


# CYTOPATHOLOGY

The background features abstract geometric shapes. A large light blue triangle points downwards from the top right. An orange triangle points downwards from the top left. A teal triangle points upwards from the bottom left. The word 'CYTOPATHOLOGY' is centered in a bold, brown, sans-serif font.

## outlines:

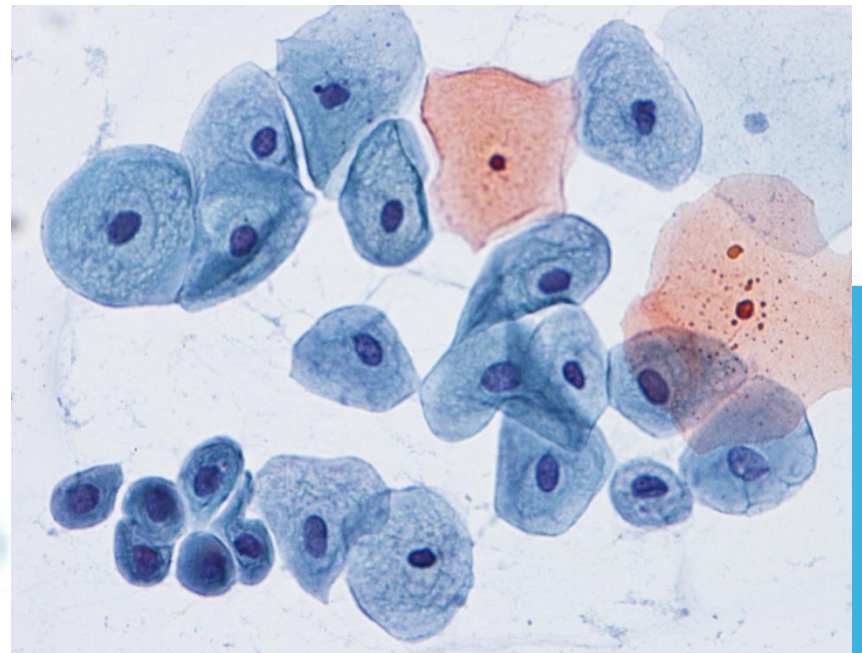
- 1- Definition of cytopathology.
  - 2- Differences between cytopathology and histopathology.
  - 3- Advantage and disadvantage of cytopathology.
  - 4- Sampling techniques.
  - 5- Indications of cytopathology.
- 

## DEFINITION

Scientific **study of cells** obtained from tissues or body secretions **to identify disease.**

The individual cells **reflect** the normal and abnormal morphology of the **tissue** from which they are derived.

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



# TYPES

Based on **sampling techniques**, cytology is classified into the following:

1. Exfoliative Cytology.
2. Abrasive Cytology.
3. Aspiration Cytology.

# Sampling techniques

The collection of exfoliated cells  
“Exfoliative Cytology”.

Brushing or similar abrasive techniques  
“Abrasive Cytology”

Aspiration biopsy

# EXFOLIATIVE CYTOLOGY(NATURAL SPONTANEOUS EXFOLIATION )

Based on spontaneous **shedding of cells** derived from the lining of an organ into a cavity.

- It is **the simplest** of the three sampling techniques.
- Contents of the sample are derived from several sources.

**Examples:** vaginal smear, sputum, urine, effusion.

The material is collected **spontaneously** or by a **syringe** or a **cotton swab**.



MAK

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# ABRASIVE CYTOLOGY(ARTIFICIAL ENHANCED EXFOLIATION)

- Cells are obtained directly from the surface of the target of interest.

- Samples are taken by :

**scraping**, : from cervix( pap smear), vagina, oral cavity(Buccal mucosal smear), and skin lesions.

**brushing, washing. and lavage**: bronchi, GIT, and urinary tract

**Examples**: cervical scraper, endoscopy, and gastric lavage.

Samples can be obtained from superficial or deep lesions.

The purpose of this procedure is to dislodge cells.... **enrich the sample with cells** obtained directly from the surface of the target of interest.









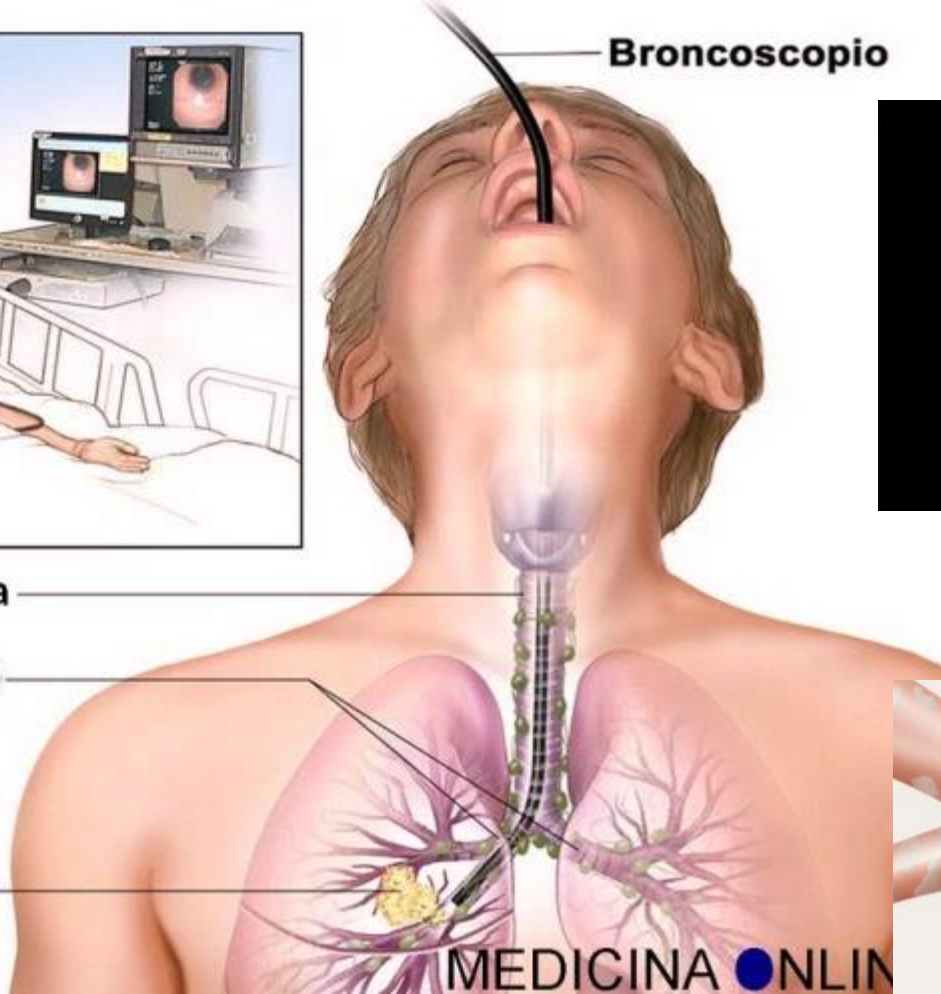
Broncoscopio



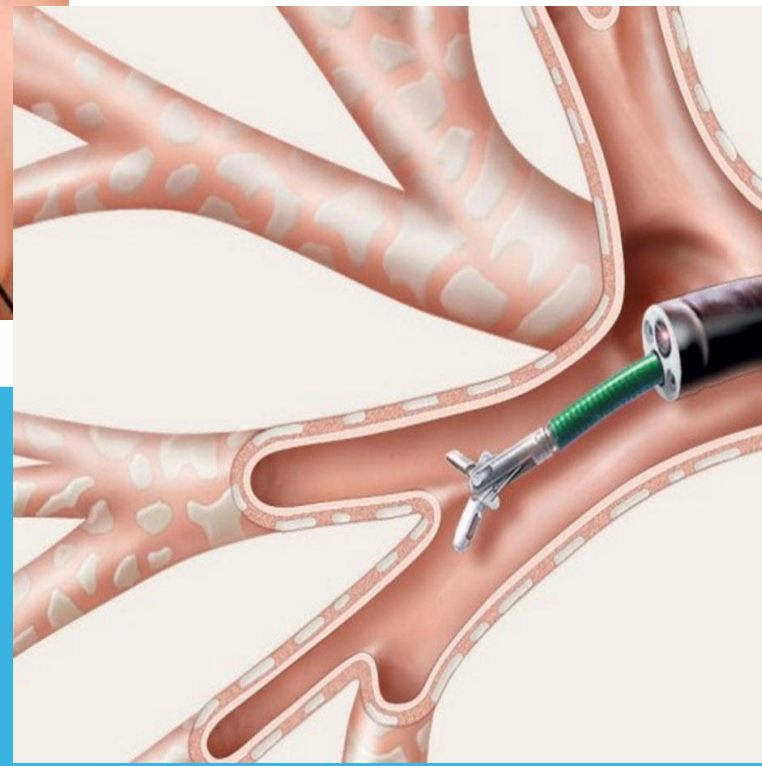
Trachea

Bronchi

Tessuto da prelevare



MEDICINA ONLINE



### 3- Fine Needle Aspiration Cytology (FNAC):

- FNAC provides many advantages to the surgeons being an **easy, reliable, cost effective** diagnostic technique which could give **rapid** results.
- The procedure could be performed in **outpatient** setting **without anesthesia**.
- It is usually **not** more **painful** than a venipuncture and can be **repeated immediately** if the acquired material is inadequate.

# FNAC

Samples are obtained from

**solid tissue**: body organs, tumors & other swell

e.g lymph node, breast and thyroid

A **needle** with a syringe is used.

Simple, safe, rapid, cost effective

Virtually every organ in the body is accessible to this method.



