular nuclei and a low nuclear:cytoplasmic ratio, the cells in B have large pleomorphic nuclei with a high nuclear:cytoplasmic ratio and are clumped together in sheets.

- What do you think the diagnosis might be? **The cells are severely dysplastic and the diagnosis is cervical cancer (neoplasia)**
Non-keratinized Stratified Squamous Epithelium

Surface squamous cells being shed

Note that cells are nucleated all the way to the apical surface in non-keratinized tissue.
Pseudostratified Ciliated Columnar Epithelium

- Mucus layer
- Goblet cell
- Cilia
- Nuclei in lower portions of cells
- Basement membrane
- Lamina propria

Trachea, H&E stain 400x
Fibrocartilage of Intervertebral Disc

Fibrocartilage, intervertebral disc

Cortex

Parallel bundles of collagenous fibers

Lacunae

Medulla

Intervertebral disc, H&E

400x
Hyaline Cartilage

**chondrocytes** cells which maintain cartilage

**lacunae** chambers (houses chondrocytes)

**matrix** material which fills space between lacunae

**perichondrium** fibrous layer nourishes the cartilage (dense irregular connective tissue)

**chondroblasts** at boundary of perichondrium and cartilage proper

**Glands** in surrounding connective tissue:

**mucus acinar gland** (tracheal gland) makes mucus which "floats" on top of cilia.

**serous gland** with darker shallow cuboid makes thin serous fluid which bathes the cilia, allowing free movement of cilia.