



**Faculty of Applied
Science
Medical Analysis
Department
Micritechnique (MA505)**

Lecture 5

TISSUE SECTIONING

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Outlines



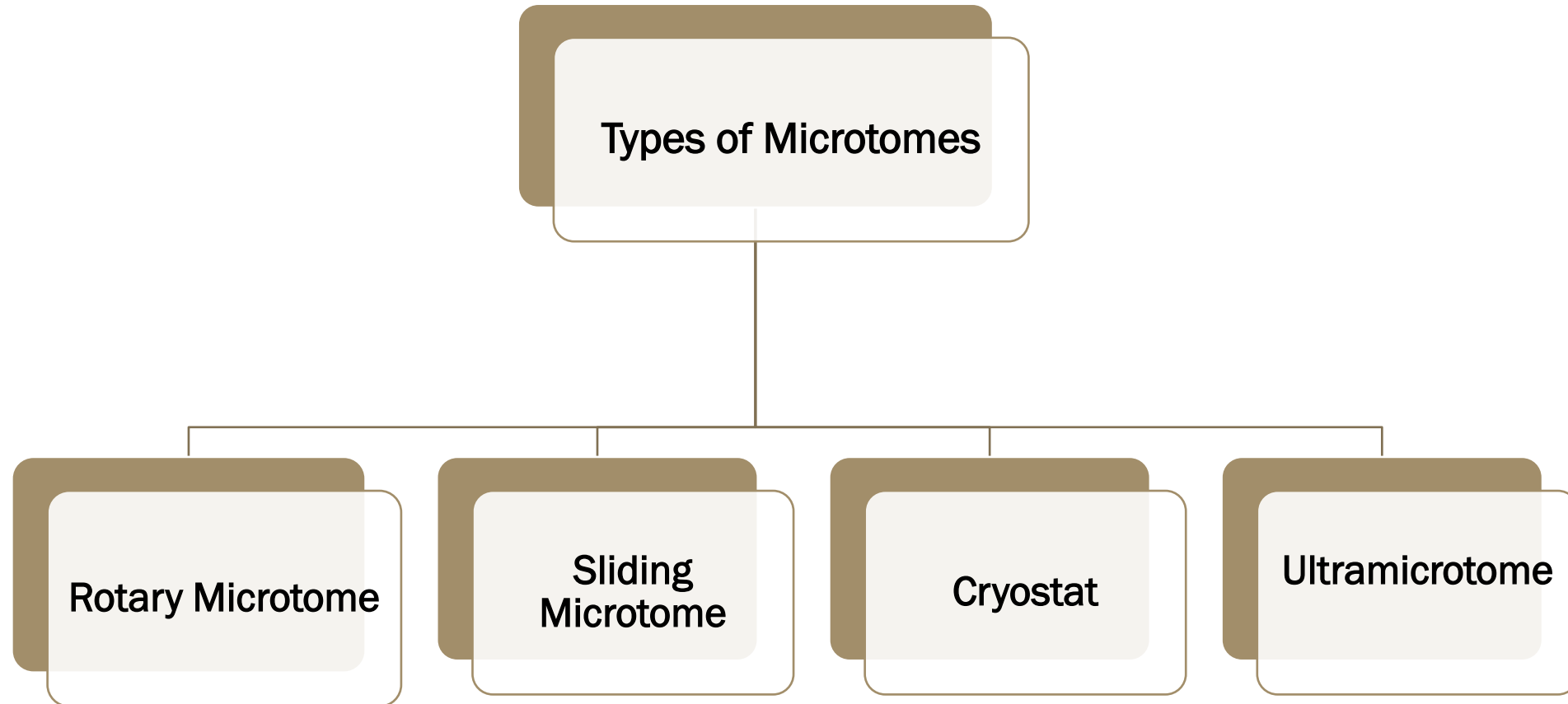
- **What is Microtomy?**
- **Types of Microtomes**
- **What is Rotary microtome?**
- **Components of a Rotary Microtome**
- **What happens if the section is too thick?**
- **Important factors affecting sectioning**
- **Common Sectioning Problems**
- **Class activity**
- **References**
- **Next lecture**

Learning outcome

- By the end of this lecture, students will be able to:
- Define microtomy and explain its importance in histological preparation.
- Describe the principle of microtomy and sectioning.
- Identify the major types of microtomes.
- Describe the main components of a rotary microtome.
- Explain appropriate section thickness for different applications.
- Differentiate between common microtome blades/knives.
- Explain the principle of ribbon formation. Identify common sectioning problems and their causes.
- Suggest appropriate solutions for poor-quality sections.
- Explain how proper sectioning affects microscopic examination

What is Microtomy?