## FNAC consists of:

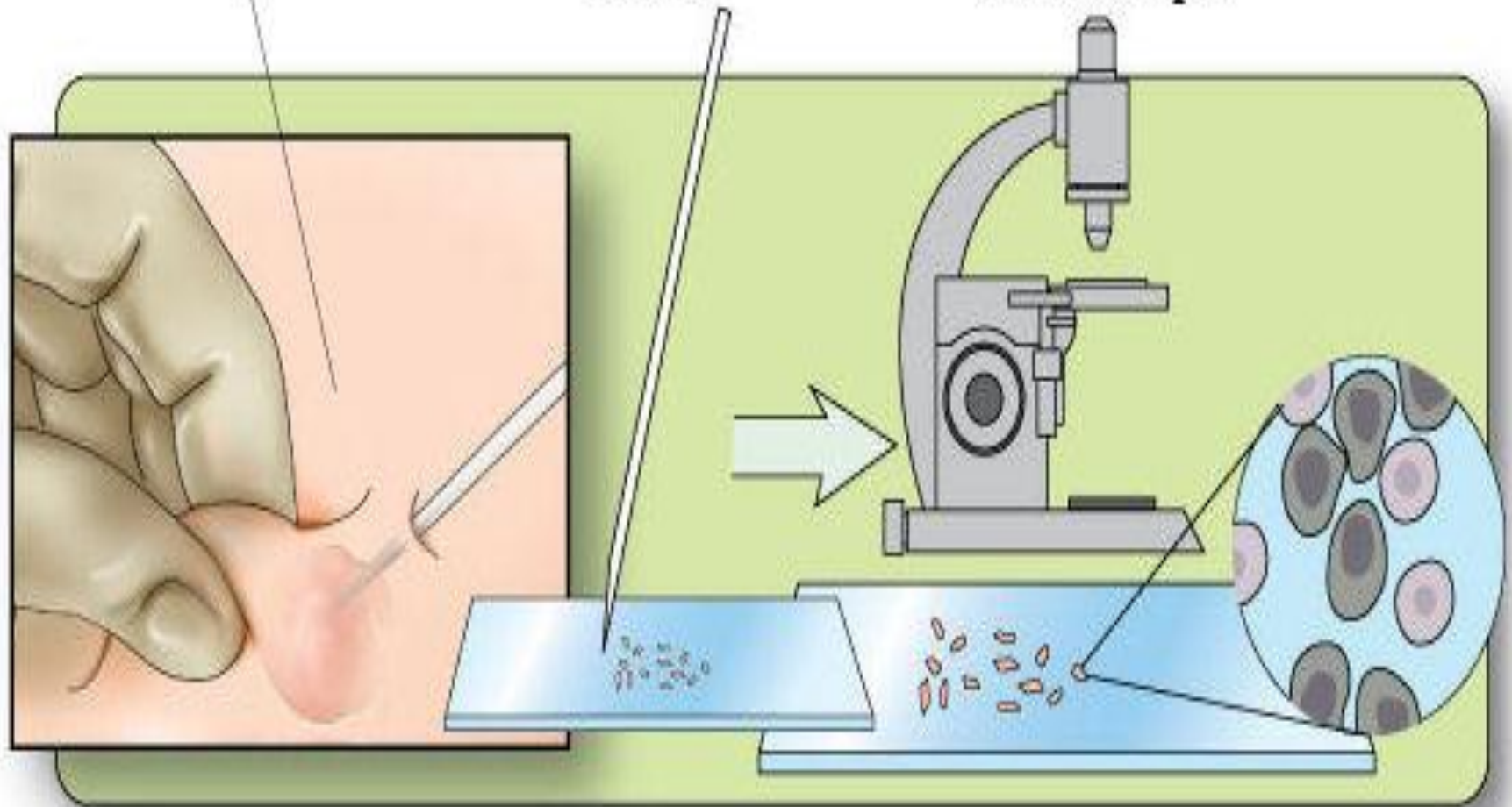
- Using a **needle** and syringe to remove material from a **mass**.
- Smearing** it on a glass slide.
- Applying a routine **stain**.
- Examining it under the microscope.

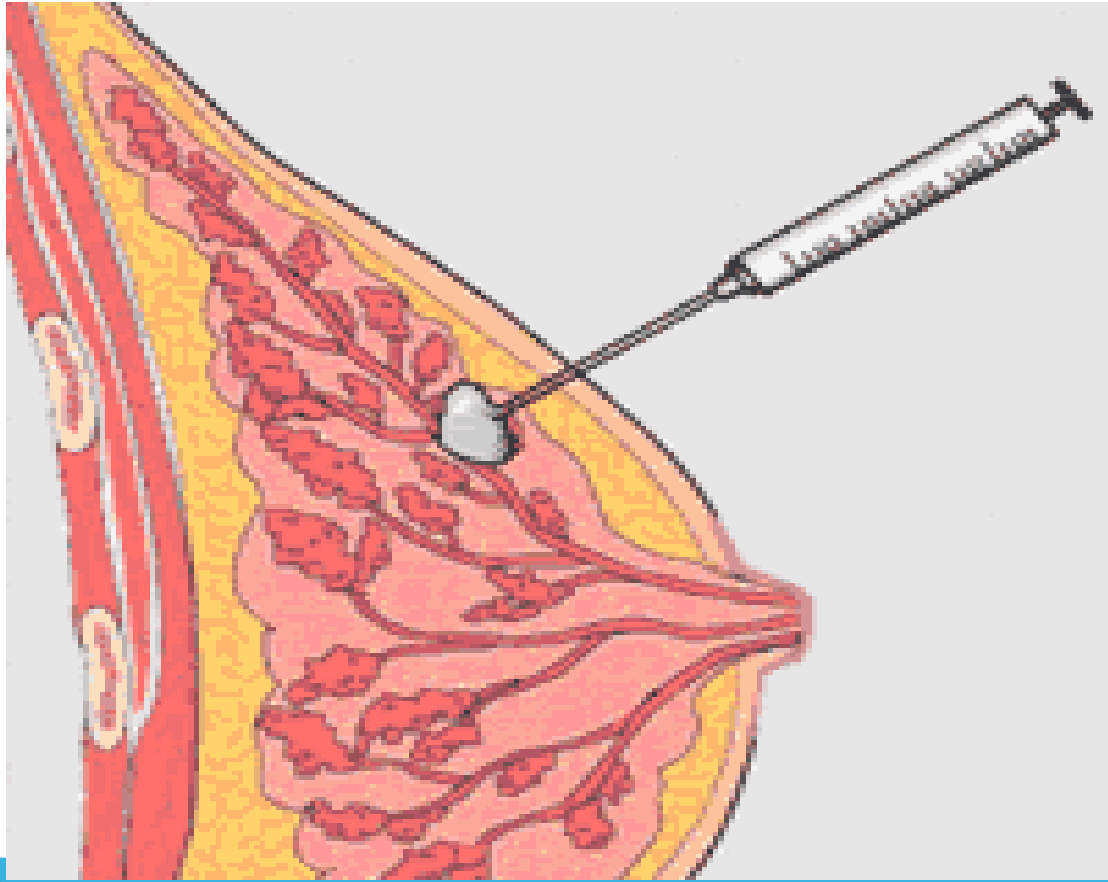


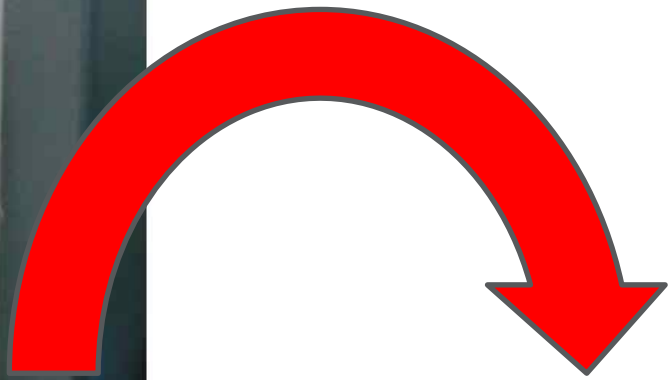
Thin needle draws out small bits of tissue

Tissue samples placed on glass slides

Tissue samples examined under microscope







## Fixatives used in Cytopathology:

1- 95% ethyl alcohol (for Pap smear & FNA).

2- **Spray fixatives** (does not result in lysis of RBC & better preserved of nuclear details).

3- **Carnoy's fixative** (lysis of RBC).

4- Other (**Formaline**)

# *Stains used in cytopathology:*

## *1. Papnicolaou stain:*

Mainly used in Exfoliative cytopathology.

Good & better demonstration of nuclear details.

## *2. Hematoxyline & Eosin (H& E):*

Mainly used in FNA.

## *3. Leishman & Giemsa stains:*

Mainly in FNA.



## Characteristics of ideal stain in cytopathology:

- 1-Evaluation of **architectural pattern** of tissue fragments.
- 2- *Proper evaluation of **nuclear** morphology (most important characteristic).*
- 3- *Proper evaluation of **cytoplasmic** morphology.*
- 4- Evaluation of **background** (blood, secretions, mucin.....)

# Staining methods in Cytopathology:

## 1. Air – dried Giemsa staining:

**Air** drying follows by staining with **Giemsa**).

Well demonstrated **cytoplasmic** details.

Exaggerated cells & nuclear size.

Poorly seen individual cells.

## 2. Wet –fixed Pap staining:

**Alcohol** fixation follows by staining with **Pap** or **H & E**.

Excellent demonstration of **nuclear** details.

Normal size of cell & nucleus.

Clearly seen individual cells.

# Air – dried Giemsa staining:

# Wet – fixed Pap staining:

Air drying

Alcohol fixation

staining with Giemsa).

staining with Pap or H & E

Well demonstrated  
cytoplasmic details

Excellent demonstration of  
nuclear details

Exaggerated cells &  
nuclear size.

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Poorly seen individual  
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# Differences between cytopathology and histopathology

- It differs importantly from histopathology in that cytology examines only discrete cells or small groups of cells, but histopathology examines intact tissues.

## Histopathology

I. Deals with the **form** and the **structure of the tissue**.

II. Evaluation usually begins with a tissue **biopsy** so it is **more invasive and traumatic**.

## Cytopathology

I. Deals with the **changes** within the **nucleus and cytoplasm** of cells.

II. Fine needles with small gauge are usually preferred so it is **less invasive and traumatic**.

III. Basic stain is H&E

IV. Diagnosis obtained after **days**.

V. **Expensive** means of diagnosis do not allow for repetition

III. Basic stain is **Pap** stain (however **H&E** could be used as well)

IV. **Rapid diagnosis** that could be obtained within **minutes**.

V. **Inexpensive** simple means of diagnosis which allows frequent repetition of cellular sampling



## 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 disease**
- 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 disadvantage of diagnostic cytology:

- Tumors cannot be **graded**.
- **Margins** cannot be evaluated.
- Interpretation of the morphological cellular changes is based only on individual cell observation.
- Limited information about structural arrangement (**architecture**) of the cells within the lesion.
- **Less definitive diagnosis** as to the specific tumor type or the distribution of an inflammatory infiltrate.



➤ Very bad negative test: A problem related to the small sample size and "blind" nature of many common collection techniques, is the possibility that the specimen may not represent the primary lesion.



The following points should be kept in mind when starting a cytological evaluation:

- 1) Cytology is an aid to clinical diagnosis, and results must be interpreted in the **context of the overall case**. The cytologic diagnosis must be based on the **entire clinical evidence available**, rather than on changes in individual cells.
- 2) Cytology can be but is not always a substitute for histopathology.



