

Introduction To Cytopathology

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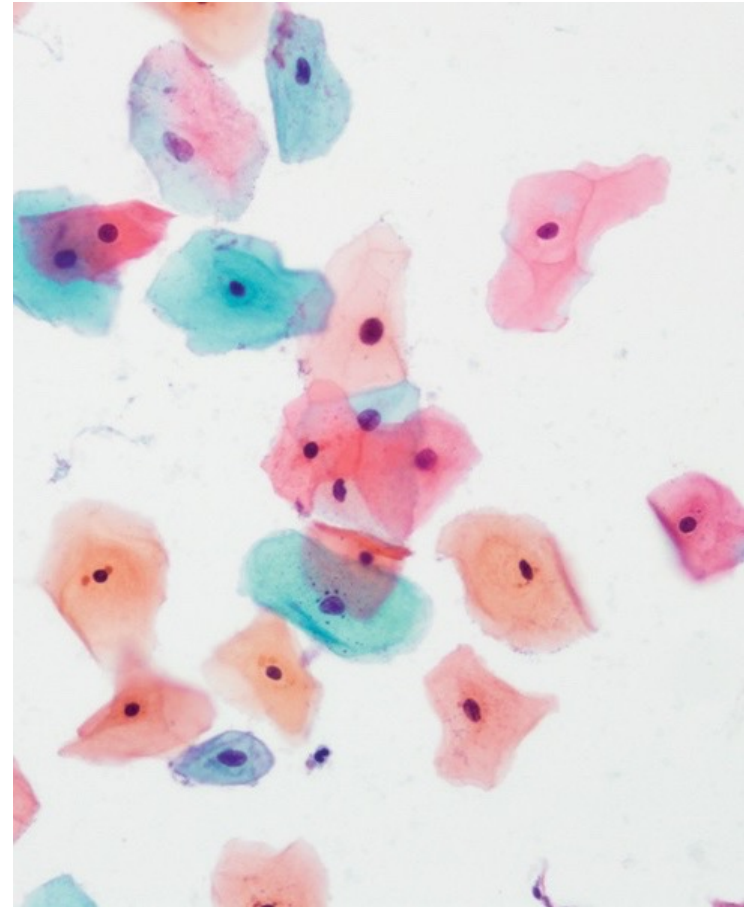


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Introduction

What is diagnostic cytopathology?

It is a branch of pathology that studies and diagnoses diseases on the **cellular level**.