- **Microtomy** is the process of cutting very thin sections of tissue from an embedded tissue block so that the sections can be placed on microscope slides and examined microscopically.
- The instrument used to cut these sections is called a **microtome**.
- **Why is microtomy important?**
- Tissues are normally too thick for light to pass through them adequately.



What is Rotary microtome?

- The **rotary microtome** is the most commonly used instrument for routine paraffin sections.
- **Main characteristics**
- Tissue block moves vertically.
- Knife/blade remains relatively fixed.
- Produces thin, serial sections.
- Commonly used for routine histopathology.
- Typical sections may be approximately **3–5 μm** thick for routine paraffin histology.

Components of a Rotary Microtome

- **1. Handwheel**
- Used to move the specimen holder up and down.
- **2. Specimen/block holder**
- Holds the embedded tissue block securely.
- **3. Knife/blade holder**
- Holds the cutting blade at the appropriate position.
- **4. Thickness adjustment**
- Controls the thickness of the section.
- **5. Coarse advance mechanism**
- Moves the specimen toward the blade during trimming.
- **6. Base**
- Provides stability to the instrument.
- **7. Section collection area**
- The area where sections/ribbons are collected after cutting.



Rotary Microtome Main Applications

For observing the morphological structure of normal cellular tissues of plants and animals

For studying, observing and determining the morphological changes of cellular tissues

For immunohistochemistry, immunofluorescence, genome sequencing, etc.

Section Thickness

Application	Approximate thickness
Routine paraffin histology	3–5 μm
Thicker paraffin sections	5–10 μm
Frozen sections	~5–10 μm
Resin semithin sections	~0.5–2 μm
Ultrathin EM sections	Tens of nanometers

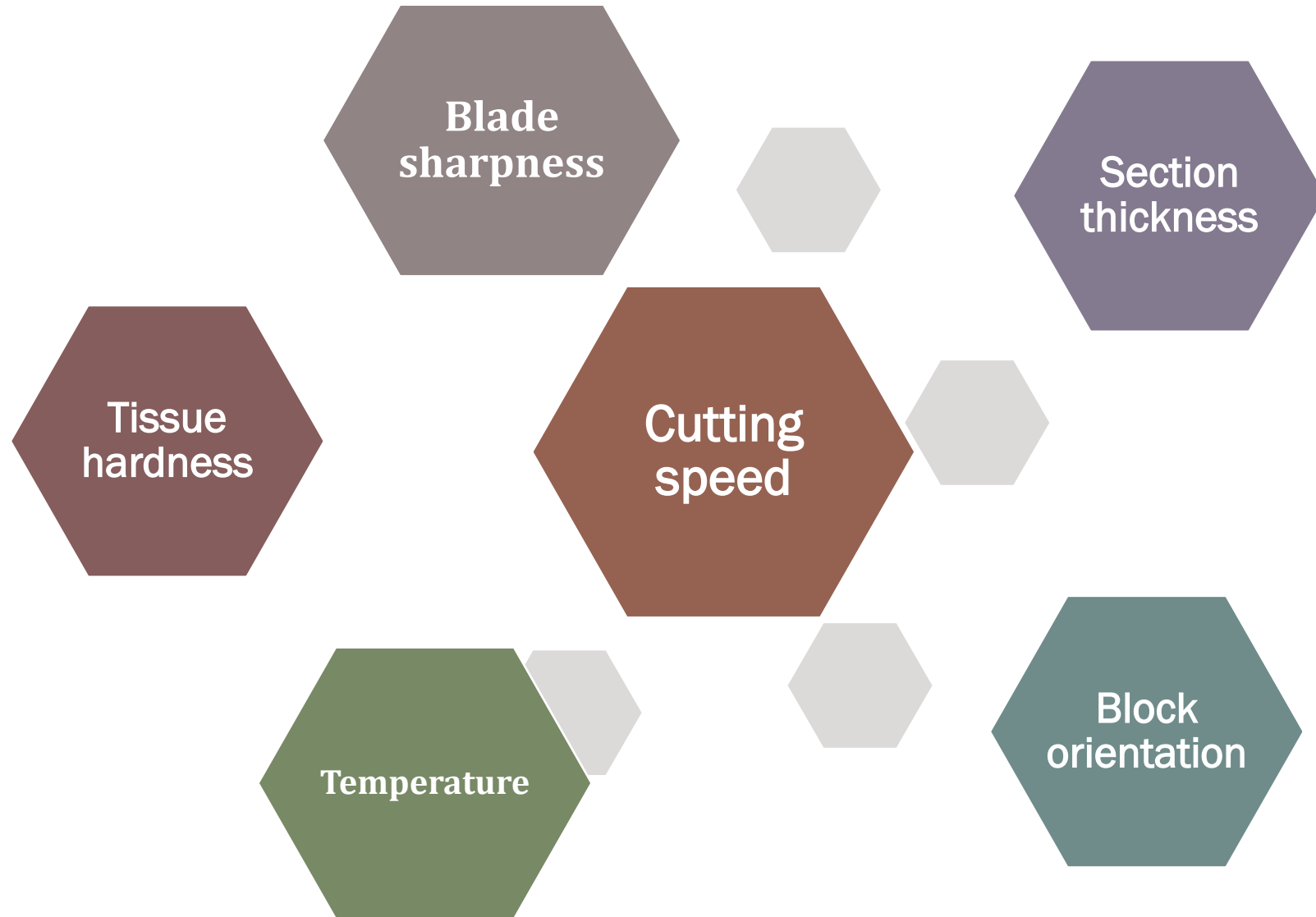
What happens if the section is too thick?