Indications for  
Cytopathology:

Premalignant lesion

inflammation

Differentiation between benign  
and malignant

hormonal patterns

malignancy

Follow-up

Barr body

## Indications for Cytopathology:

- 1- Differentiation between **benign and malignant lesions**.
- 2- Diagnosis of **malignancy** and the identification of the neoplastic cells in primary, metastatic (secondary).
- 3- Diagnosis of **premalignant** diseases.
- 4- Detection of **inflammation** and certain types of pathogenic agents.

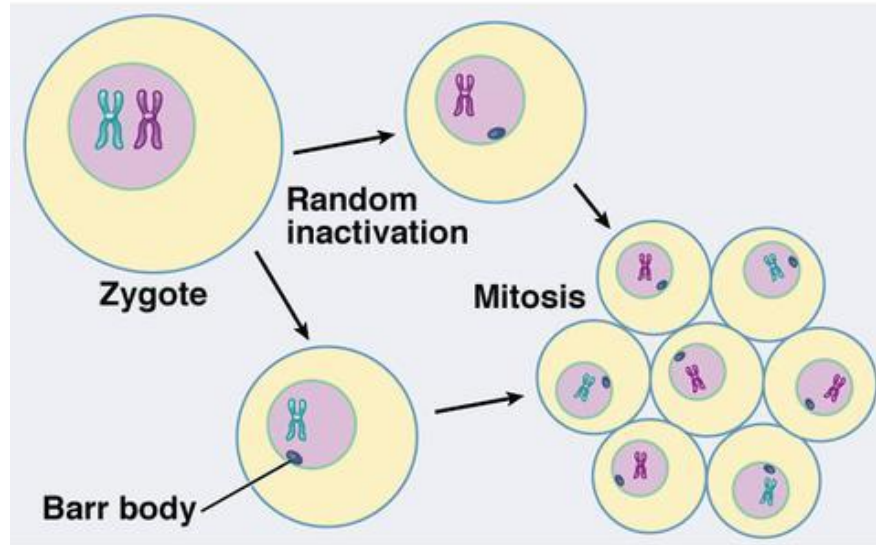
5- Study of the **hormonal patterns** through the examination of the squamous cells in vaginal smears; which are under the influence of ovarian hormones.

6- **Follow-up** and **monitoring of response** to chemotherapy and irradiation, the latter producing certain cellular features which could be diagnostic on cytological examination.

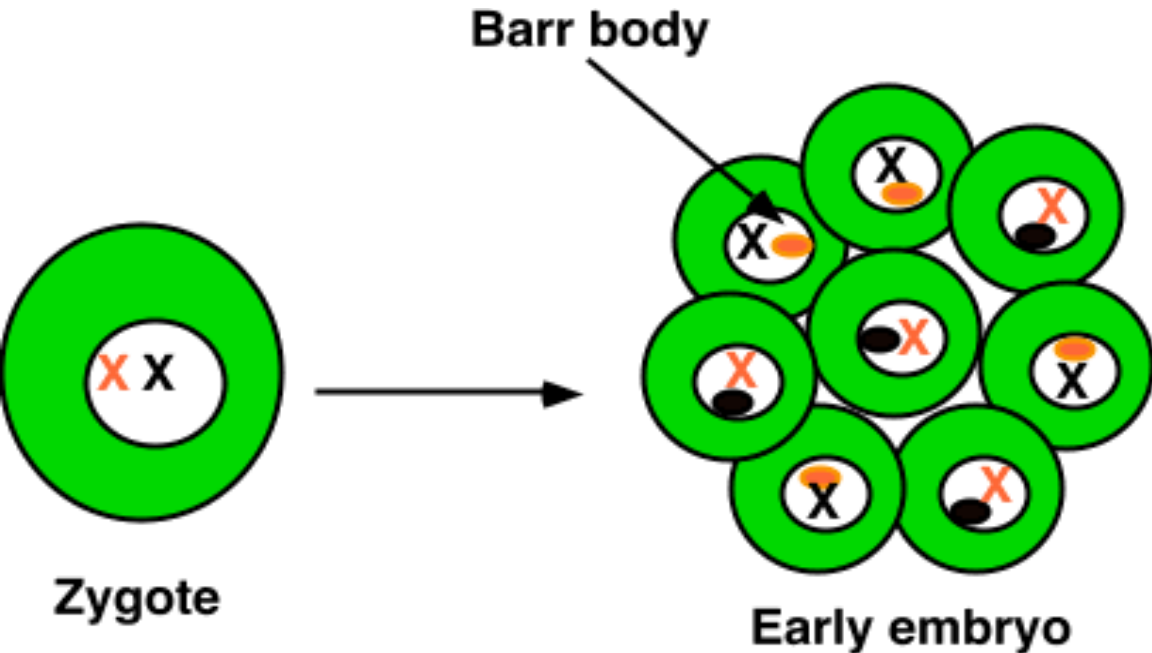
7- The identification of **sex chromosome**: if a newborn presents with ambiguous genitalia, one can not tell whether the sex is male or female.

The presence of a **dark dot 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 (♀).

# Barr Bodies



Barr body



Cytopathology can be further subdivided into:

Gynecological Cytopathology, include cervicovaginal cytopathology.....etc.

Non gynecological Cytopathology include cytopathology of all other organs.

Fine Needle Aspiration (FNA): include FNA of breast, FNA of thyroid.....etc.

# Gynecological cytopathology:

Two types of epithelia are present in female genital organs

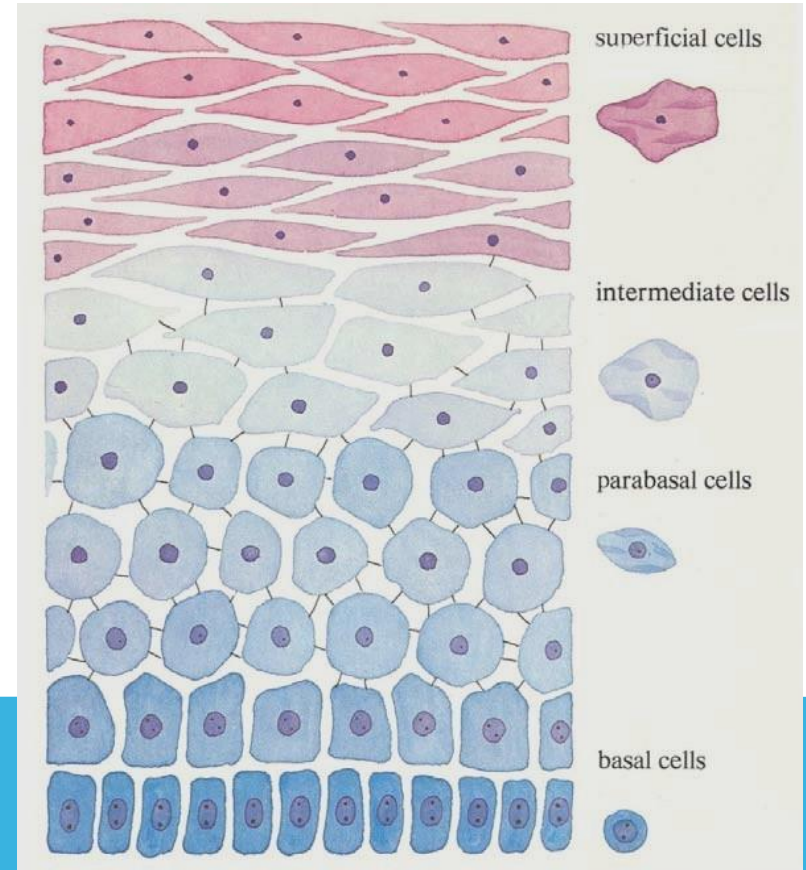
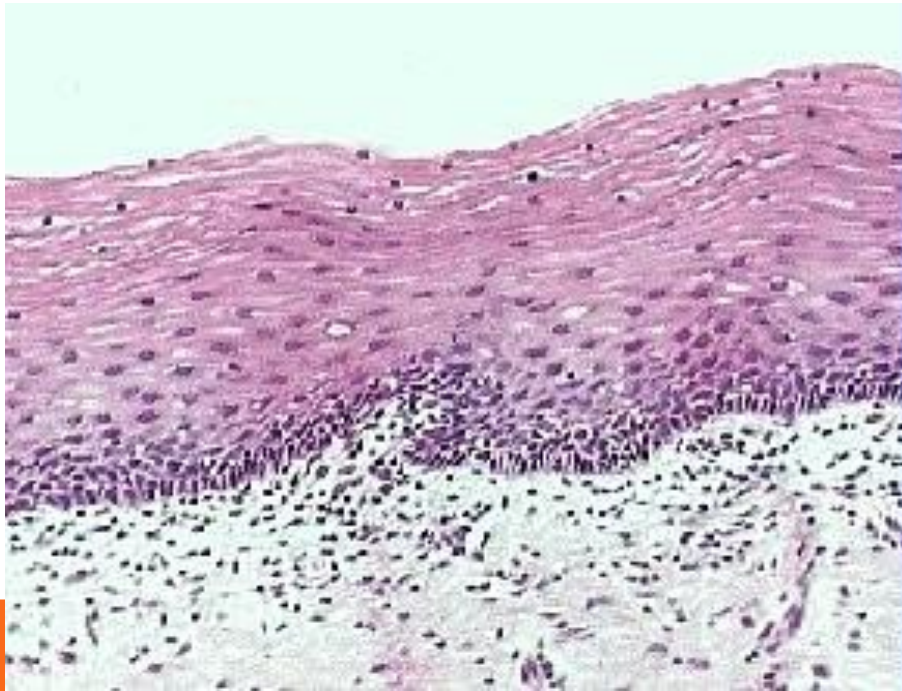
Columnar epithelium: lined uterus & endocervix.

Squamous epithelium: lined ectocervix & vagina.

**Squamous Metaplasia** of endocervical epithelium (columnar) into Squamous epithelium is usual process occurring in all women, as a result of hormonal effects. (Changes more in cytoplasm of cells more than nuclei).

