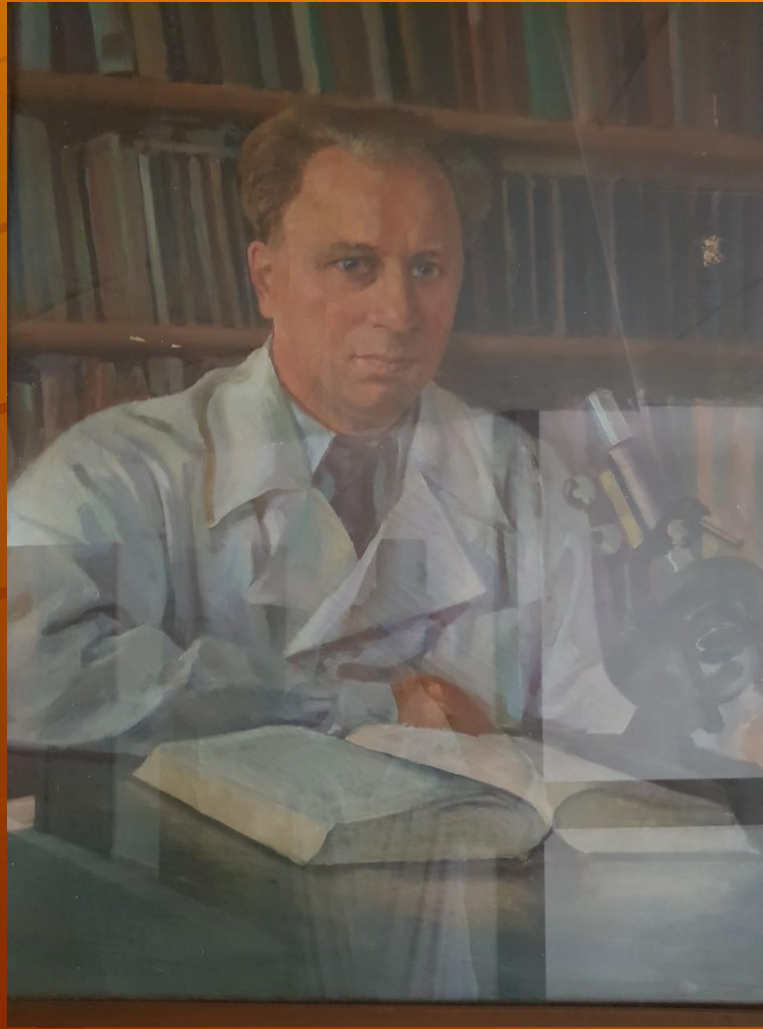


*Introduction to
Pathology*

The History of the Pathology Department

The Department of Morphopathology (until 1991– Anatomical Pathology) was founded by professor F. Agheicenko in 1945. He was the first head of the department. At that time the main research of the department was morphology of CNS tuberculosis, supporting also 5 doctors of medicine theses.



Introduction to Pathology

Pathology Literally it is the study of suffering
What happens to tissues/organs of the body in the presence of disease.

Disease - Literally a “lack of ease”

Pathological process of the body organ(s) with its' own signs and symptoms, dysfunction of significant number of **cells** in the organ must occur first.

Importance of Pathology

- The knowledge and understanding of pathology is essential for **doctors** as well as **general practitioners** and **specialists**.
- because, if they would not understand the language spoken by pathologists in the form of laboratory reports, they would not be able to provide adequate treatment and prescribe preventive measures for patients.

The importance of the pathological service

- ✓ Pathology services lie at the heart of health care services provided to patients and the community.
- ✓ Pathology is a clinical knowledge service that is fundamental to modern medical practice and health care.
- ✓ Pathology is used in the diagnosis, treatment and management of an increasing range of clinical conditions.



The importance of the pathological service

- ✓ **Pathology investigations are an integral part of the clinical consultation and procedural process with overseas studies indicating that 70-80 per cent of all health care decisions affecting diagnosis or treatment involve a pathology investigation.**
- ✓ **Pathology is essential to the prevention, early detection, diagnosis and treatment of many of the leading causes of disease— e.g. cancer, cardiovascular disease and diabetes.**



Evolution of Pathology

In the past, .. people mistook magic for medicine...!

Now people mistake medicine for magic....!

From religious beliefs to rational approach (Antiquity to AD 1500)

•

Era of gross pathology (AD 1500 to 1800)

•

Era of technology development and cellular pathology (AD 1800 to 1950s)

•

Modern pathology (1950s to dawn of 21 st century)



From religious beliefs to rational approach (Antiquity to AD 1500)

Hippocrates (460-377 BC)

Permanently dissociated medicine from religious mysticism. Considered the father of medicine, used direct observation as the main method.

Aristotle (384-322 BC)

Formulated the first concepts of embryology and comparative anatomy, describing the chicken embryo and the sperm fluid.

From religious beliefs to rational approach (Antiquity to AD 1500)

Follow about 14 centuries of decline

Avicenna (980-1037)

with his work "The Canon of Practical Medicine"
which will become the book of many European
sages from the medieval period.



Era of gross pathology (AD 1500 to 1800)

Giovanni B Morgagni(Italy) 1682-1771

- ◆ Introduced clinicopathologic correlation in the study of disease

◆ **John Hunter** (Scotland) **1728-1793**

Introduced pathology museum in the study of disease.

◆ **R.T.H. Laennec** (France) **1781-1826**

Described several lung diseases such as various tuberculous lesions of lungs, bronchiectasis. Described cirrhosis of liver (later called Laennec's cirrhosis). Invented stethoscope.

Era of technology development and cellular pathology (AD 1800 to 1950s)

Rudolf Virchow (Germany) 1821-1905

Father of cellular pathology. That introduced histopathology as a diagnostic branch by his cellular theory

George N. Papanicolaou (USA) 1883-1962

Father of exfoliative cytology Developed Pap smear for detection of cervical cancer in 1930s

Modern pathology (1950s todawn of 21st century)

Watson and Crick 1953

Described the structure of DNA

Nowell and Hagerford 1960

Philadelphia chromosome in CML i.e. t(9;22)

Galland Pardue 1969

In Situ Hybridization

Kary Mullis 1983

Introduced polymerase chain reaction (PCR)



Classification of Diseases:

➤ **Developmental** – genetic, congenital.

➤ **Acquired:**

***Inflammatory** – Trauma, infections, immune, etc.

***Neoplastic** – tumors cancers

***Degenerative** – ageing.

***Metabolic.**

***Iatrogenic: Drug induced.**

Branches of Pathology

- General Pathology
- Systemic Pathology
- Gross Pathology
- Cellular Pathology
- Surgical Pathology
- Clinical Pathology
- Immunopathology

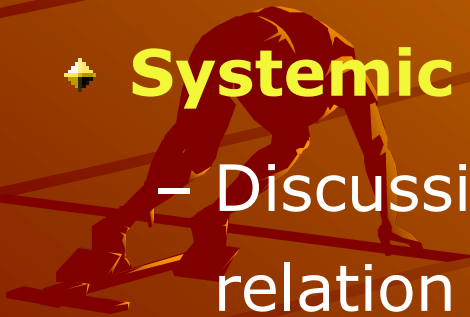
Learning Pathology:

◆ **General Pathology**

- Common changes in all tissues. e.g..
Inflammation, cancer, ageing, edema,
hemorrhageetc.

◆ **Systemic Pathology**

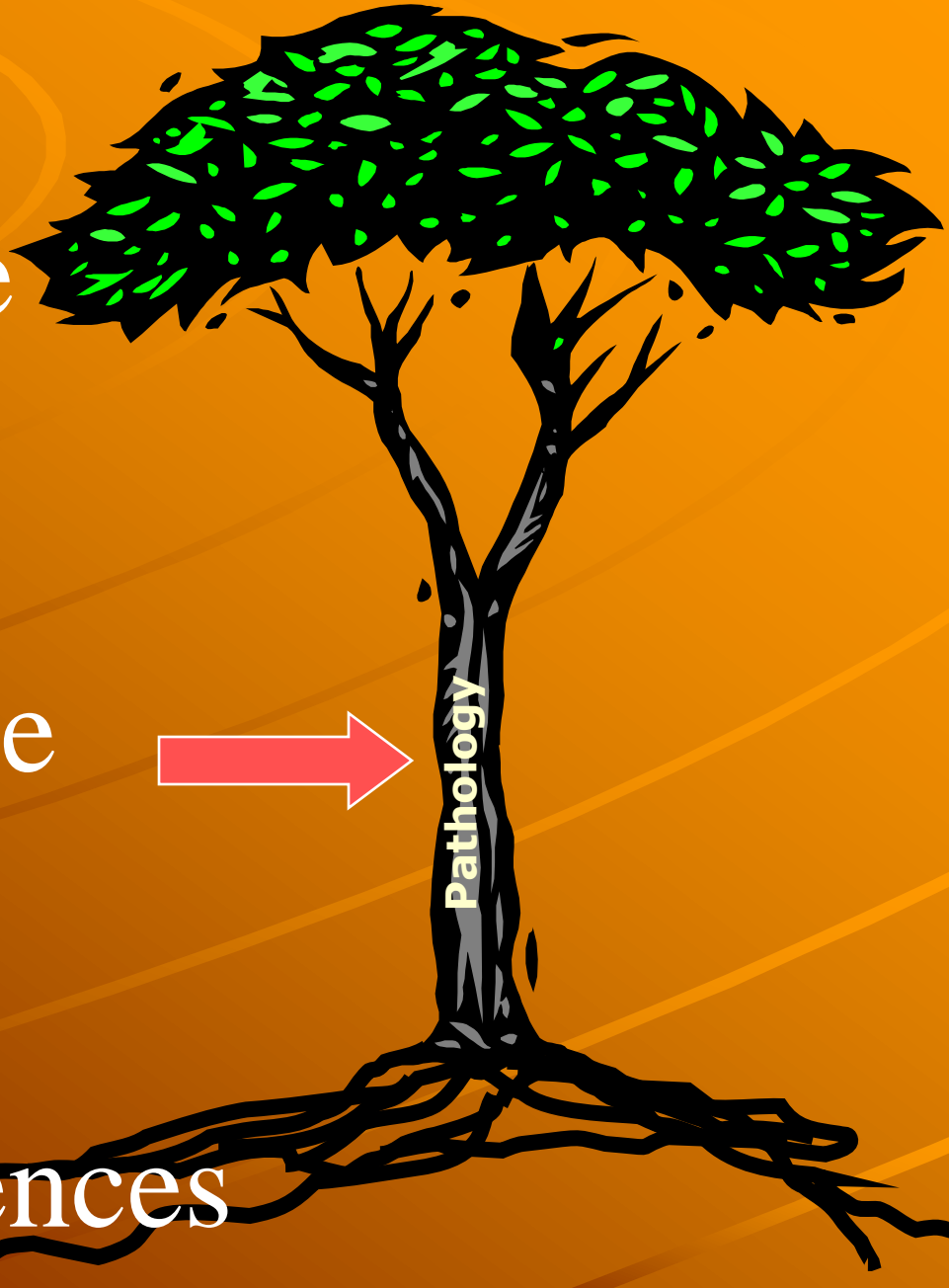
- Discussing the pathologic mechanisms in
relation to various organ systems e.g. CVS,
CNS, GIT.....etc.