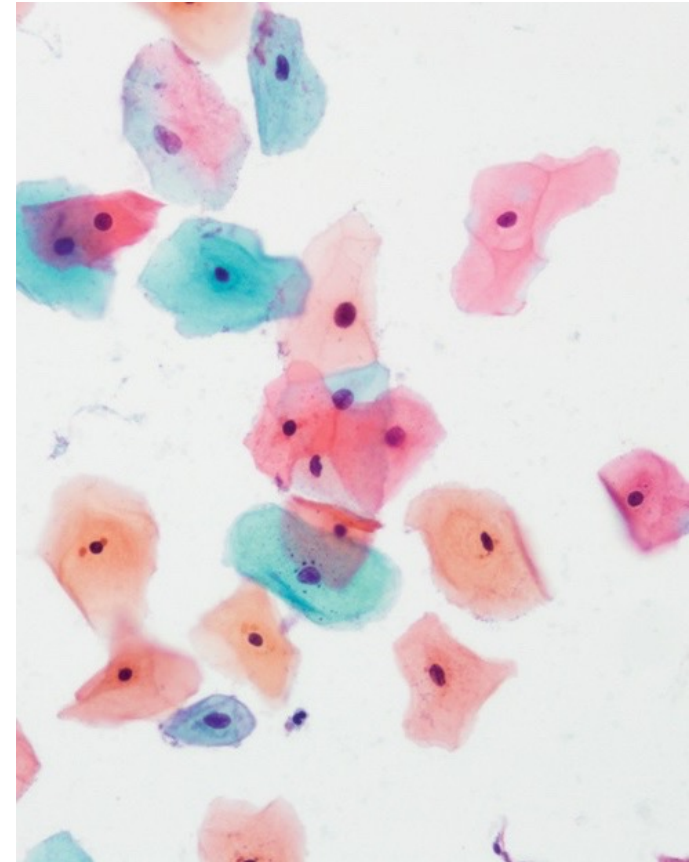


Classification Of Cytopathology

- **Gynecological Cytopathology:**
Include cervicovaginal cytopathology.
- **Non-gynecological Cytopathology:**
Include cytopathology of all other organs.

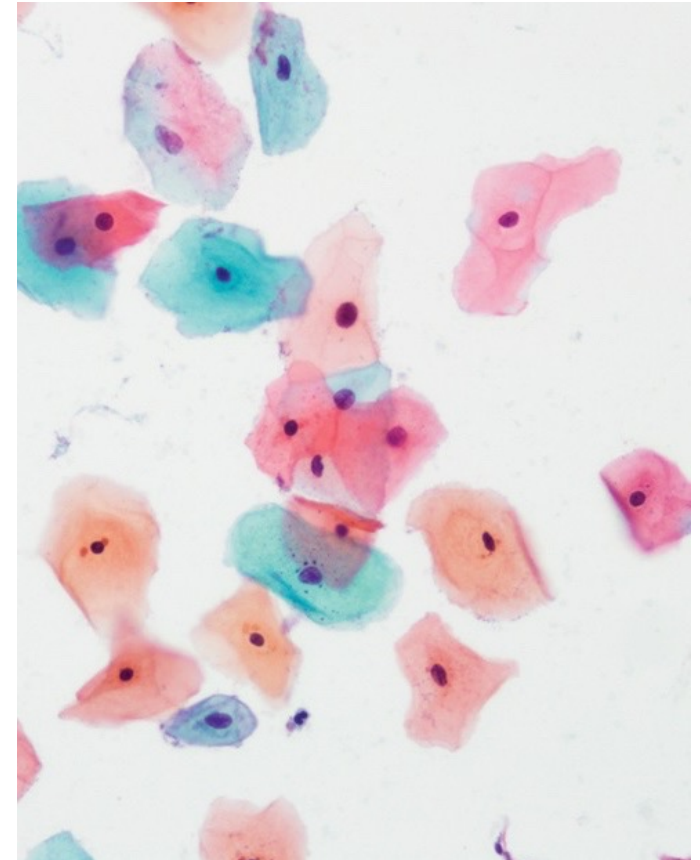
Advantages of diagnostic cytology:

- Superior **morphologic detail**.
- Ability to **characterize** the cellular components of various fluids.
- **Rapid**: Speed of sample collection and diagnosis .
- **Inexpensive**: Excellent cost effectiveness.
- **Simple**: Minimally invasive diagnostic procedure not requiring surgery or specialized anesthesia.



Advantages of diagnostic cytology:

- It is better in evaluating the **infectious diseases**.
- No injury to tissue allowing **repeated sampling**
- It is better for **hormonal assay**.
- Cytopathological smear cover a **wider surface** than that involved in surgical biopsy.



The Disadvantages Of Diagnostic Cytology:



- **Limitations in Staging:** Cytological techniques do not help stage cancers, which is essential for treatment planning.
- **Sample Quality Dependent:** Diagnostic accuracy depends highly on the quality of the sample collected and the expertise of the person performing the aspiration and interpretation.
- **Limited Tissue Architecture Information:** Cytology does not provide the same detail about tissue architecture as histopathology, which can be crucial for specific diagnoses.
- **Sensitivity and Specificity Issues:** It may have lower sensitivity for certain types of cancer, meaning it could miss some cases.
- **Operator-Dependent:** The success of procedures like FNA relies heavily on the skill of the clinician performing the procedure.