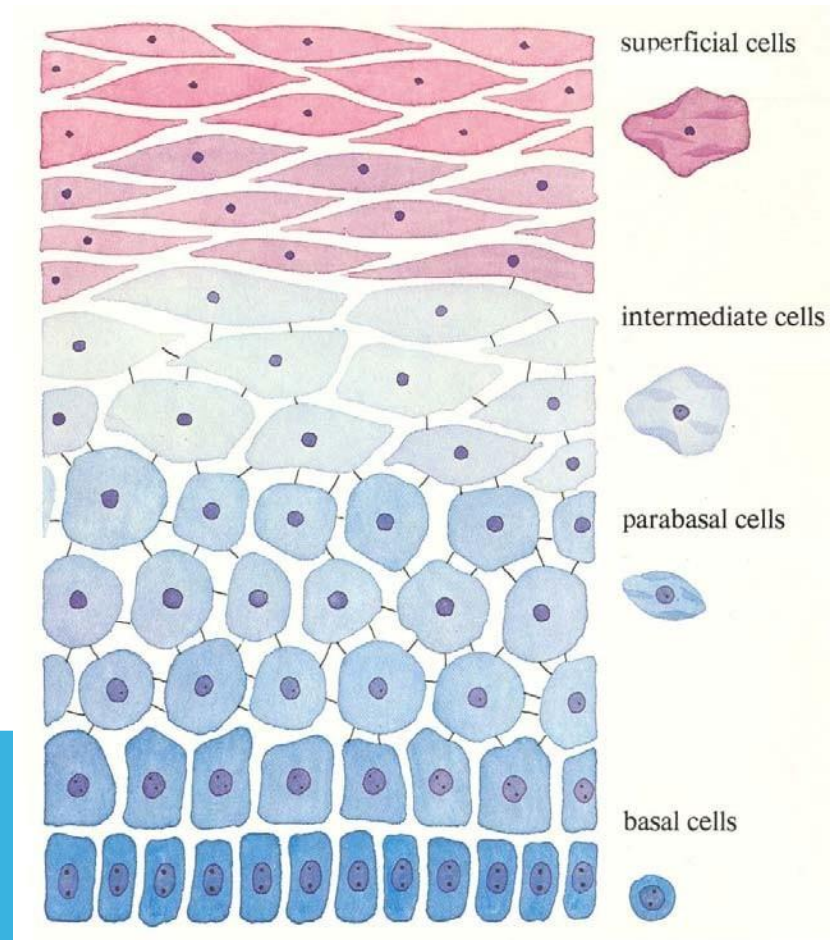
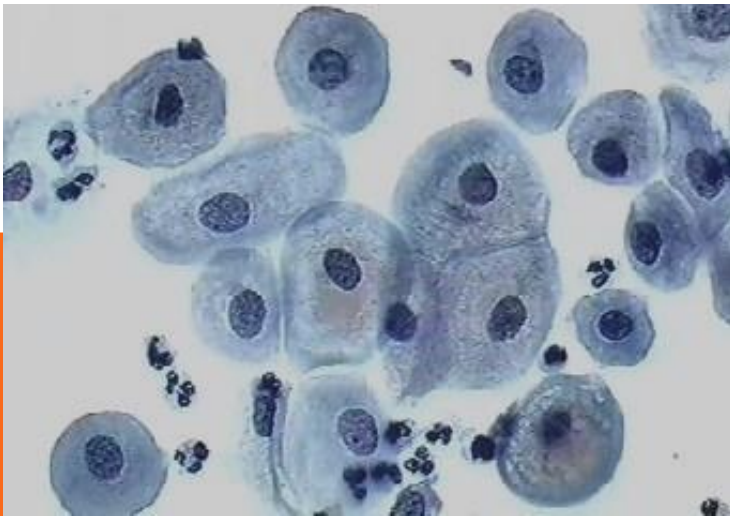
For reporting of cervico-vaginal cytology, **Bethesda system (1991)** is currently used.

# SQUAMOUS EPITHELIUM

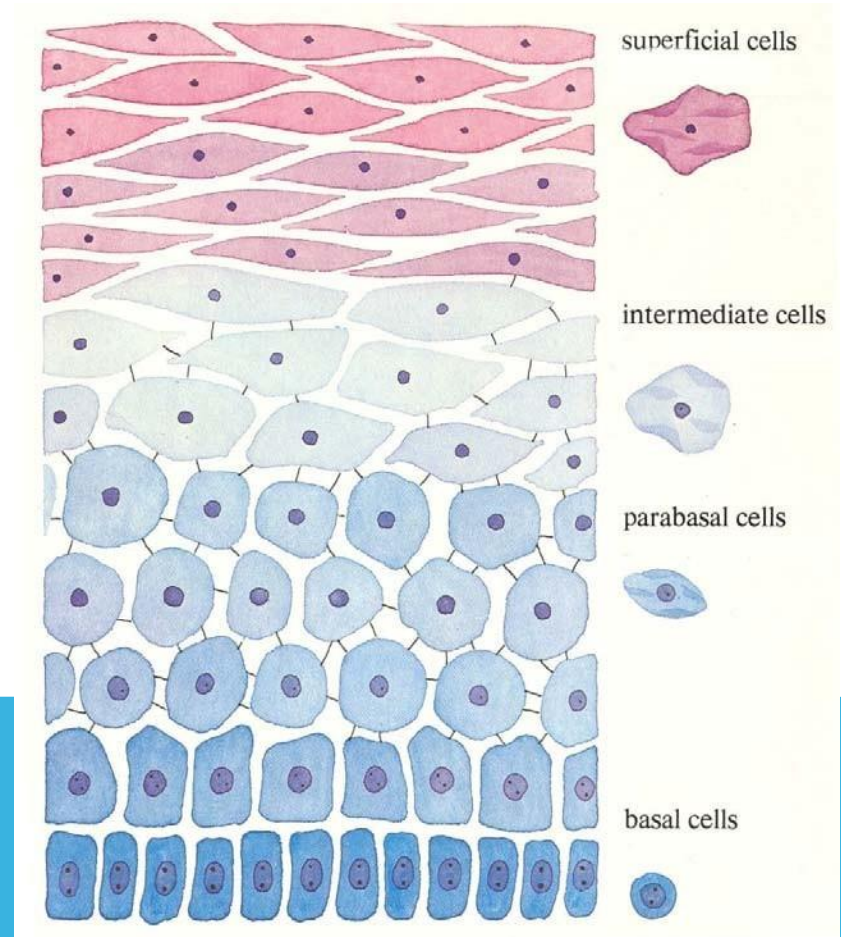
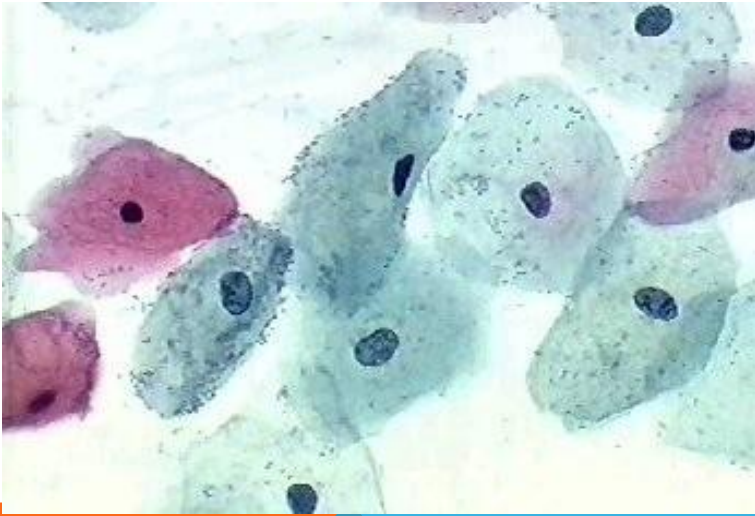




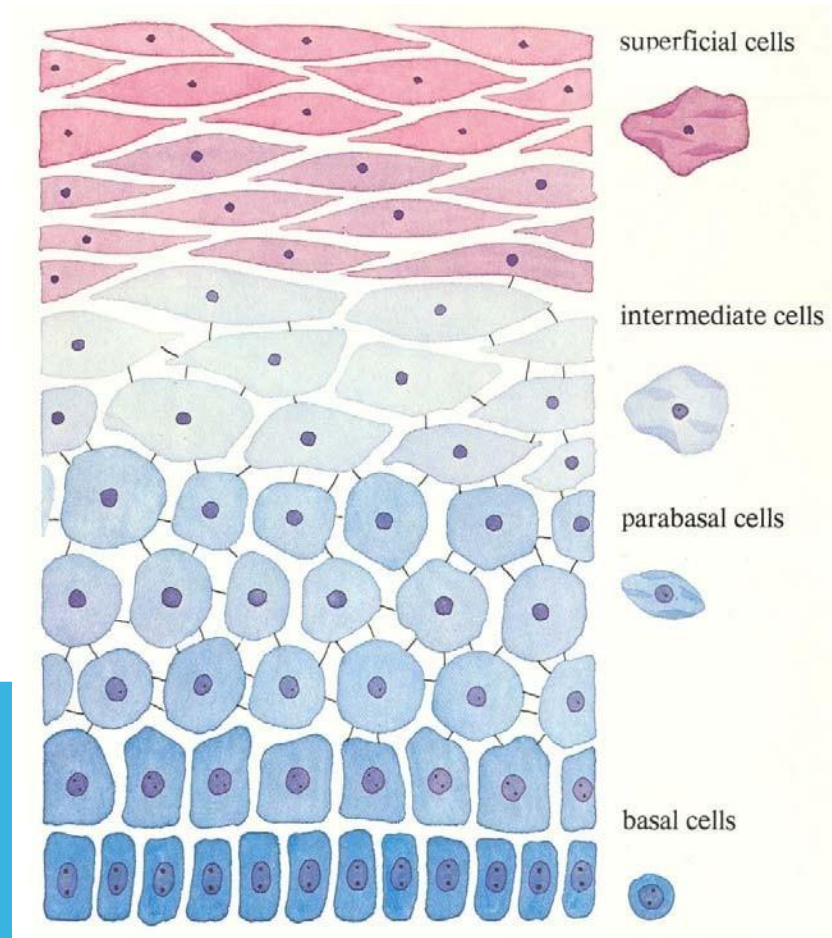
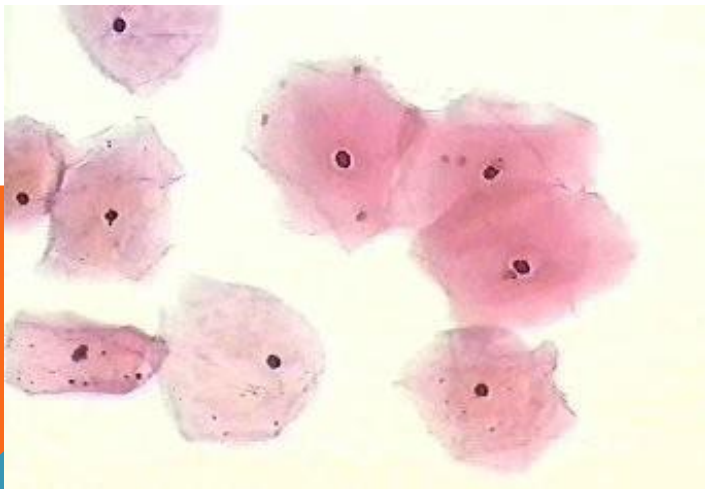
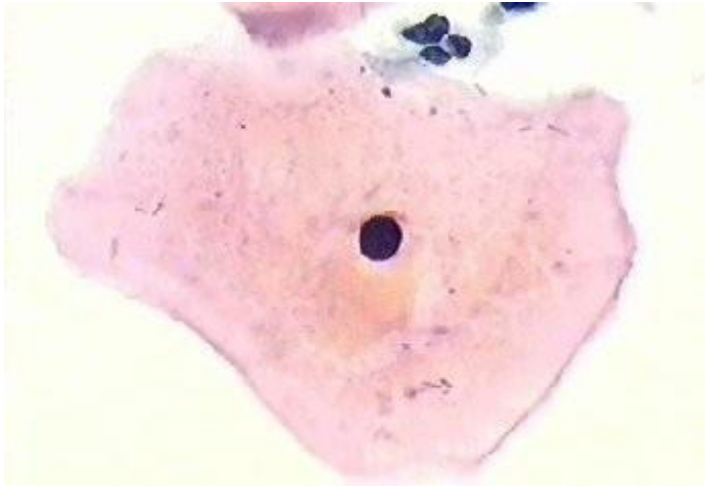
# PARABASAL CELLS