Clinical medicine

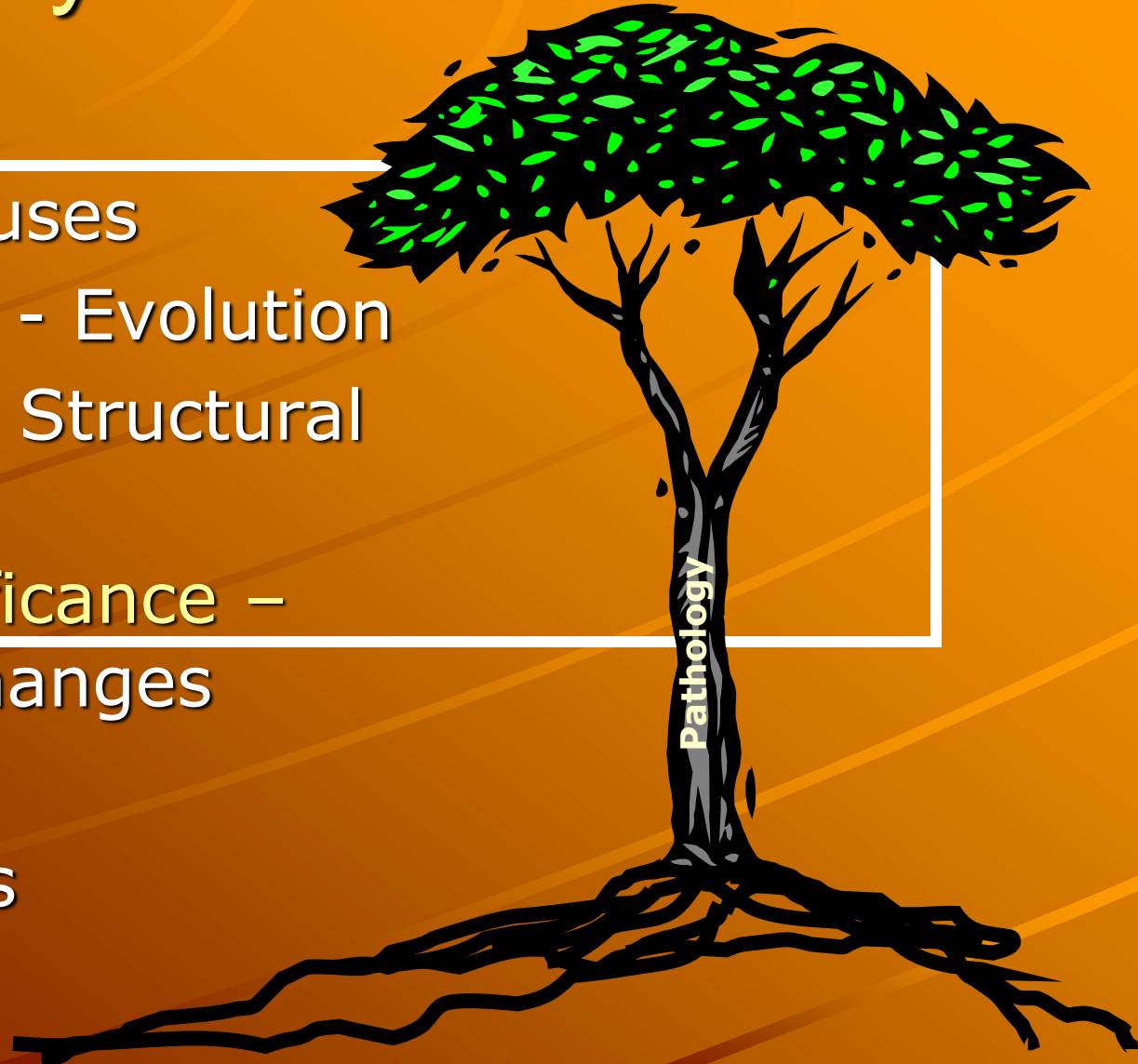
Connecting bridge

Fundamental sciences



Study of Disease:

- ◆ Epidemiology
- ◆ Etiology - Causes
- ◆ Pathogenesis - Evolution
- ◆ Morphology - Structural Changes
- ◆ Clinical Significance –
Functional Changes
- ◆ Management
- ◆ Complications
- ◆ Prevention



Why is the pathologist's conclusion important?

- ◆ All tumors are not the same!
- ◆ The pathology report gives specific information regarding the cells characteristics that allow treatment decisions to be made as well as influence the outcome.

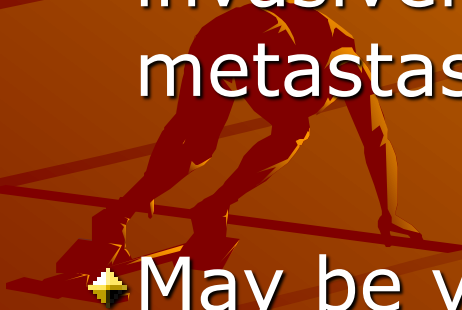
What is the pathologist looking at?

- ◆ Disturbances of normal tissue
- ◆ Analyzes each cell for size, shape, chromatin content, cell cycle and viability
- ◆ Image uniformity, size, and cell nucleus configuration.



From Pathologist, we get...

- ◆ Grading and staging (staging may be Clinical, Pathologic or a combined
- ◆ Based on recognition of tumor size, invasiveness and local or distant metastasis
- ◆ May be verified and converted to pathologic stages based on tissue samples.



What is “Diagnosis”?

- ◆ The formal name(s) used to describe a patient’s disease
- ◆ The process of identifying a disease based on the patient’s symptoms, the doctor’s findings, and the results of investigations and laboratory tests

What is needed to make a diagnosis?

- ◆ A system of classification that supplies the necessary names, definitions, and criteria
- ◆ The means to ascertain the defining characteristics of a disease in the individual patient



Methods of the study in Pathology

◆ **Biopsy/post surgical biological material**

◆ **Cytology**

◆ **Autopsy**

Methods of investigation in pathology

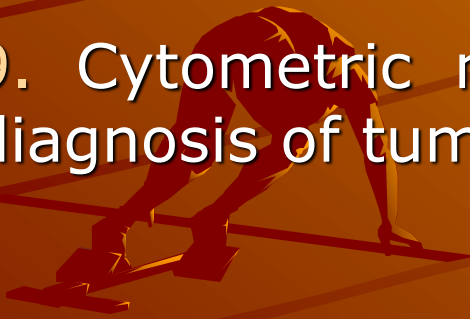
1. Macroscopic examination is the examination done with the naked eye, the collection of samples for microscopic examination is done from both the affected and the apparently normal regions.
2. Microscopic examination is done by microscopic examination of the collected fragments.
3. Immunopathological method - determination of the presence of antibodies in examined tissue

Methods of investigation in pathology

4. Immunohistochemical method - assessment of certain cellular and tissue antigens via of poly- and monoclonal antibodies.
5. Molecular method - determines the state and molecular composition of nucleic acids.
6. Cytopathological method - examination and determination of changes at the cellular level

Methods of investigation in pathology

7. Electron-microscopic method, examination with an electron microscope with a magnification power of several hundred thousand times
8. Cyto-genetic method, studying the state of chromosomes and detecting genetic defects
9. Cytometric method - provides important clues in the diagnosis of tumor diseases, such as leukemia.