Factors that determine the appearance of cells

- 1. Cell Type and Origin:** Different cells have distinct morphological characteristics based on their origin and function within the body.
- 2. Sample Collection Method:** The technique used to collect the sample, such as scraping, aspiration, or brushing, can affect cell integrity and appearance.
- 3. Sample Preparation:** This includes the method of smear preparation, the use of fixatives, and the staining techniques, all of which can alter cellular appearance.
- 4. Fixation:** The type and quality of fixation can preserve or alter cell morphology. Poor fixation may cause cellular distortion or degradation.

Factors that determine the appearance of cells

5. Staining: The choice of stain and the protocol can enhance or obscure cellular details. For instance, the Papanicolaou stain highlights nuclear and cytoplasmic features in gynecological cytology.

6. Physiological Conditions: The patient's physiological conditions, such as hydration status, hormonal levels, or inflammation, can influence cellular appearance.

7. Pathological Changes: Disease processes such as infections, inflammation, or malignancy can lead to cellular changes like atypia or metaplasia.

8. Technician Expertise: The skill of the cytotechnologist or pathologist in preparing and interpreting the slide can impact the quality of the results.

Factors that determine the appearance of cells

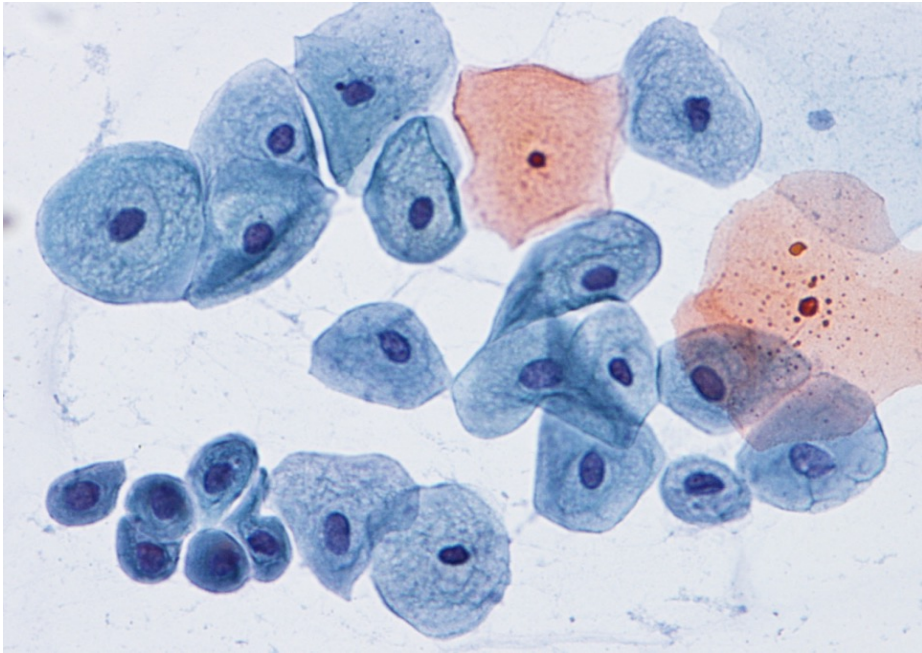
9. Artifacts: Contaminants or procedural artifacts may introduce changes in cell appearance that could be mistaken for pathological alterations.

10. Age of the Specimen: Cellular details can degrade over time, especially if the specimen needs to be preserved correctly.

11. Environmental Factors: Temperature, humidity, and exposure to light can affect the specimen from collection to examination.

12. Technical Equipment: The quality of microscopes and imaging equipment used to view the cells can affect the resolution and clarity of cellular details.

Differences Between Cytopathology and Histopathology



Hmm.....I examine the structure of few separated cells **NOT** an intact tissue.



Important

- Cytopathology **should not** be compared to histopathology!!!
- Used together will provide rapid and most accurate diagnosis!!!!

- **Application for Cytopathology:**

1.Cancer Screening: It is routinely used to detect cancers, notably cervical cancer, via the Pap smear test.