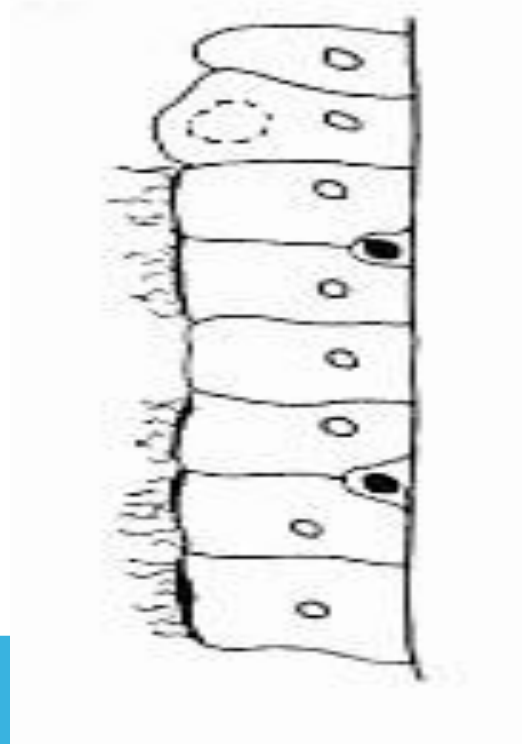
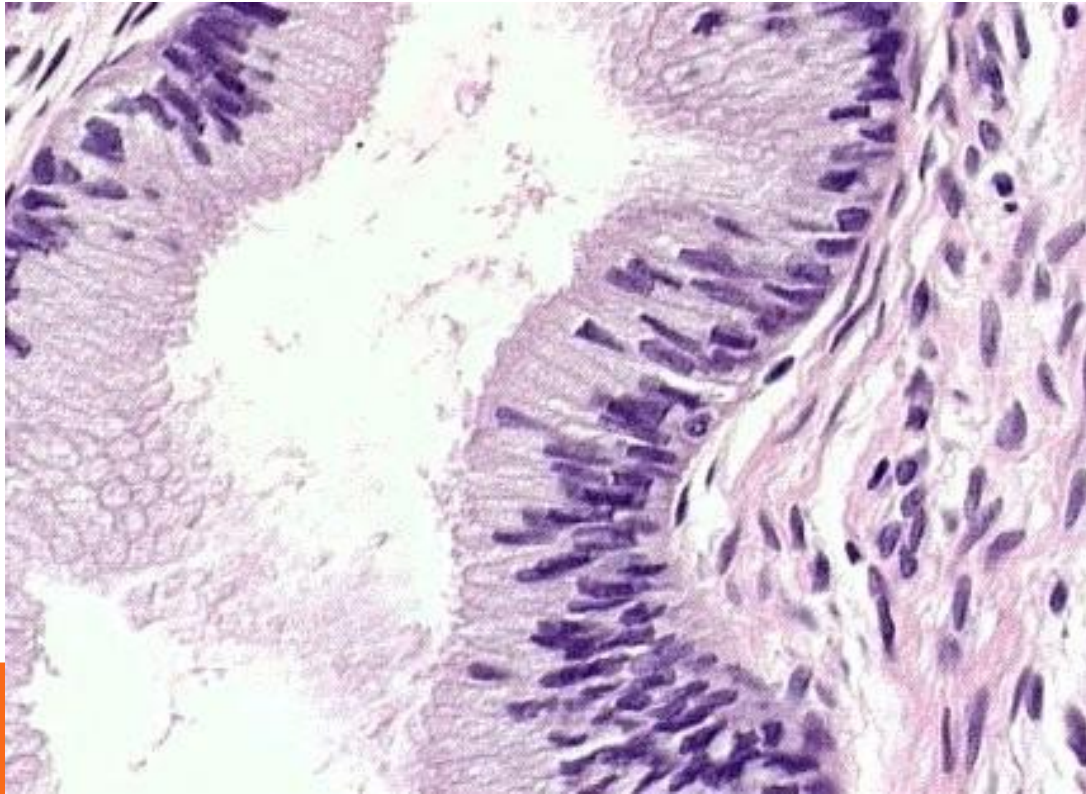
# Intermediate CELLS



# Superficial CELLS



# ENDOCERVIX

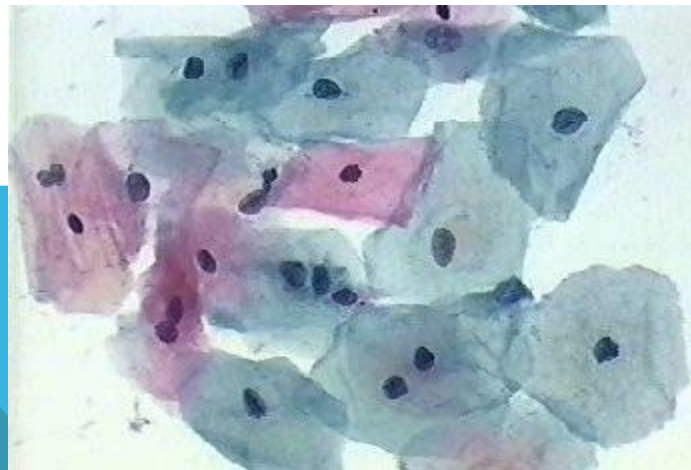
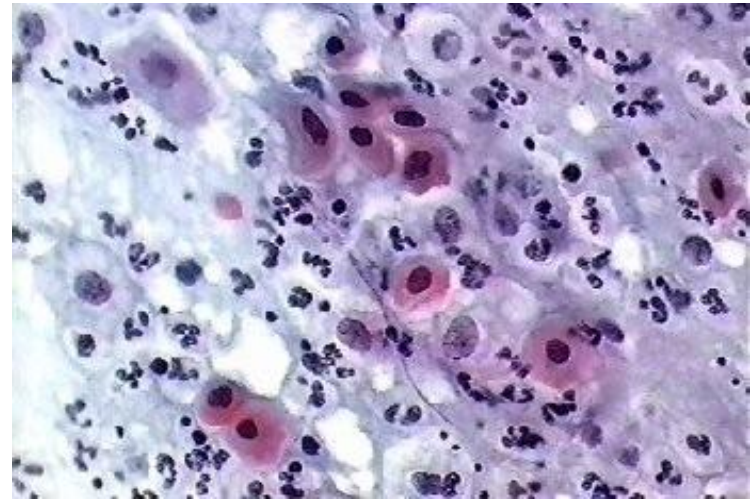
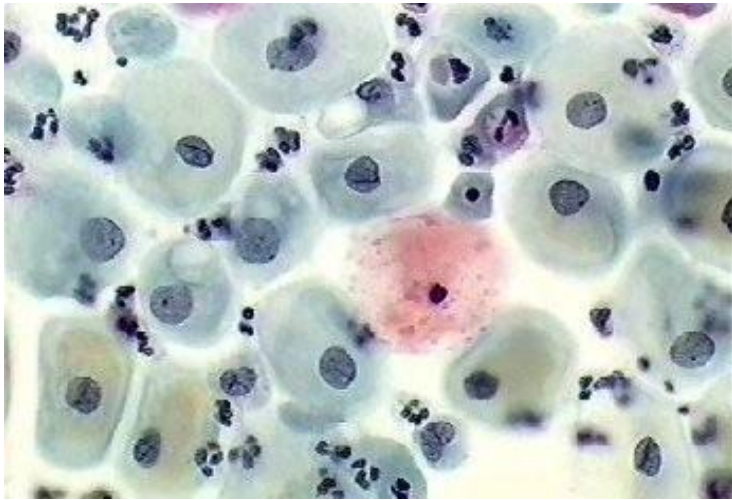


# Endocervical CELLS



characteristics	Normal Squamous cells	Metaplastic Squamous cells	Malignant Squamous cells
<b>Cell arrangement</b>	Exfoliated singly	<b>Cohesive sheets</b> or groups	Singly or <b>dyscohesive sheets.</b> Variable size & shape of cells.
<b>Cytoplasmic characteristics</b>	<b>Abundant cytoplasm</b> Well defined cell borders	<b>Either pale to dense cytoplasm.</b> <b>Cytoplasmic processes.</b> <b>Poor defined cell borders.</b>	<b>Scant cytoplasm</b>
<b>Nuclear characteristics</b>	<b>Centrally</b> located nucleus. <b>Absent nucleoli.</b> <b>Low N/C ratio.</b>	<b>Larger nuclei than normal.</b> <b>With or without nucleoli.</b>	<b>Variable size &amp; shape.</b> <b>High N/c ratio.</b> <b>Prominent nucleoli.</b>