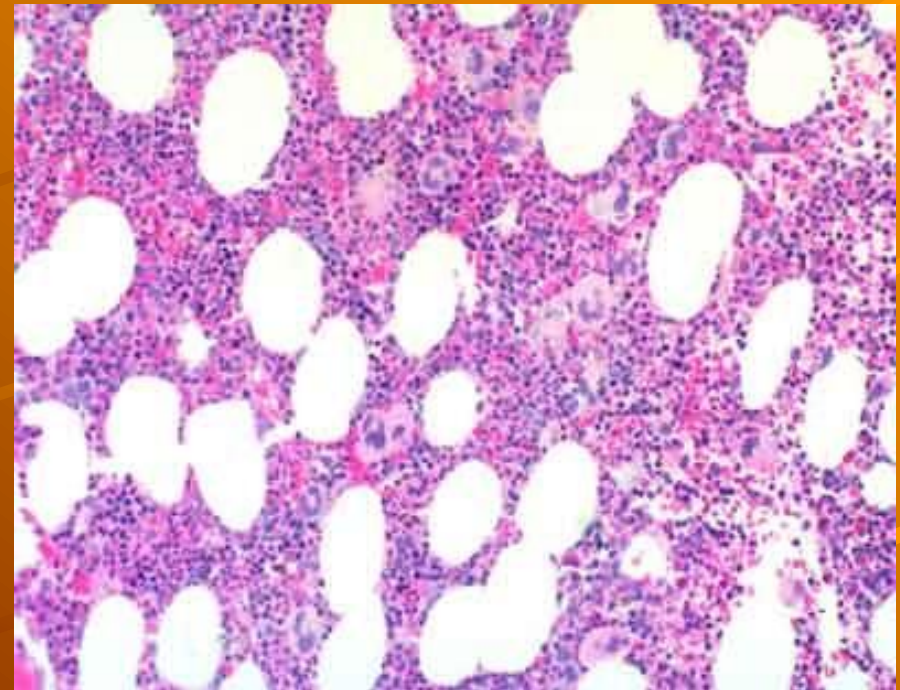
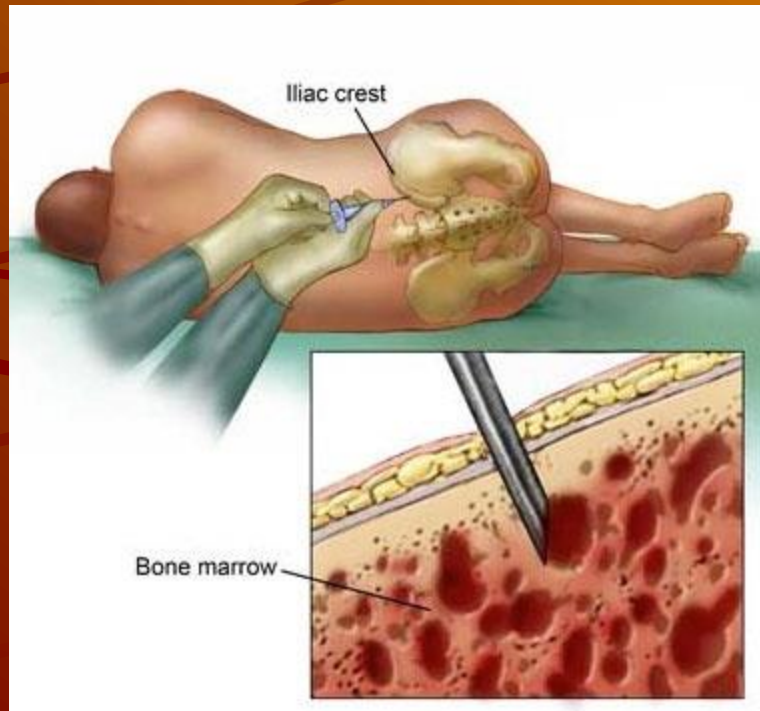
Microscopic methods used at present

- ◆ Optical microscopy
- ◆ Phase contrast microscopy
- ◆ Fluorescence microscopy
- ◆ Microscopy in dark field
- ◆ Electron microscopy



What is Biopsy?

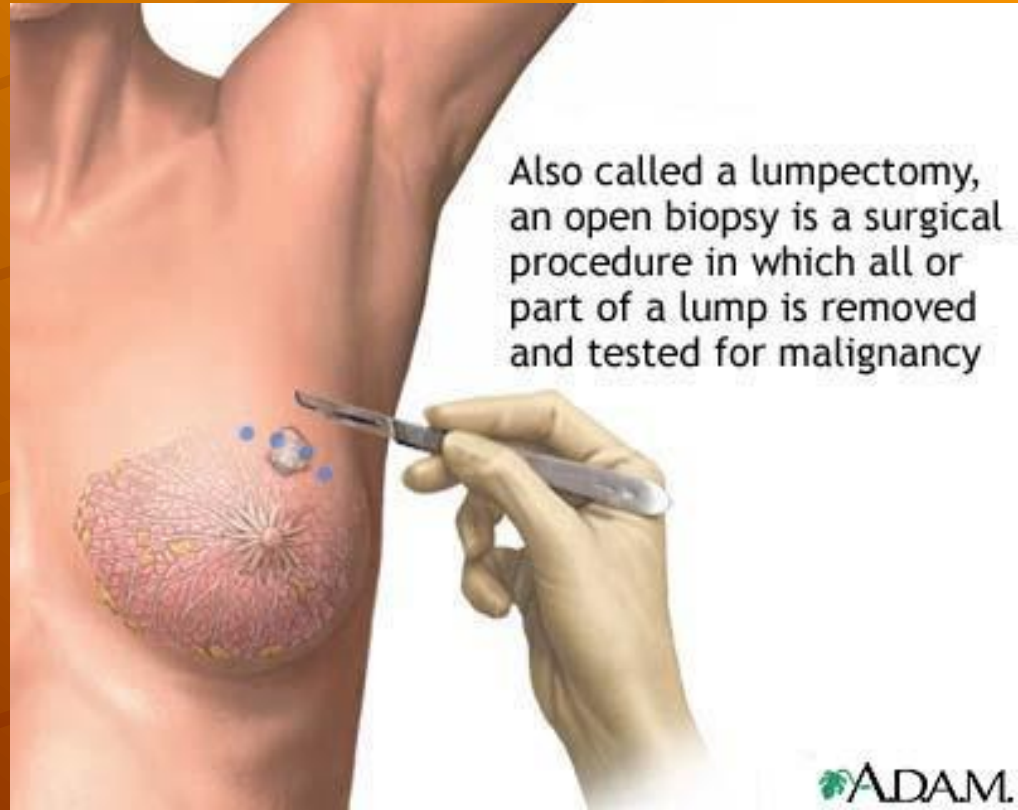
A biopsy is the removal of a sample of tissue from the body for examination. The tissue will be examined under a microscope to assist in diagnosis. Therefore, only very small samples are needed.



Obtaining Tissue Samples

3. Open biopsy

- Most invasive
- Direct vision
- Tumor is surgically removed either totally or partially



Also called a lumpectomy, an open biopsy is a surgical procedure in which all or part of a lump is removed and tested for malignancy

Laparoscopic biopsy



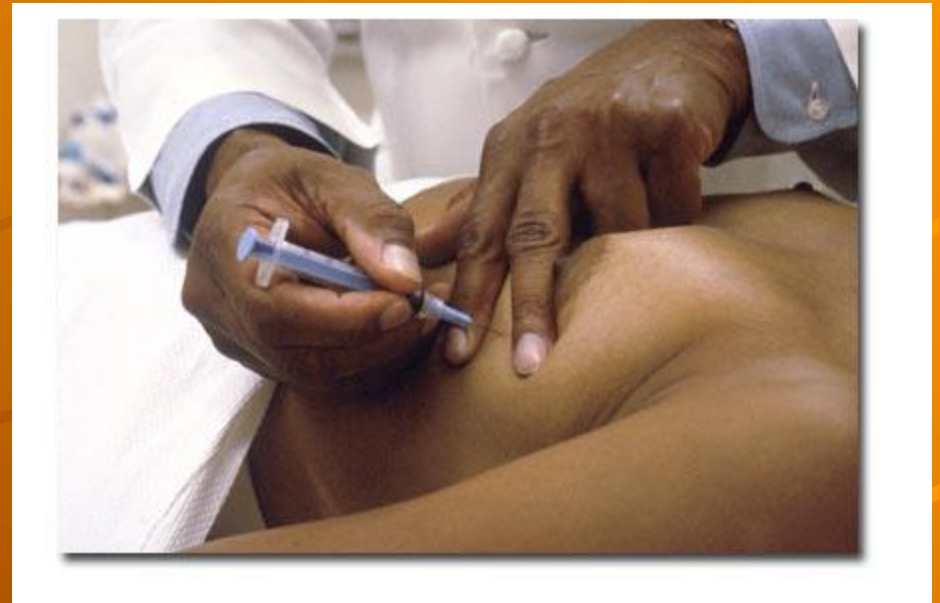
Endoscopic biopsy



Obtaining Tissue Samples

2. Fine Needle Aspiration

- More invasive than exfoliative cytology
- Acquire single cells
- A small core needle is inserted directly into the tumor
- Used to get sample from remote and relatively inaccessible tumors
- Pancreas, breast lump



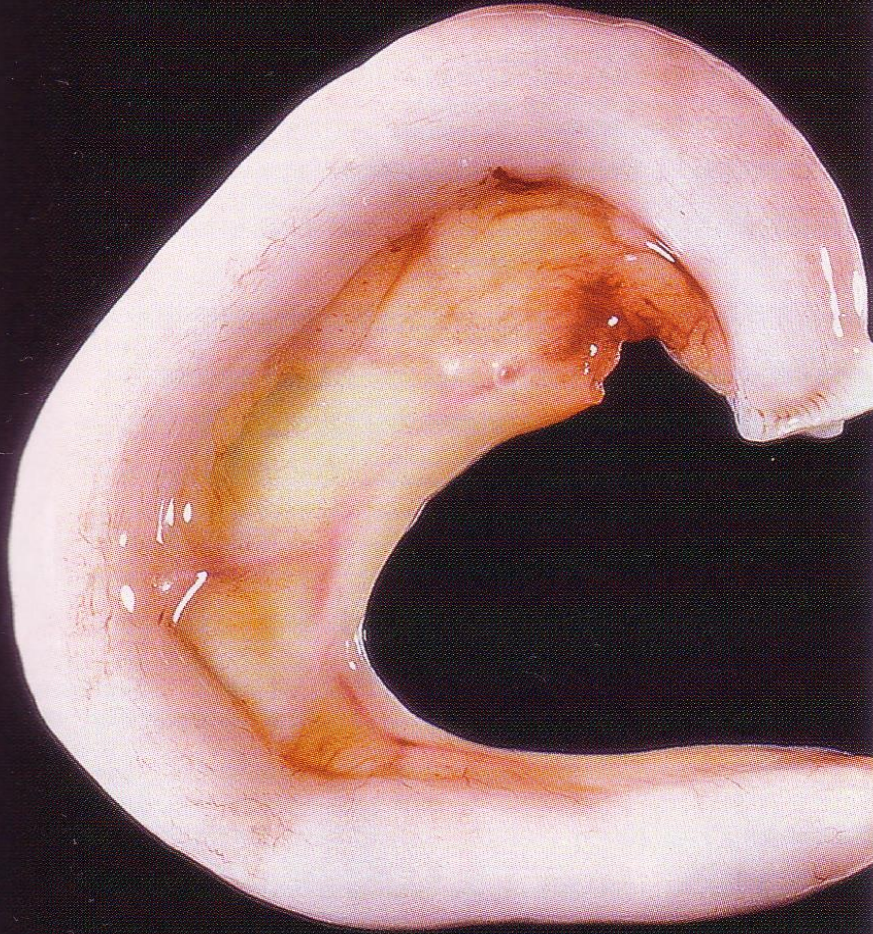
Obtaining Tissue Samples

Core Needle Biopsy

- A thick, specially designed needle with a cutting edge is used;
- The maneuver for obtaining the biopsy material is not the aspiration, but the cutting of the tissue;
- The tissue obtained is sufficient to determine whether the formation of interest is benign or malignant and to differentiate between invasive and non-invasive types of cancer;
- Thick needle biopsy is optimal for solid, not cystic lesions.