2.Cancer Diagnosis: Fine Needle Aspiration (FNA) cytology is used to diagnose malignancies in various body sites, such as the thyroid, breast, lymph nodes, and liver.

3.Infectious Diseases: Identification of bacterial, fungal, viral, and parasitic infections in samples from virtually any body site.

4.Inflammatory Conditions: To assess inflammatory processes and autoimmune diseases by examining cell types and their changes.

5.Body Fluid Analysis: Analyzing cells in serous fluids (pleural, peritoneal, and pericardial) to diagnose infections, metastatic diseases, or other conditions.

6.Transplant Monitoring: Checking for organ rejection or infection signs in transplant patients.

Application for Cytopathology:

- 7. Therapeutic Monitoring:** Monitoring the efficacy of chemotherapy or radiation therapy in cancer patients.
- 8. Hormonal Disorders:** Evaluating endocrine functions, particularly in thyroid cytology.
- 9. Research:** Studying cell biology and pathology, including the behavior of cancer cells and the effects of experimental drugs.
- 10. Forensic Investigations:** In forensic pathology, identifying cells from body fluids may be critical in criminal investigations.
- 11. Prenatal Testing:** Rarely can cytopathology be applied to evaluate fetal cells in amniotic fluid to detect genetic and developmental disorders.
- 12. Subtyping of Tumors:** Determining the specific type of tumor cells present can guide treatment options.
- 13. Respiratory Diseases:** Assessing sputum or bronchial washings for respiratory diseases, including lung cancer and tuberculosis.
- 14. Immunocytochemistry:** Using antibody-based techniques to detect specific markers on cells, aiding in the diagnosis and classification of neoplasms.

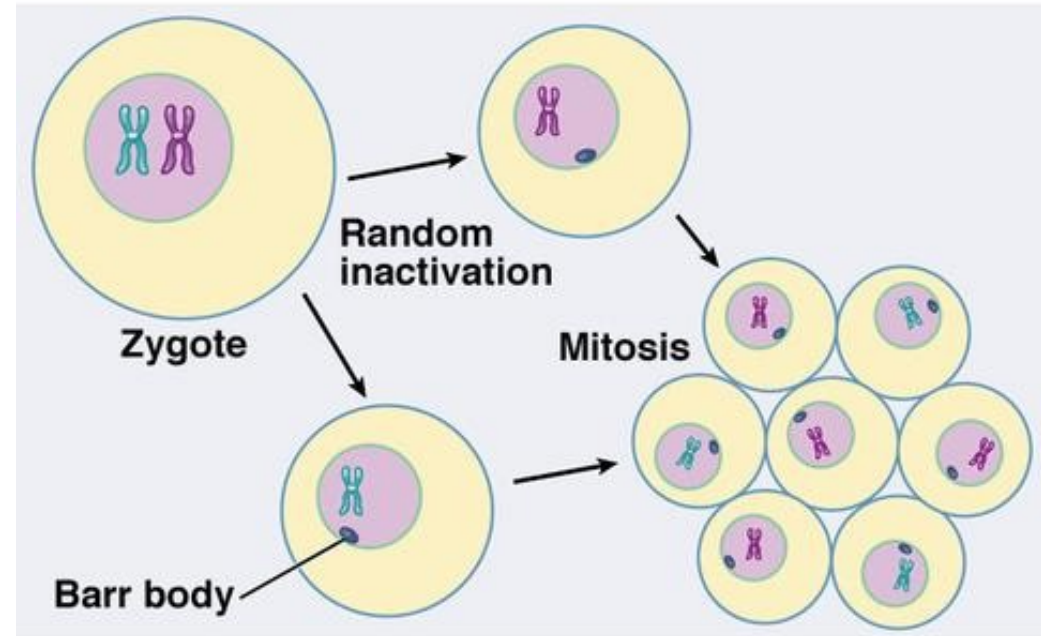
Application for

Cytopathology:

7- The identification of **sex chromosome**: if a newborn presents with ambiguous genitalia, one can not tell whether the sex is male or female.