- A section that is too thick may:
- Reduce light transmission
- Produce overlapping structures
- Make nuclear details difficult to distinguish
- Increase staining intensity
- Make microscopic interpretation difficult

What happens if it is too thin?

- Very thin sections may:
- Tear easily
- Produce incomplete tissue representation
- Lose important structures
- Be difficult to handle
- **Important principle**
- **Section thickness must be selected according to the tissue, embedding medium and purpose of examination.**

Important factors affecting sectioning



TYPES OF BLADES USED IN MICROTOMY

The blade is very important for producing smooth, uniform tissue sections.

1. STEEL BLADES (REUSABLE)



- Made of stainless steel
- Can be sharpened and used multiple times
- Economical



Used for:
Routine paraffin sections

2. DISPOSABLE BLADES (SINGLE USE)



- Made of stainless steel
- Very sharp and consistent
- No sharpening needed
- Convenient



Used for:
Routine paraffin sections

3. GLASS KNIVES (REUSABLE)



- Made of glass
- Very sharp edge
- More fragile
- Require careful handling



Used for:
Resin (semithin) sections

4. DIAMOND KNIVES (REUSABLE)



- Diamond edge
- Extremely sharp and durable
- Very expensive



Used for:
Ultrathin sections
(Electron microscopy)

What is a ribbon?

- A **ribbon** is a continuous series of paraffin sections that remain attached to one another as they are cut.
- The sections adhere to each other because of interactions between the freshly cut paraffin surfaces.
- **Why is ribbon formation useful?**
- It allows:
 - Rapid collection of serial sections
 - Preservation of section order
 - Examination of consecutive tissue levels
 - Easier placement of multiple sections on slides

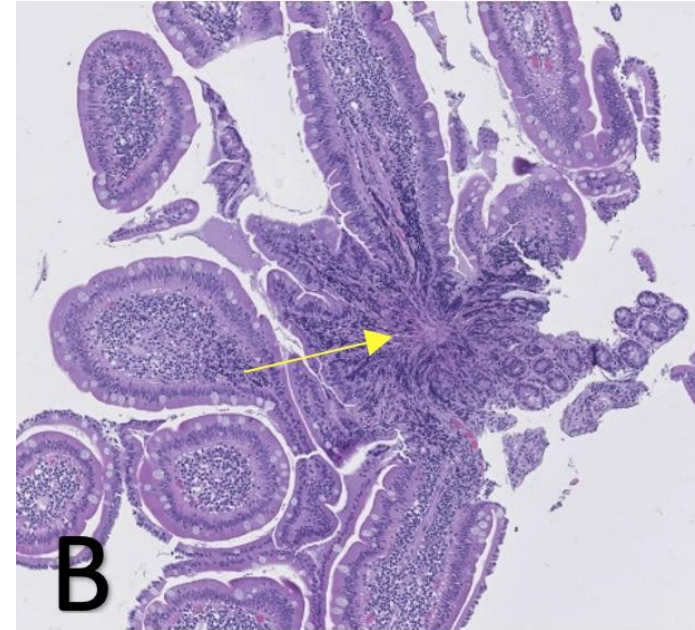
Factors affecting ribbon formation

- Good ribbon formation depends on:
- Appropriate paraffin hardness
- Sharp blade
- Correct clearance angle
- Appropriate section thickness
- Proper cutting speed
- Suitable room/block temperature

