

Introduction to Histopathology and Cytology

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Key concepts, terminology, and practical workflow for students and trainees

1. What Is Histopathology?

Aspect	Description
Definition	Microscopic examination of whole tissue sections to study disease-related structural changes.
Specimen	Fixed, processed, embedded in paraffin, cut into 3–5µm sections, stained (e.g., H&E).
Primary Uses	Cancer diagnosis & grading, inflammatory disorders, infectious disease, degenerative changes, transplant rejection.
Typical Workflow	1. Gross examination ? 2. Fixation ? 3. Tissue processing ? 4. Embedding ? 5. Sectioning ? 6. Staining ? 7. Microscopic interpretation.
Key Tools	Microtome, cryostat, automated stainers, digital slide scanners, light microscope (bright-field, polarized, fluorescence).

1.1 Core Histological Stains

Stain	Main Targets	Typical Applications
Hematoxylin & Eosin (H&E)	Nuclei (hematoxylin) + cytoplasm/extracellular matrix (eosin)	Routine diagnostic work-up
Periodic Acid-Schiff (PAS)	Glycogen, mucopolysaccharides, basement membranes	Fungal organisms, glycogen storage disease
Masson's Trichrome	Collagen (blue), muscle (red), nuclei (black)	Fibrosis, muscle pathology
Silver stains (e.g., GMS, reticulin)	Fungi, reticular fibers	Opportunistic infections, liver architecture
Immunohistochemistry (IHC)	Specific antigens using antibodies	Tumor typing, prognostic markers, infectious agents

2. What Is Cytology?

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Aspect	Description
Definition	Study of individual cells or small clusters obtained without preserving tissue architecture.
Specimen Types	Fine-needle aspiration (FNA), body fluids (pleural, peritoneal, cerebrospinal), brushings, exfoliative smears, liquid-based cytology (LBC).
Primary Uses	Rapid triage of lesions, screening (Pap test), evaluation of metastatic disease, infectious disease detection.
Typical Workflow	1. Sample collection ? 2. Immediate fixation or air-drying ? 3. Smear preparation or cell block ? 4. Staining (Diff-Quik, Papanicolaou, Giemsa) ? 5. Microscopic review ? 6. Ancillary studies (IHC, molecular).
Key Tools	Cytocentrifuge, slide printer, automated LBC processor, fluorescence microscope, digital imaging.

2.2 Common Cytology Stains

Stain	Main Targets	Typical Applications
Papanicolaou (Pap)	Nuclear detail (hematoxylin) + cytoplasmic transparency (orange-green counterstains)	Cervical screening, body fluid cytology
Diff-Quik (Romanowsky)	Granular cytoplasmic components, metachromasia	Rapid on-site evaluation (ROSE) of FNA
Giemsa	Nuclear chromatin, cytoplasmic granules	Hematologic smears, parasite detection
May-Grünwald-Giemsa (MGG)	Similar to Diff-Quik	