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Barr Bodies



- The presence of a dark dot (Barr body) attached to the nuclear membrane from inside (Barr body +ve) indicates that a sex chromosome is present, i.e., the genotype of the baby is XX (♀).



Steps In Cytopathology

- Sample collection
- Smear preparation
- Fixation of sample
- Staining of smear
- Interpretation

General Information

- Specimens submitted should be properly labeled with (at minimum) the **patient's name** and a **second identifier** such as hospital and room number
- The label should be placed on the **container** not on the lid.
- The specimen should be accompanied by an attached **Cytology requisition**/transmittal.



Specimen Receipt

Identity Verification

Proper ID on
both specimen
and requisition

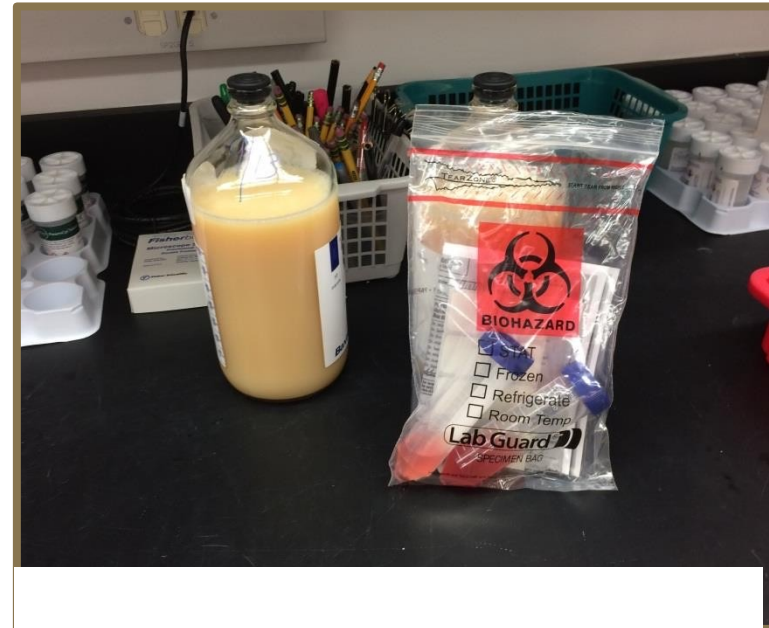
Date and time
collected

Unique
identifier

Specimen
source

Submitting
physician
signature

*Must match
patient to
specimen*



Cytology Non-Gynecology Test Requisition

 **Cleveland Clinic**
Laboratories

2119 E. 93rd / L15
Cleveland, OH 44106
216.444.5755 or 800.628.6816

CYTOLOGY NON-GYNECOLOGIC TEST REQUISITION

<<FORM_ID>>

The requisition should be filled out completely and include:

- Patient **identification**, name & Hospital number
- Requested **test**
- Specimen **source**
- **Date and time** of specimen collection
- Pertinent **clinical information**