Common Sectioning Problems

A. Compression

- **Appearance:**
- The section appears shorter or compressed in the direction of cutting.
- **Causes:**
- Dull blade
- Soft paraffin
- Excessive cutting pressure
- Incorrect cutting conditions

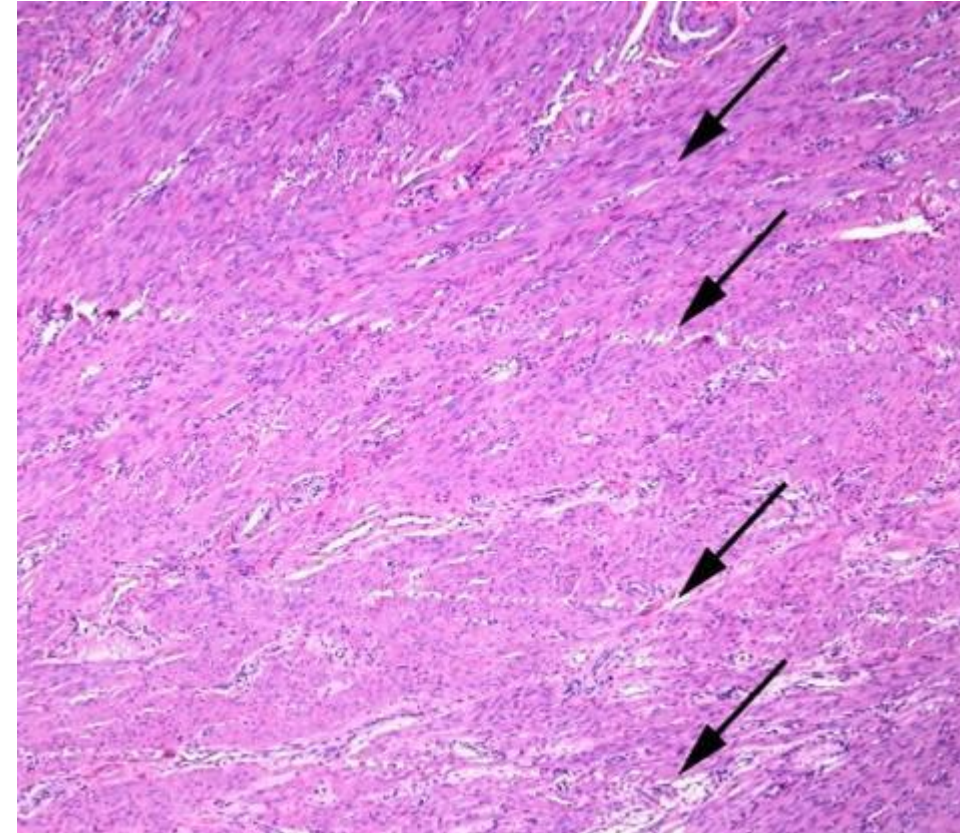


Solutions:

Use a sharper blade
Adjust block temperature
Check blade angle
Reduce cutting speed

B. Chatter

- **Appearance:**
- Alternating thick and thin bands appear in the section.
- **Causes:**
- Hard tissue
- Loose block
- Excessive vibration
- Incorrect clearance angle
- Poorly supported specimen