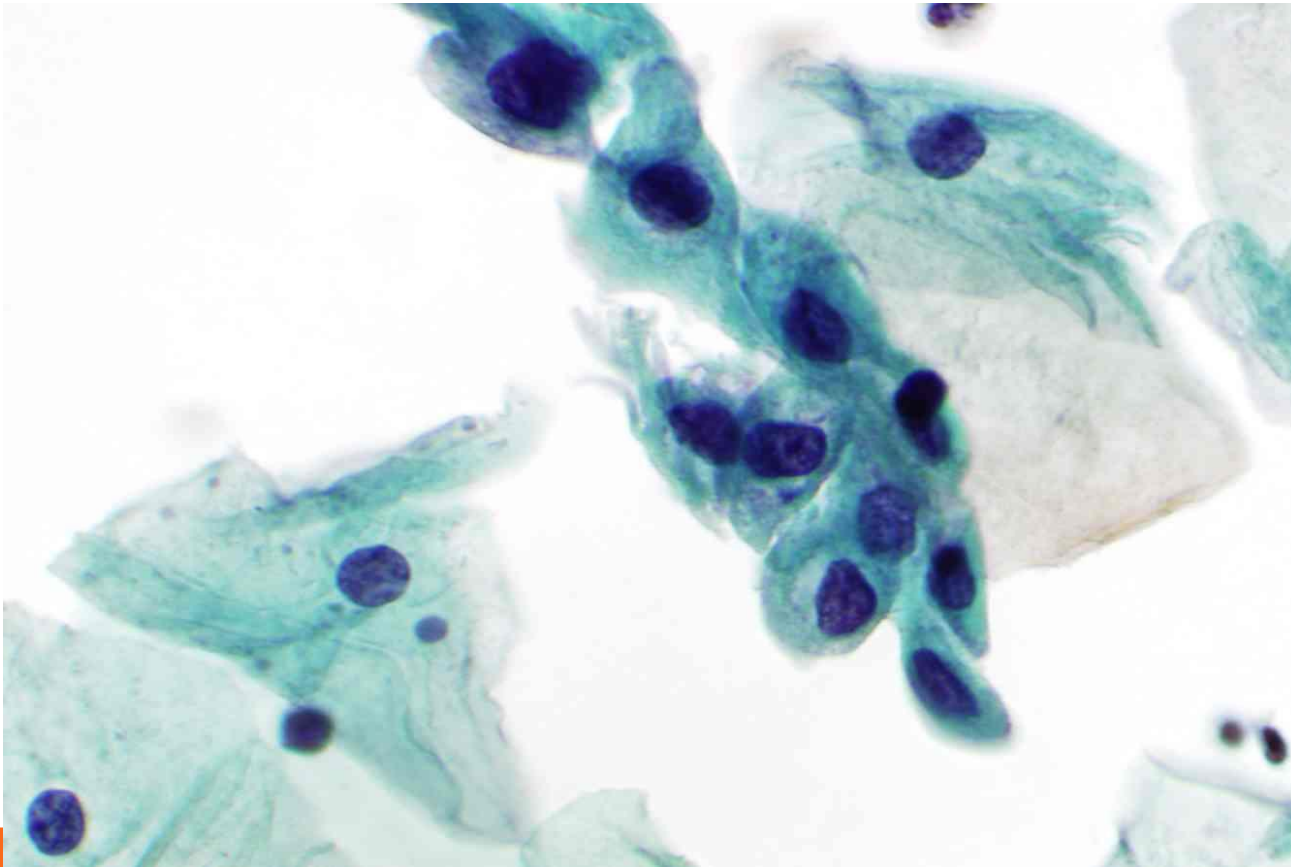
# NORMAL SMEAR



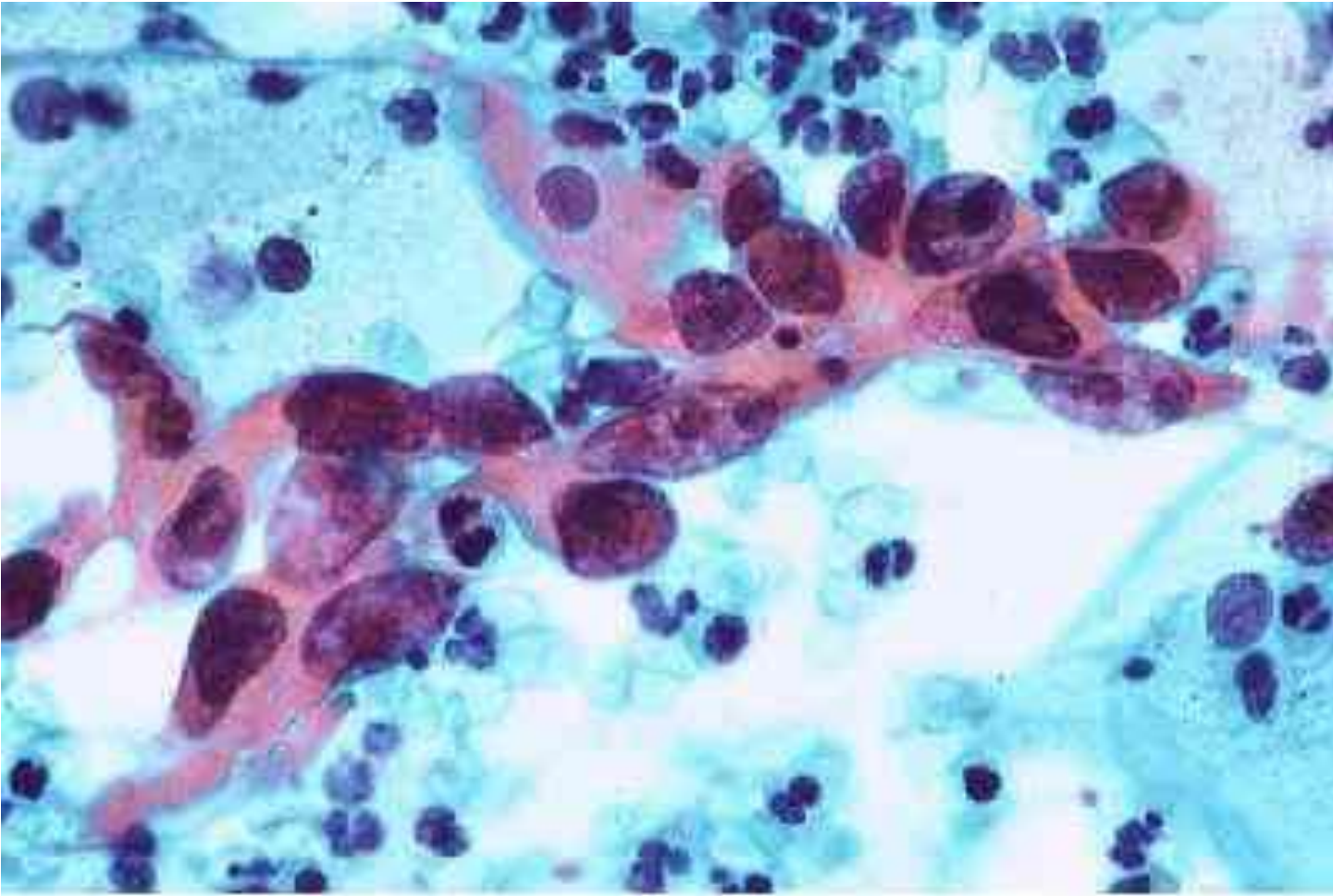


Normal squamous cells





Squamous metaplastic cells



Squamous cell carcinoma

# Non-Gynecological cytopathology:

Include cytological examination of all other organs (e.g. respiratory system cytopathology, urine cytopathology.....)

## 1. Serous effusions:

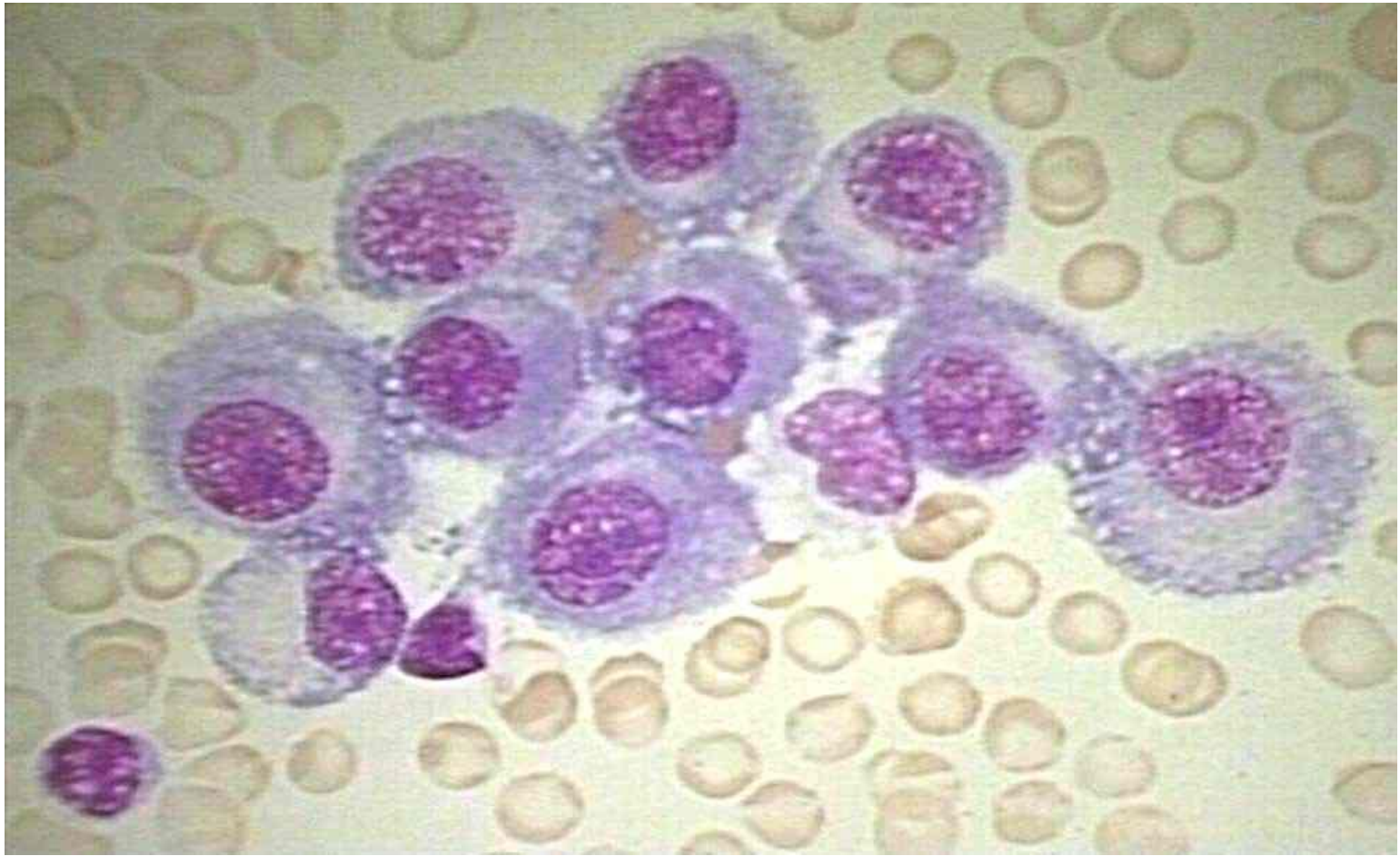
Accumulation of fluid in serous cavities (e.g. pleura, peritoneum) is abnormal & can result from many causes (**inflammation, cancers....**).