Post surgical biological material



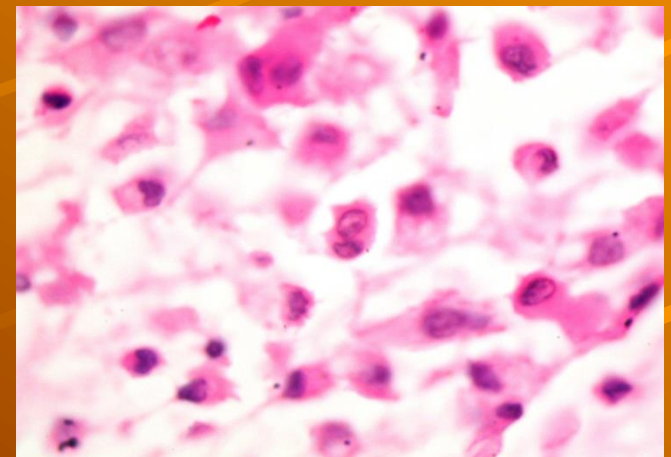
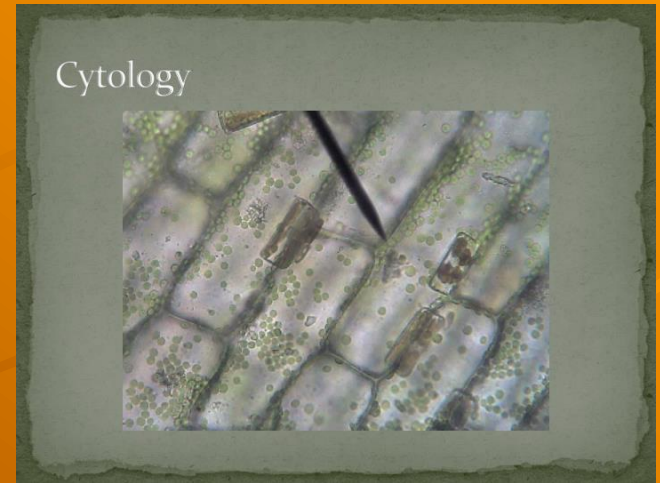
Vermiform appendix

What is Cytology?

◆ Cytology can also be referred to cytopathology, which analyzes the cellular structures needed to diagnose pathologies

Exfoliative Cytology

- Recovery of exfoliating cells
- Least invasive method
- Study of single cells from various surfaces or secretions shed by the tumor
- PAP smear-early detection of cervical and uterine



- **Necropsy:** Gross examination of the animal cadaver by systematic dissection in order to evaluate any abnormal changes (**lesions**) that may be present.

- **Autopsy:** Synonymous to necropsy in human medicine

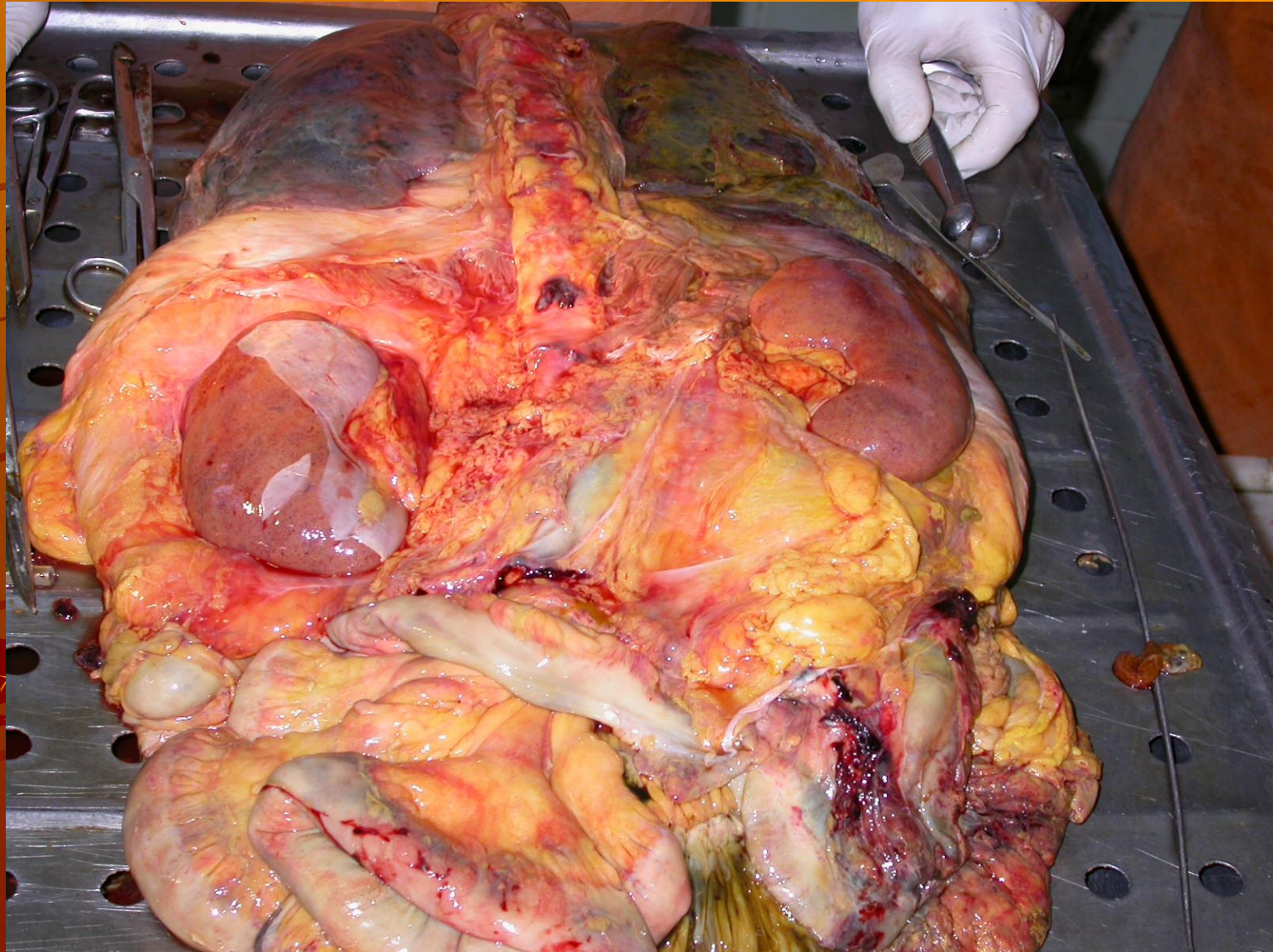


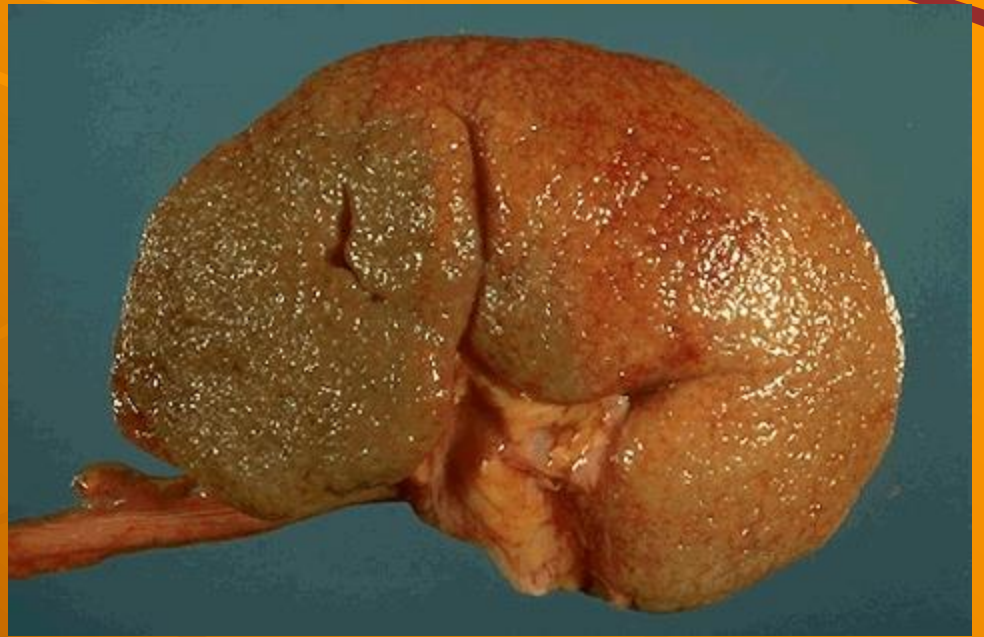
- **Autopsy** means "see for yourself". It is a special surgical operation, performed by specially-trained physicians, on a dead body. Its purpose is to learn the truth about the person's health during life, and how the person really died.