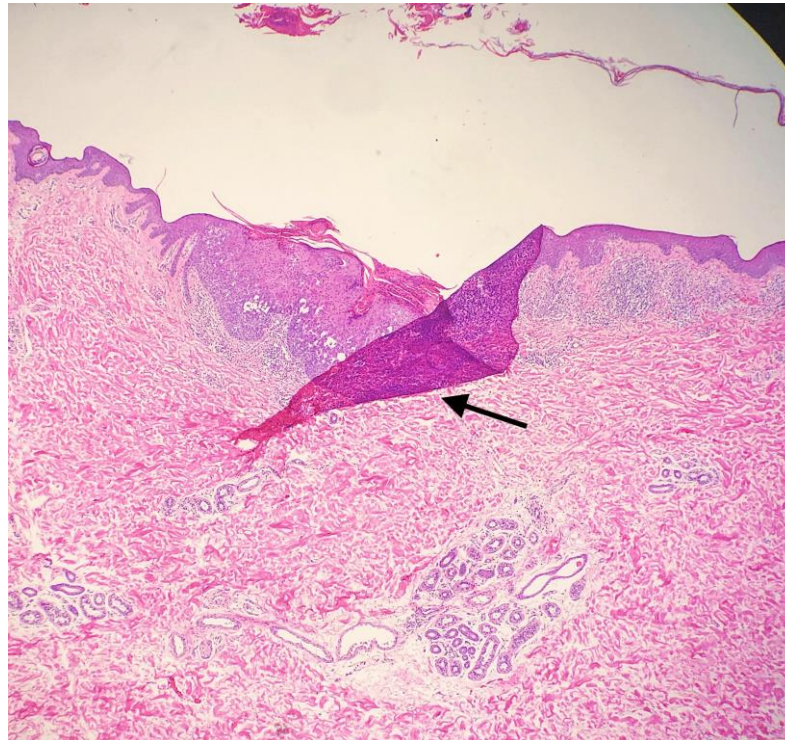


Solutions:

Secure the block properly
Adjust the knife angle
Check microtome stability
Modify cutting conditions

C. Wrinkles (folds)

- **Appearance:**
- The section contains folds or wrinkles.
- **Causes:**
- Poor floating-out technique
- Incorrect water-bath temperature
- Section not properly flattened



Solutions:

Use an appropriately heated water bath
Allow the section to flatten
Avoid excessive water-bath temperature

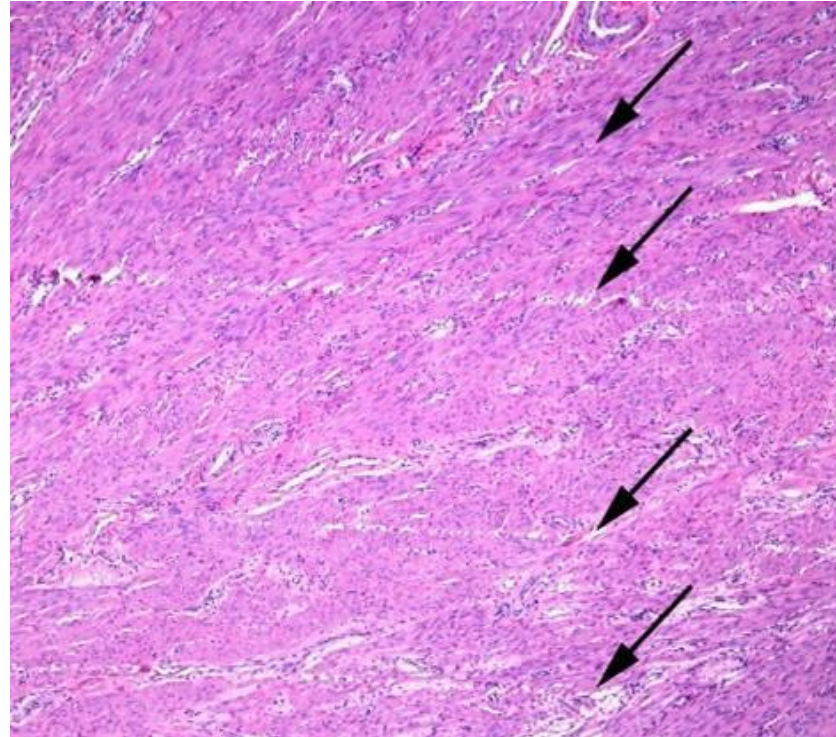
D. Thick and Thin Sections

- **Appearance:**

- The section alternates between thick and thin areas.

- **Causes:**

- Loose block
- Loose knife holder
- Microtome mechanical problems
- Incorrect cutting technique



- **Solutions:**

- Tighten all components
- Check block fixation
- Check microtome settings

Section Does Not Form a Ribbon

- **Possible causes:**
- Paraffin too soft
- Paraffin too hard
- Blade not suitable
- Incorrect clearance angle
- Incorrect section thickness
- **Solution:**
- Adjust the **block temperature, blade angle and cutting conditions.**



Factors Affecting Section Quality

- **B** = Block quality
- B** = Blade quality
- T** = Temperature
- M** = Microtome condition
- S** = Sectioning technique

References

- Bancroft, J. D., & Gamble, M. (Eds.). (2019). Theory and practice of histological techniques (8th ed.). Elsevier.
- Suvarna, S. K., Layton, C., & Bancroft, J. D. (Eds.). (2019). Bancroft's theory and practice of histological techniques (8th ed.). Elsevier.

Next lecture

- Histological Staining