PATIENT INFORMATION (PLEASE PRINT IN BLACK INK)			CLIENT INFORMATION		
Last Name		First	MI		
Address		Birth Date	Sex	<input type="checkbox"/> M <input type="checkbox"/> F	
City		SS #			
State	Zip	Home Phone			
Hospital/Physician Office Patient ID #		Accession #			
MEDICAL NECESSITY NOTICE: When ordering tests for which Medicare reimbursement will be sought, physicians (or other individuals authorized by law to order tests) should only order tests that are medically necessary for the diagnosis or treatment of a patient, rather than for screening purposes.					
INSURANCE BILLING INFORMATION (PLEASE ATTACH CARD OR PRINT IN BLACK INK)					
BILL TO: <input type="checkbox"/> Client/Institution <input type="checkbox"/> Medicare <input type="checkbox"/> Insurance (Complete insurance information below) <input type="checkbox"/> Patient					
PATIENT STATUS: <input type="checkbox"/> Inpatient <input type="checkbox"/> Outpatient <input type="checkbox"/> Non-Hospital Patient Hospital discharge date: ____/____/____					
PRIMARY: <input type="checkbox"/> Medicare <input type="checkbox"/> Medicaid <input type="checkbox"/> Other Ins. _____ <input type="checkbox"/> Self <input type="checkbox"/> Spouse <input type="checkbox"/> Child					
Subscriber Last Name		First	MI		
Beneficiary / Member #		Group #			
Claims Address		City	State	Zip	
SECONDARY: <input type="checkbox"/> No <input type="checkbox"/> Yes (if Yes, please attach)					
DIAGNOSIS CODE (REQUIRED) ICD-10 Codes 1. _____ 2. _____ 3. _____					
NON-GYNECOLOGIC SPECIMEN (Please label all slides with #2 pencil or statmark pens)			ORDERING PHYSICIAN CONTACT		
SOURCE <input type="checkbox"/> Peritoneal fluid <input type="checkbox"/> Pericardial fluid <input type="checkbox"/> Pleural fluid <input type="checkbox"/> Bronchial Wash <input type="checkbox"/> R <input type="checkbox"/> L <input type="checkbox"/> Bronchial Brush <input type="checkbox"/> R <input type="checkbox"/> L <input type="checkbox"/> Voided Urine <input type="checkbox"/> Instrumented Urine <input type="checkbox"/> Fine needle aspiration biopsy (specify site): _____ <input type="checkbox"/> Other: _____			Physician Name _____ Physician Signature _____ Physician NPI# _____ Physician Phone _____ Physician Email _____ <input type="checkbox"/> Call Results to phone number: (_____) _____ <input type="checkbox"/> Fax report to: (_____) _____		
MOLECULAR TESTS			Clinical History: _____ _____ _____ _____ History of Malignancy (please describe): Site: _____ _____ _____		
Specimen Type: <input type="checkbox"/> ThinPrep slide <input type="checkbox"/> Cell block <input type="checkbox"/> Fluid Number of slides: _____			BLADDER <input type="checkbox"/> FISH for Bladder Cancer <input type="checkbox"/> FISH for Bladder Cancer with Urinary Cytology <input type="checkbox"/> KRAS (Cytolyt®/PreservCyt® vial) Site: _____ <input type="checkbox"/> Other: _____		
LUNG <input type="checkbox"/> EGFR Mutational Analysis (Cytolyt®/PreservCyt® vial) <input type="checkbox"/> FISH for ALK (Cytolyt®/PreservCyt® vial)					

Criteria for Specimen Rejection



Specimen received in syringe

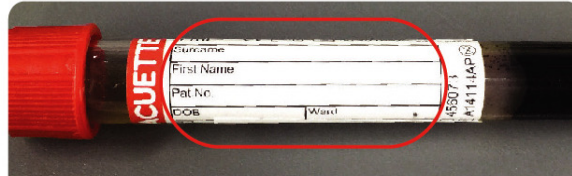


Urine in Stool Container

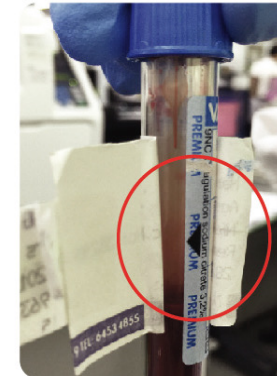
Specimen Sent in Wrong Container

Inappropriate Container

Wrong Preservative for Test



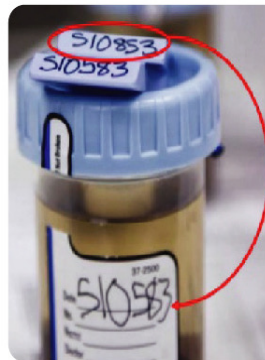
Unlabelled specimen



Insufficient Sample Volume

(Volume not to the Mark)

e.g. Citrated Blood



Incorrectly Labelled Specimens

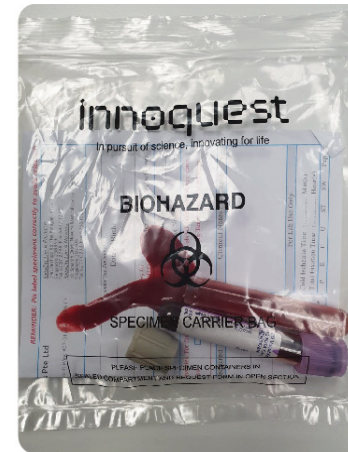
(Mismatched Specimen and Form)