- **Biopsy:** Removal and examination of tissue obtained from the living body



Autopsy





PATHOLOGY

studies the morphological substrate of diseases at different structural levels -

- 1) molecular
- 2) intracellular (ultrastructural)
- 3) cellular
- 4) tissular
- 5) organ
- 6) organe system
- 7) macroorganism

Pathology focuses on 4 aspects of disease:

- ***ETIOLOGY:*** Cause of disease.

- ***PATHOGENESIS:***

Mechanisms of development of disease.

- ***MORPHOLOGY:***

The structural alterations induced in cell and tissues.

- ***FUNCTIONAL CONSEQUENCES:***

Functional results of the morphologic changes, as observed clinically.

Etiology

“Study of the cause of a disease”

✦ ***An etiologic agent :***

is the factor (bacterium, virus, etc.) responsible for lesions or a disease state.

✦ ***Predisposing Causes of Disease:***


Factors which make an individual more susceptible to a disease (damp weather, poor ventilation, etc.)

✦ ***Exciting Causes of Disease:***

Factors which are directly responsible for a disease (hypoxia, chemical agents.... etc.).

pathogenesis

The sequence events in the response of the cells or tissues to the etiologic agent, from the initial stimulus to the ultimate expression of the disease, "from the time it is initiated to its final conclusion in recovery or death"

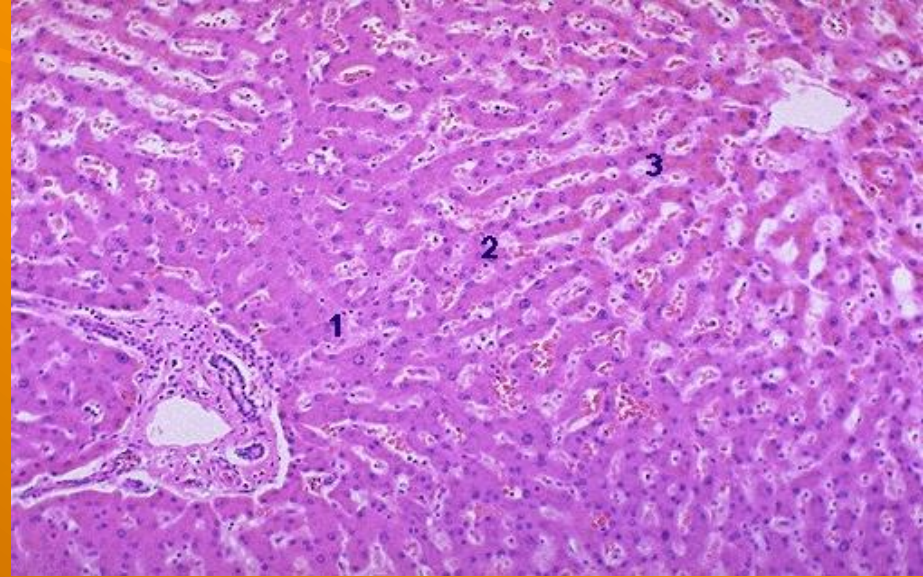


*The core of the science of pathology —
the study the
pathogenesis of the disease.*

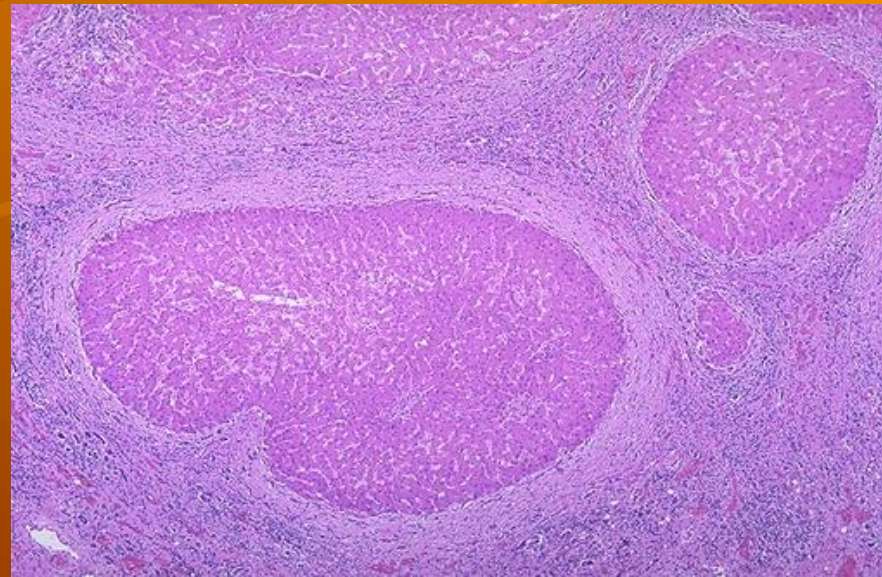
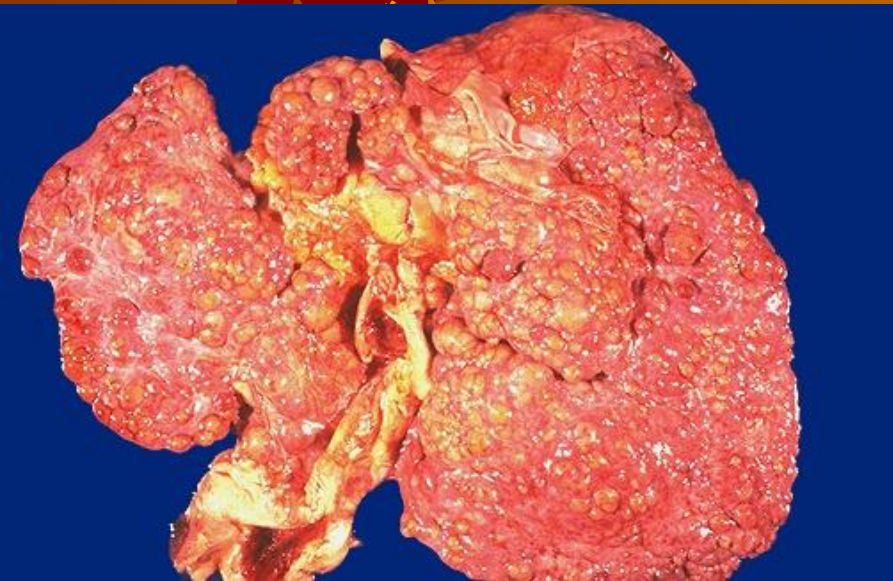
Morphology: Structural changes

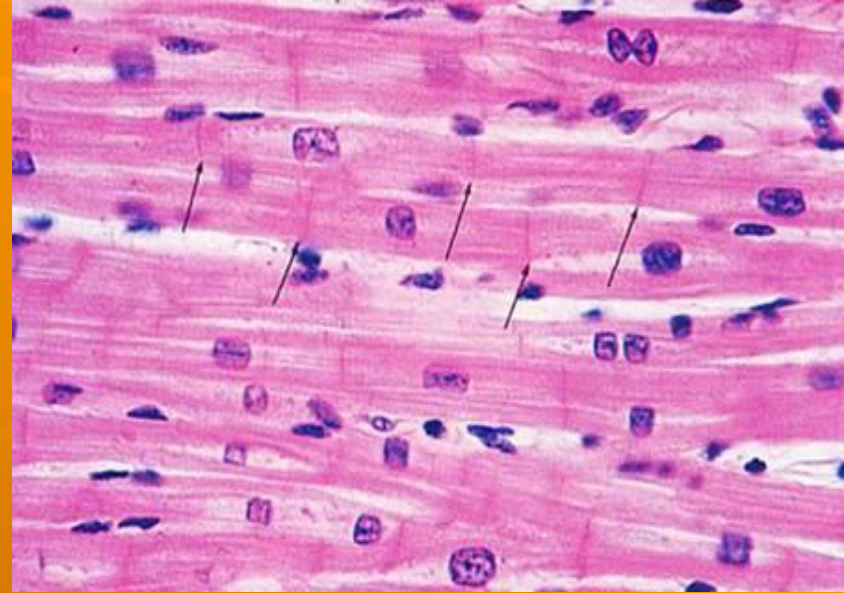
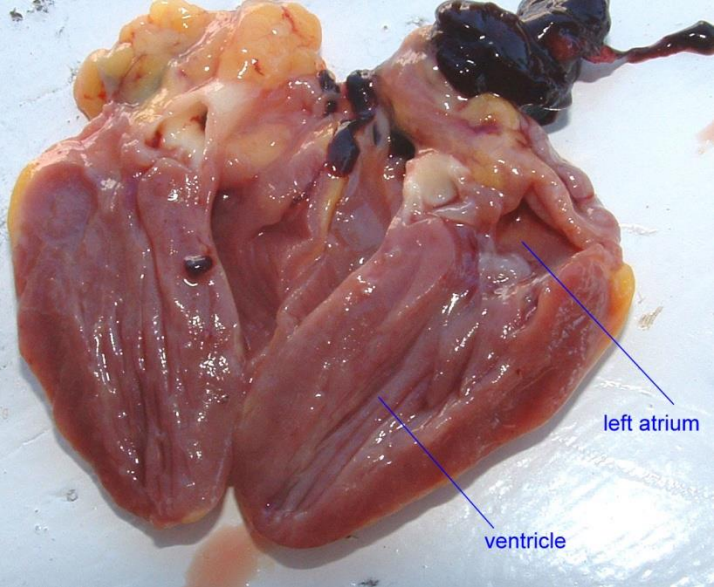
- **Macroscopic and microscopic structure of organs, tissues, cells in different pathologies.**
- **Based on these, the definitive diagnosis is established and an appropriate individual treatment is generated.**