Cytological examination of serous effusions is performed mainly **to establish the presence or absence of malignancy** (either primary mesothelioma or metastatic carcinoma to these sites) .

**Metastatic carcinomas to the serous surfaces are from lung, & ovary breast, colon, stomach,**

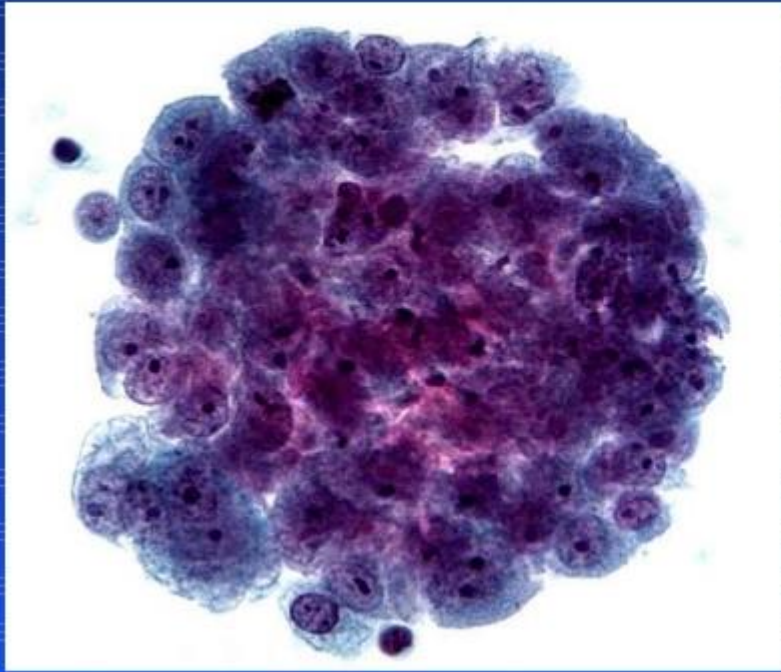
Better to differentiate between mesothelioma & metastatic carcinoma by using **special stains & immunohistochemistry.**

<u><i>Characteristic</i></u>	<u><i>reactive mesothelial cells</i></u>	<u><i>Malignant mesothelioma</i></u>	<u><i>Adenocarcinomas (metastatic)</i></u>
<b><i>Fluid characteristics</i></b>	Clear, turbid	Always hemorrhagic	Hemorrhagic
<b><i>Cells arrangement</i></b>	Singly mainly, less as tissue fragments. Ill defined cell borders.	Small to large complex sheets of cells. Well defined cell borders.	Acinar (gland like formation). Well defined cell borders.
<b><i>Nuclear characteristics</i></b>	Variable in number & shape. Normal N/C ratio Multiple micronucleoli.	Same Increase N/C ratio	Single, macronucleoli, coarse chromatin. Increase N/C ratio
<b><i>Cytoplasmic characteristics</i></b>	Moderate to abundant cytoplasm.	Scant to moderate amount.	Scant to moderate amount. Presence of cytoplasmic vacuoles & signet ring cells.



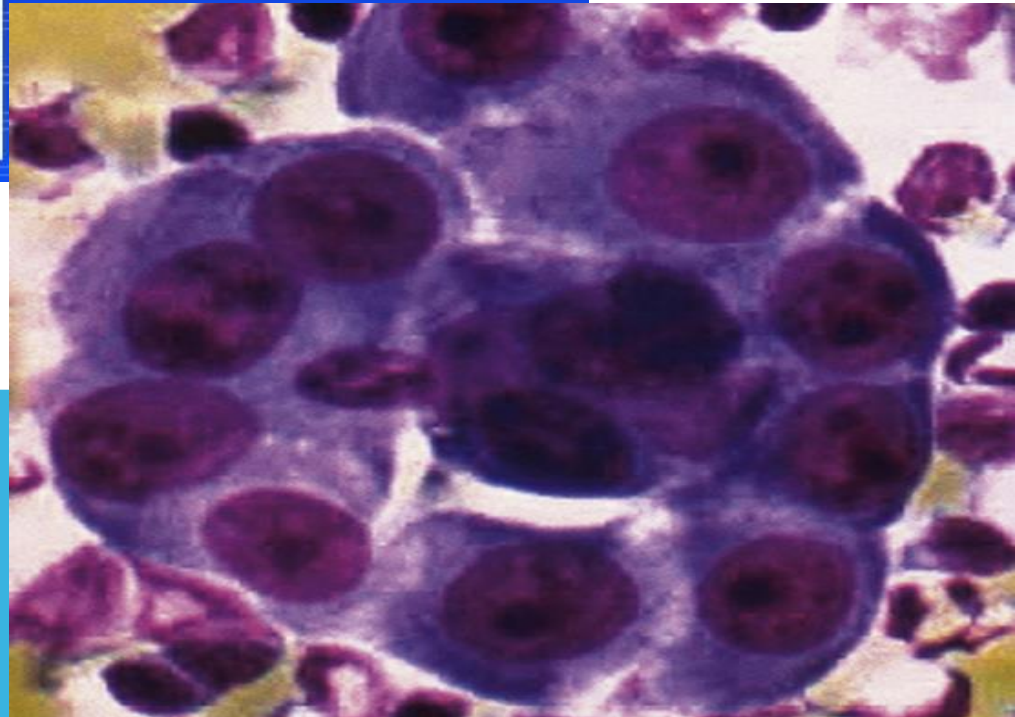
Reactive mesothelial cells

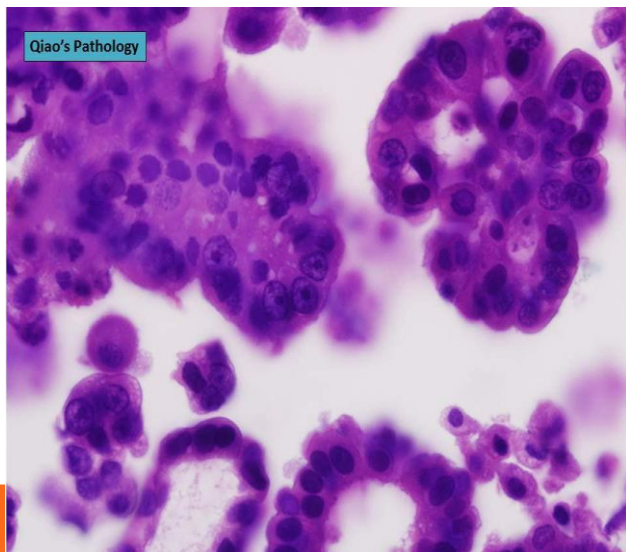
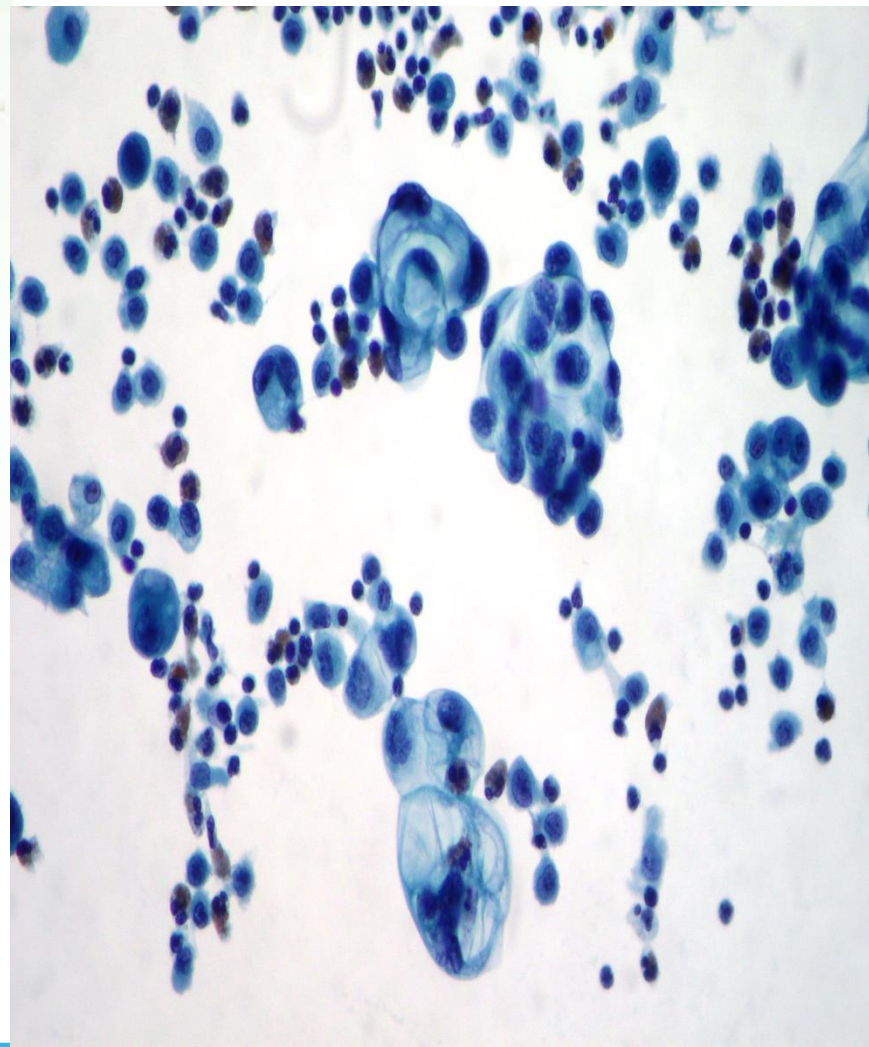
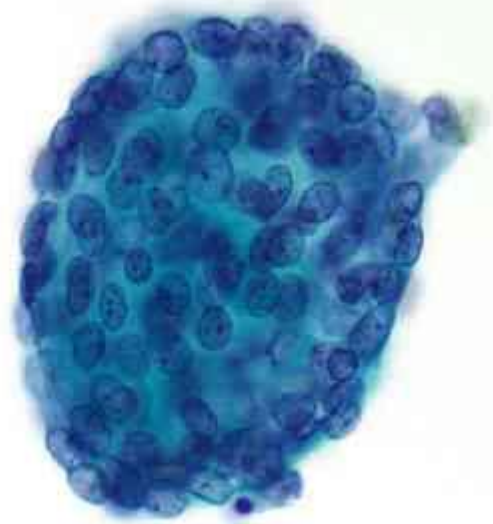
## Cytological features of mesothelioma



Loosely cohesive three-dimensional groups of mesothelioma cells with knobby outline. A multinucleate atypical mesothelial cell is seen at the periphery of the group (arrow).