Broken Container

Leaking Container

Split Sample



Highly Contaminated Sample or Request Form

Universal Precautions

- Treat all samples as infectious
- Always wear personal protective equipment (PPE) when handling specimens

Specimen Handling



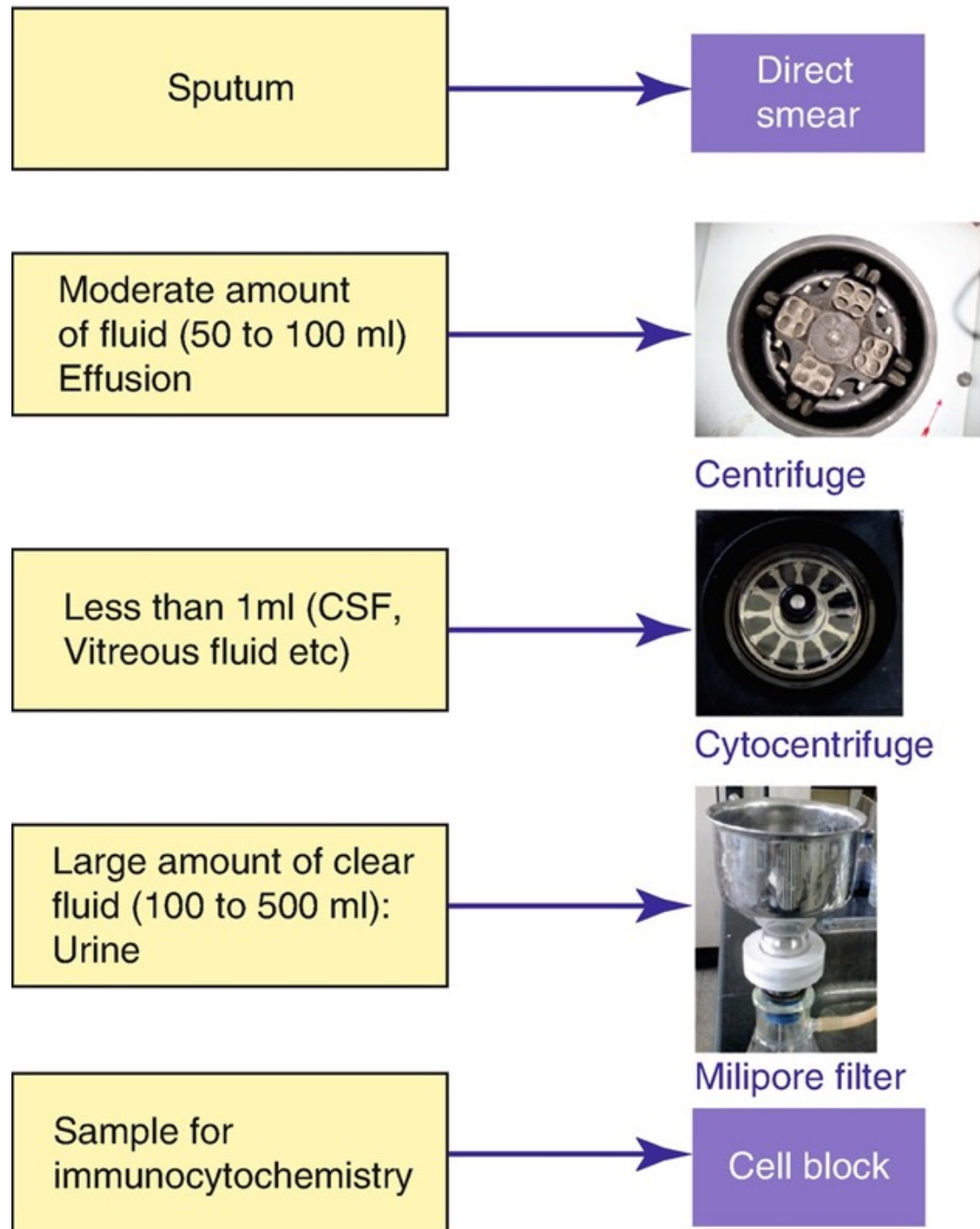
Specimen Adequacy Assessment

Gross Description

- **Volume (? mL)**
- **Transparency (cloudy)**
- **Color (amber)**
- **Extras (brush tip identified)**



Preparation of samples



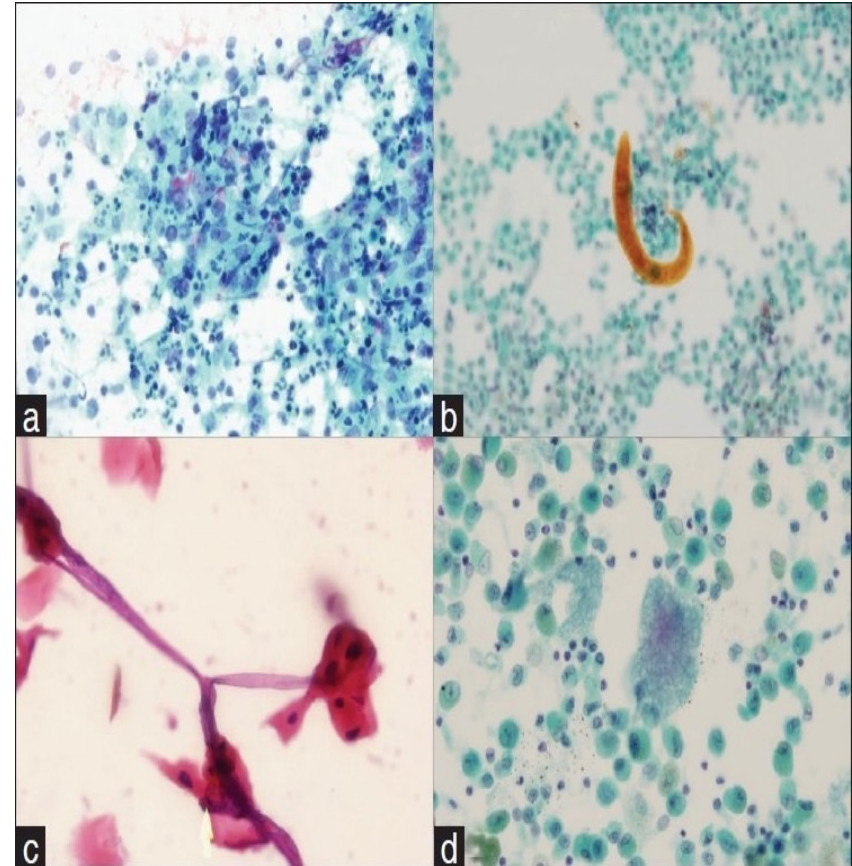
Utilization Of Cytopathology

A) Aspirate smear of an inguinal lymph node showing poorly formed **granuloma with neutrophils**.

B) Bronchoalveolar lavage specimen with **Strongyloides** in an immunocompromised patient (**Papanicolaou stain, ×600**).

C) Scrape cytology smear of a non-healing ulcer on the hand of a patient with acute myeloid leukemia. The smear showed **fungal hyphae (Hematoxylin and Eosin, ×400)**.

D) Bronchoalveolar lavage specimen showing the characteristic “**fluffy**” clusters of **Pneumocystis jiroveci** in a patients with AIDS (**Papanicolaou stain, ×600**).



References

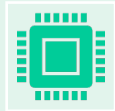


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