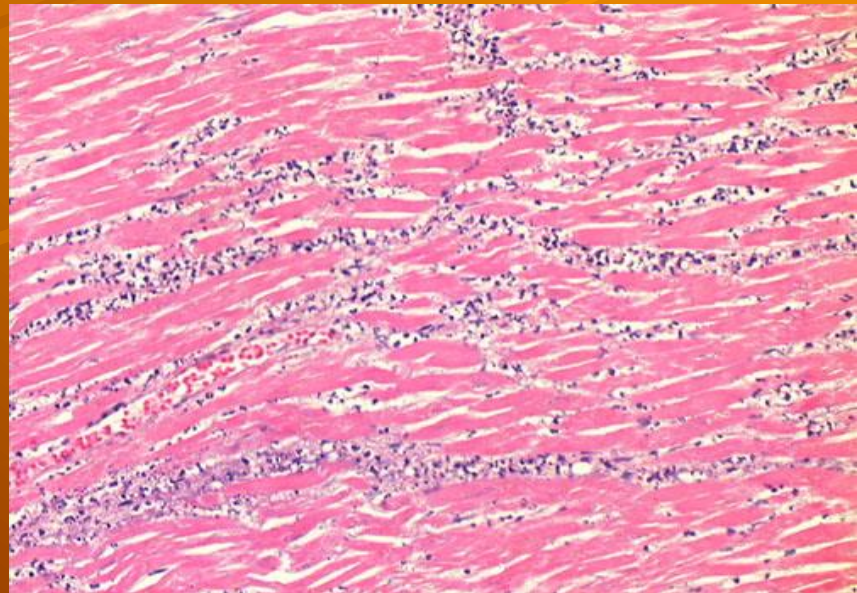
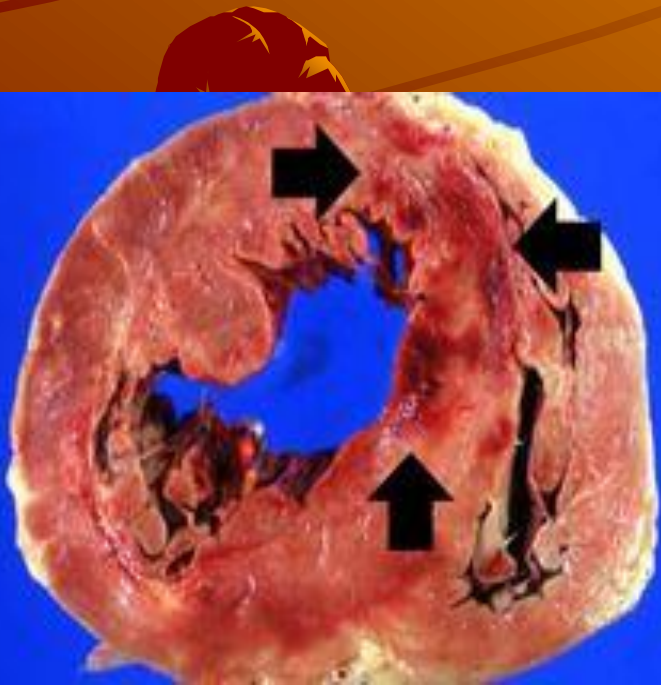


Morphology - Structural changes in disease





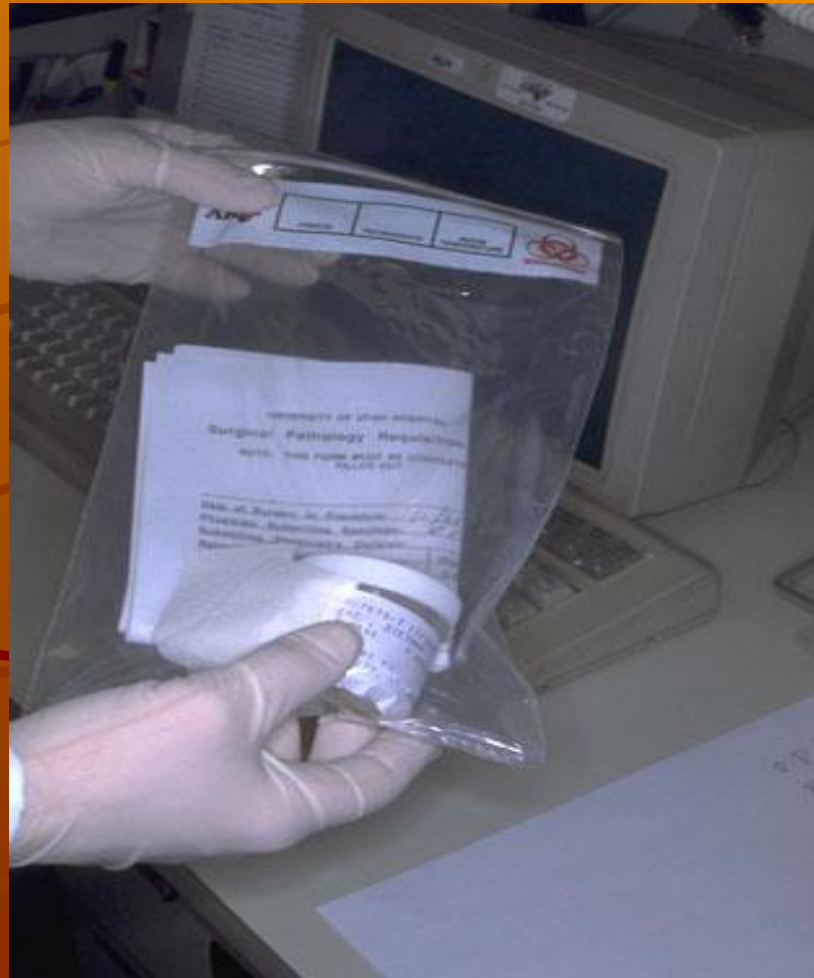
Morphology - Structural changes in disease

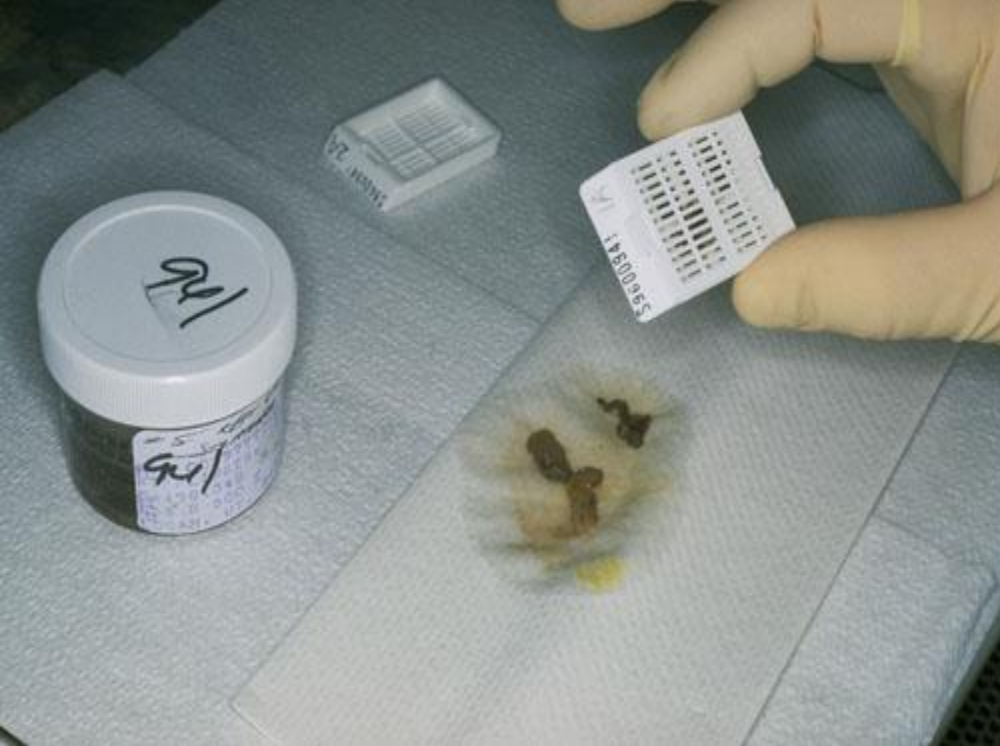


Preparing the Tissue Sample

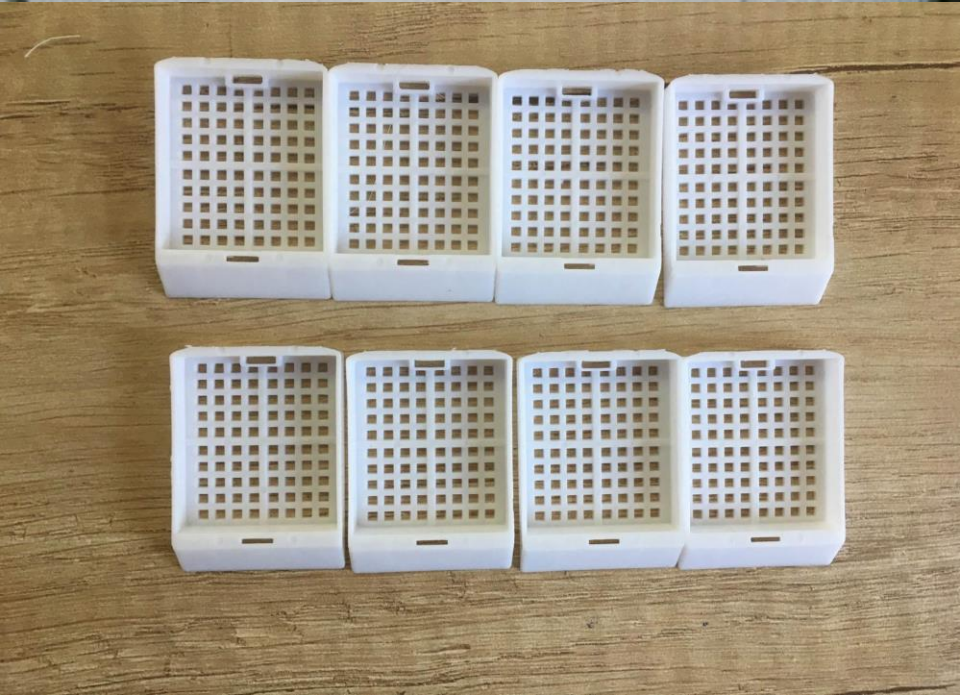
- Fix the tissue (immersed in a solution of **formalin**)
- Solid tissue placed in hot liquid **wax**
- Cut into thin slices by a **microtome**
- Placed on glass slides
- Wax is removed
- Ready for examination
- **Many stains** can be used to examine various cellular features
- Examined using a **light microscope**
- **Light microscopes can magnify objects up to 1,000 times, revealing microscopic details.**