Thinprep. Pap stain 40x.





Metastatic malignant cells

## 2. Sputum Cytology:

Offers highly diagnostic values for diagnosis of **centrally located lung cancer** (Squamous, small cell cancers of lung).

3 to 5 consecutive daily sputum examinations is advisable to increase the rate of detection of cancers.

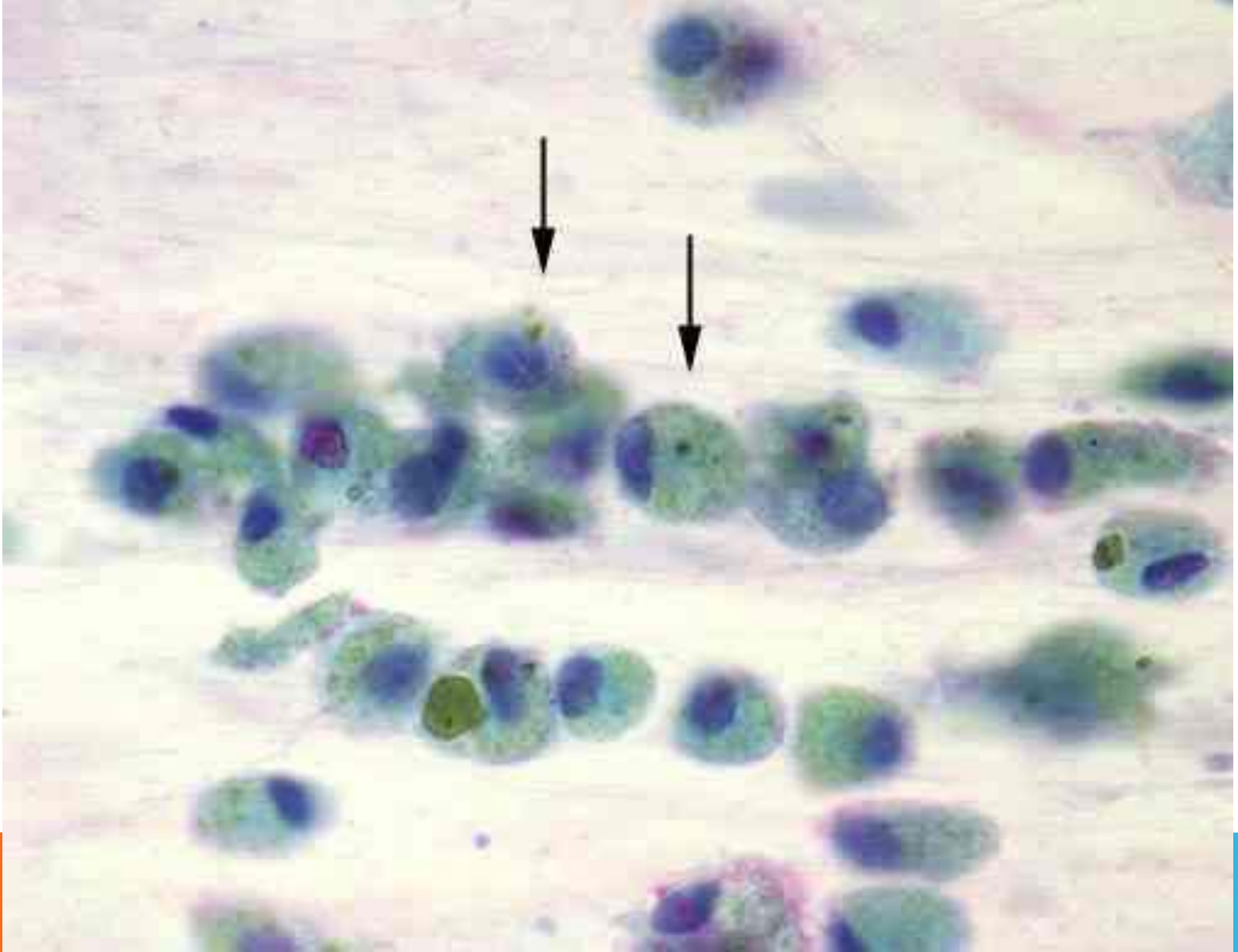
Sputum may spontaneously coughed or induced.

Sputum sample is fixed with **Sacomanno fixative**(2% polyethylene glycol With 50% ethyl alcohol).

Sputum sample is considered satisfactory when it

contains **alveolar macrophages**.





Alveolar macrophages

## FNA Of Breast:

FNA is by far the most popular , simple, cost effective, reliable, & diagnostic procedure in cytological diagnosis of breast lesions.

FNA is important part in triple screening test for early detection of breast carcinoma :

1- (physical examination) a thorough physical examination of the whole breast area, including both breasts, nipples, armpits .

### 2-Imaging tests

Imaging tests for breast cancer may involve:

**mammogram:** a way of examining the breasts using low-dose X-rays •

**ultrasound:** •

The tests used will depend on the woman's age. For women aged 35 years or older, both a mammogram and an ultrasound will be used. •

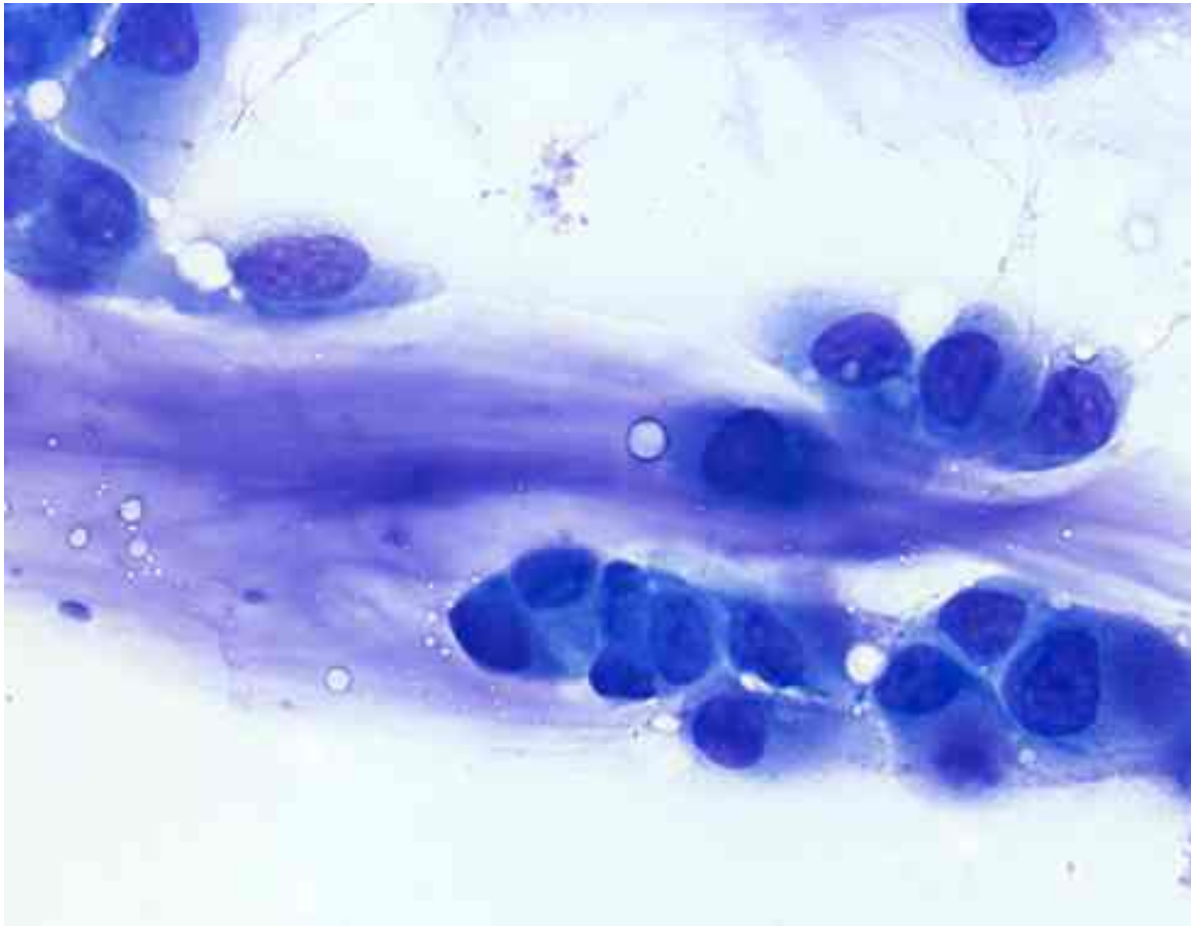
For women younger than 35 years, an ultrasound is used first and a mammogram may also be used if more information is needed. •

### 3- FNA).

<u><i>Characteristics</i></u>	<u><i>Benign pattern</i></u>	<u><i>Malignant pattern</i></u>
<i>Cellularity</i>	Almost low cellularity	High cellularity
<i>Cells arrangements</i>	Sheets of uniform ductal cells (cohesive)	Single, variable size malignant cells.  (poorly cohesive)
<i>Single bare nuclei</i>	FREQUENT	ABSENT
<i>Nuclear characteristics</i>	Uniform size	Enlarged, atypical nuclei.



Fibroadenoma of breast



Malignant cells of breast aspirate

A white rectangular card is centered on a white background. The card has the words "THANK YOU!" written in a red, hand-drawn, sans-serif font. The text is arranged in two lines: "THANK" on the top line and "YOU!" on the bottom line. The card is decorated with several roses. In the top-left corner, there is a cluster of pink and red roses with green leaves. In the bottom-right corner, there is another cluster of pink and red roses with green leaves. The overall composition is clean and elegant.

THANK  
YOU!