Collected material

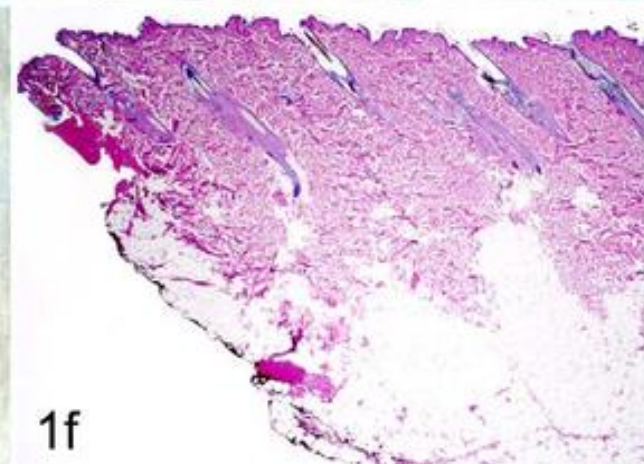
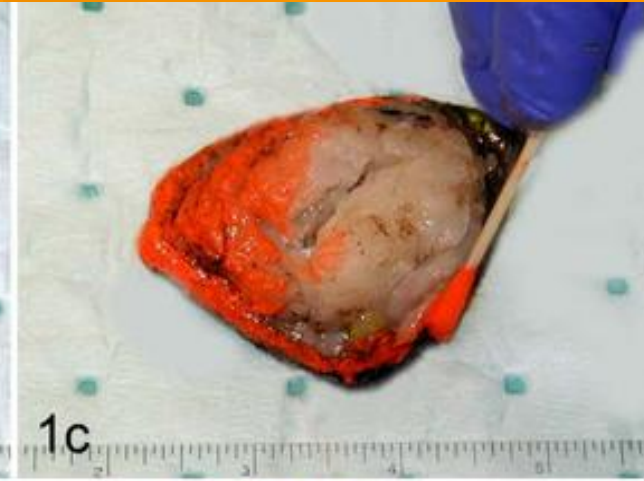




biopsy material



Marking the incision line



Processing of the material

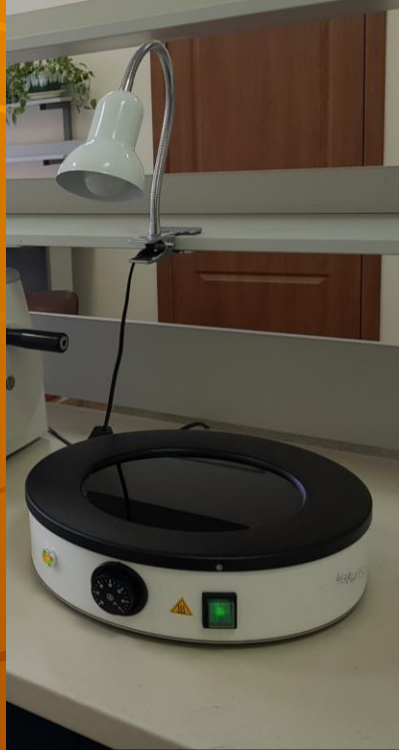


Inclusion in paraffin



Biopsy sectioning





Placing on slides



Staining



Deparaffinization



Coverage



PATHOLOGY
H&E

A. CALATAYUD
1877/66

Michael Reese Hospital



1877/66

PATHOLOGY
MASSON'S

A. CALATAYUD
1877/66

Michael Reese Hospital



1877/66

PATHOLOGY
H&E

A. CALATAYUD
1877/66

Michael Reese Hospital



1877/66

PATHOLOGY
AB - PAS

A. CALATAYUD
1877/66

Michael Reese Hospital



1877/66

PATHOLOGY
H&E

A. CALATAYUD
1877/66

Michael Reese Hospital



1877/66

PATHOLOGY
METH. SILV.

A. CALATAYUD
1877/66

Michael Reese Hospital



1877/66

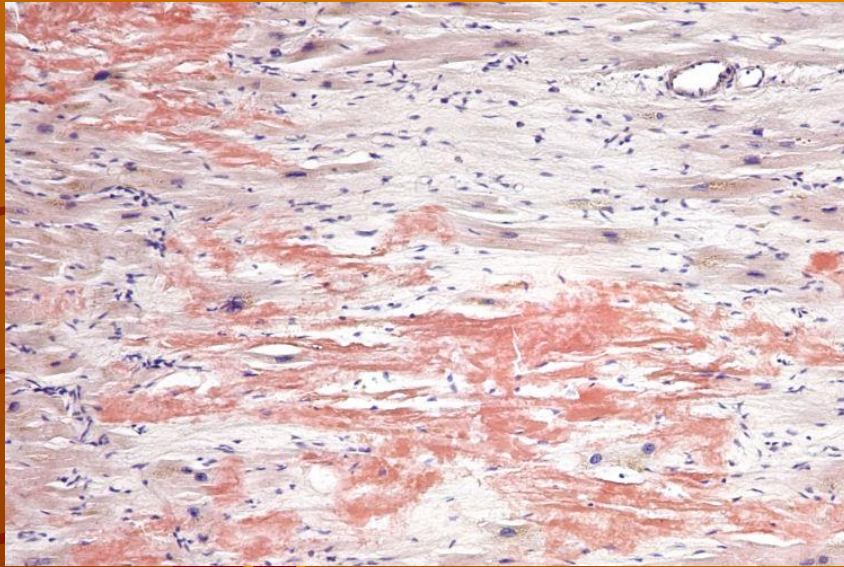
Microscopia optică



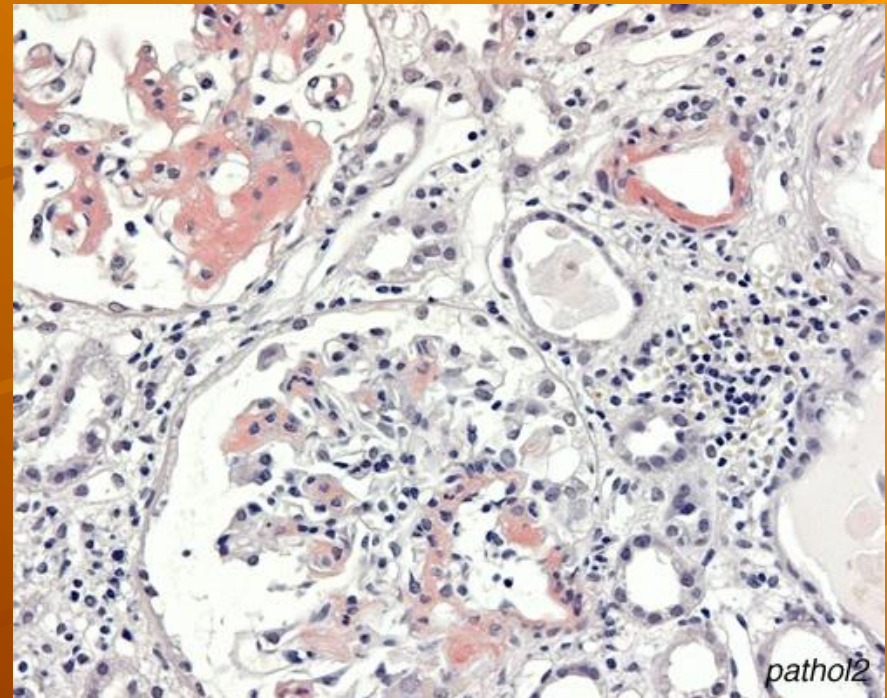
Hematoxylin and eosin stain



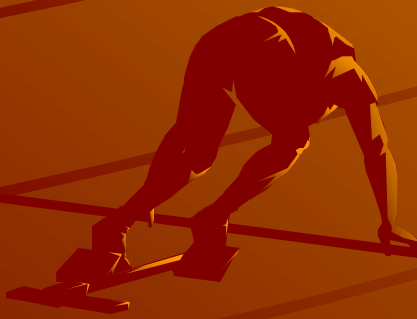
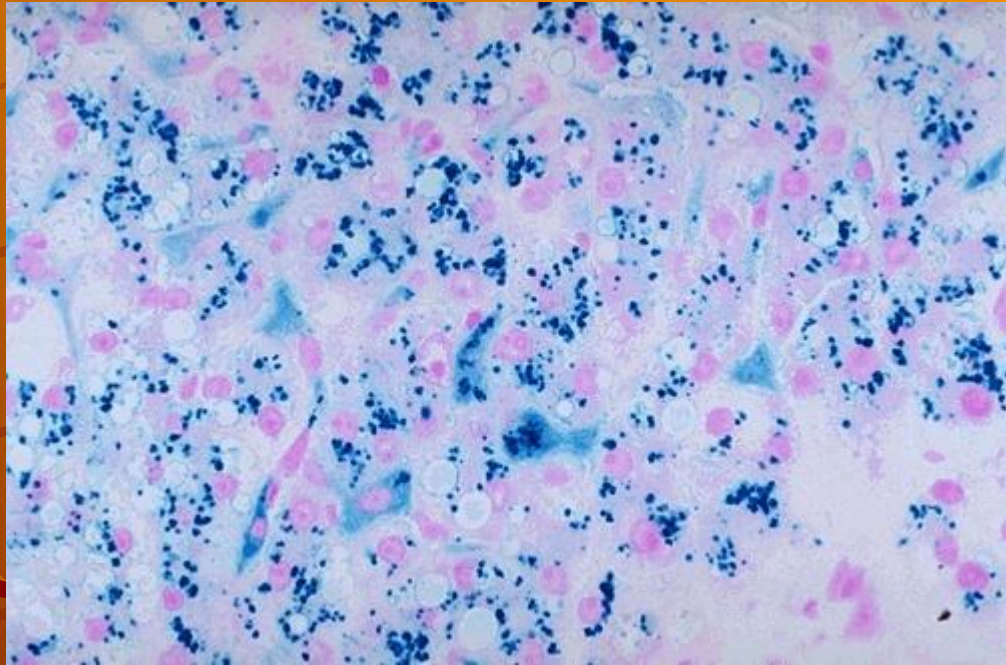
Histochemistry - Congo red stain



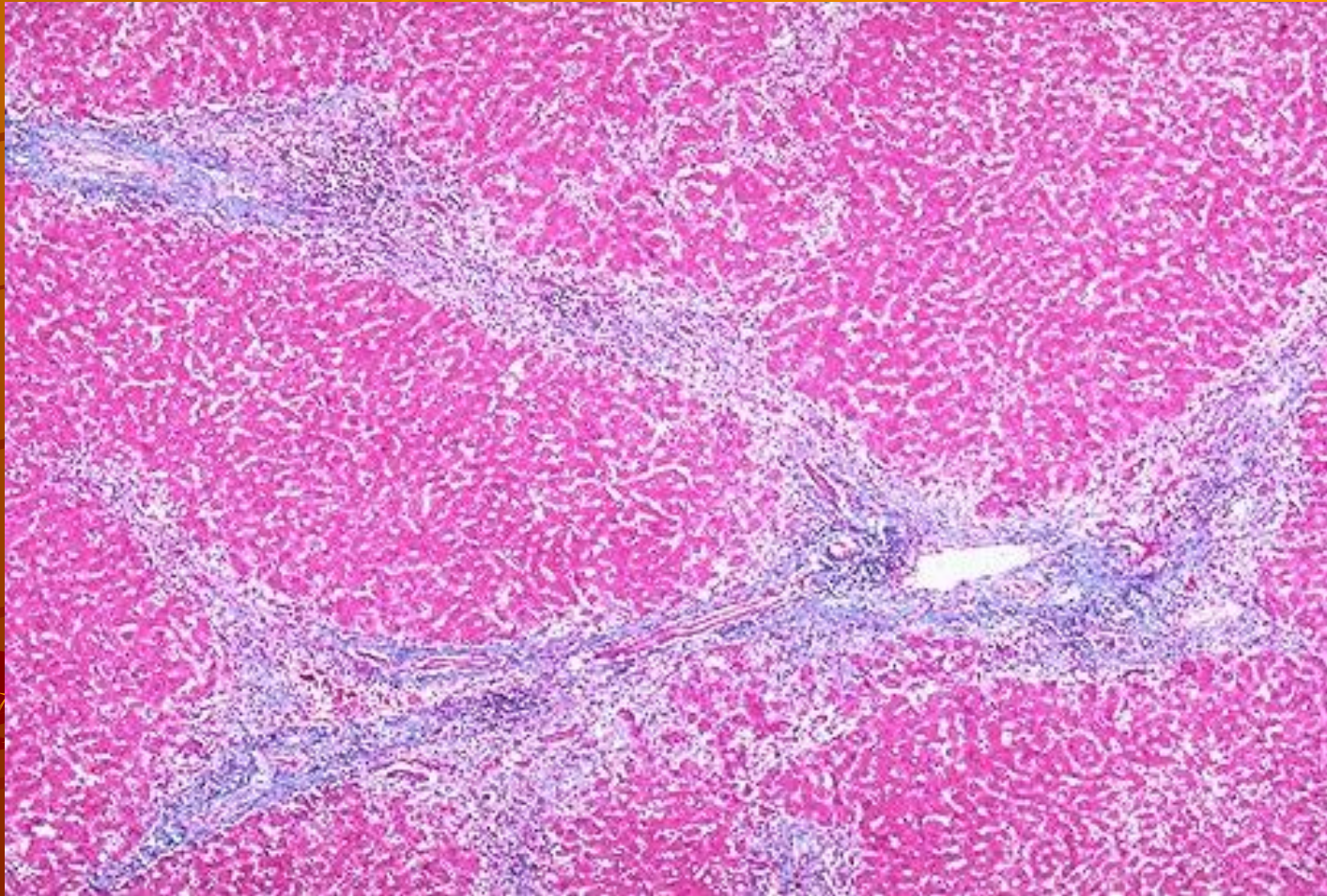
amyloidosis



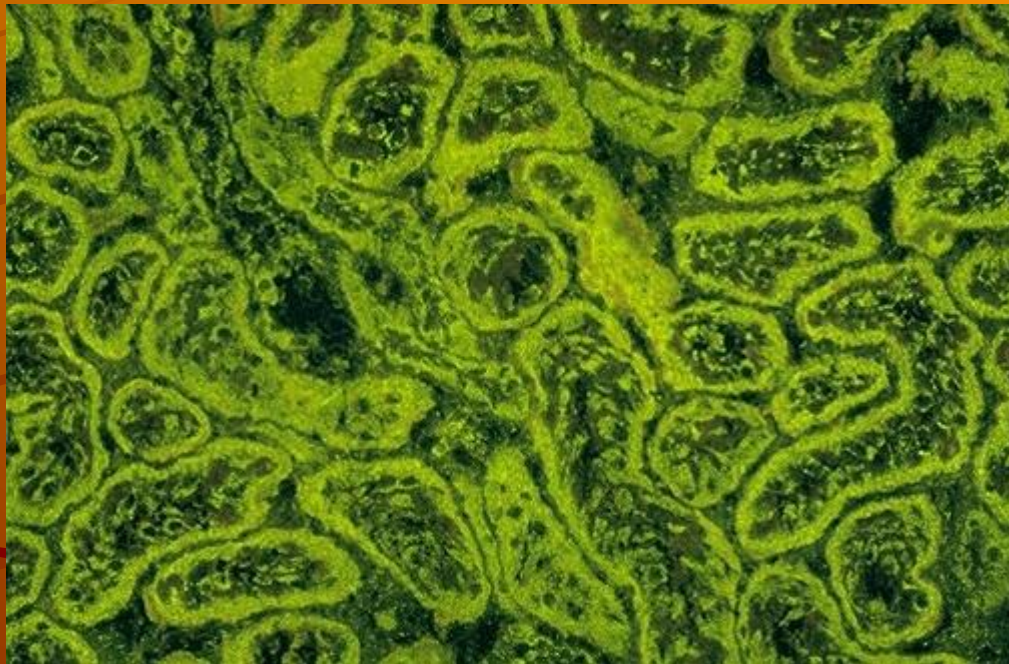
Histochemistry- Prussian Blue stain



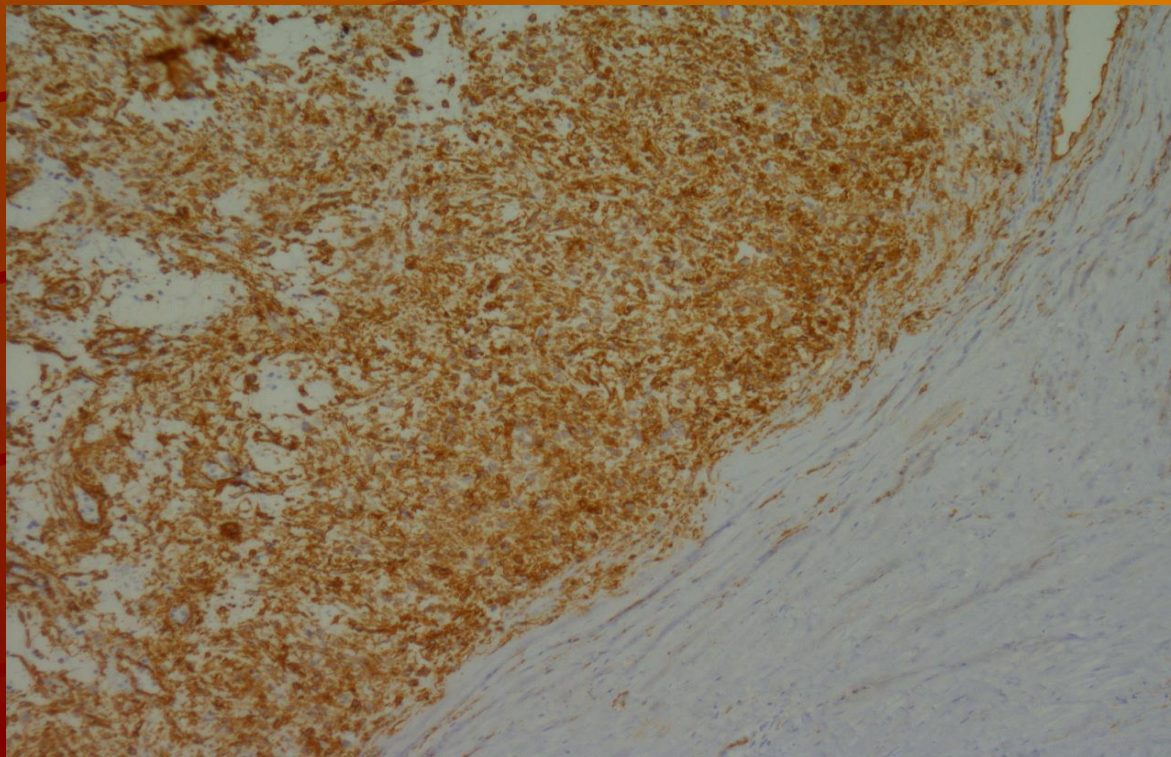
Histochemistry - Trichrom stain



Immunofluorescence



Immunohistochemistry





Normal neutrophil, electron microscopy



Clinical Symptoms & Signs

- **Clinical symptoms are the patient's complain usually by its own words.**

- ◆ **Clinical signs are seen only in the living individual.**

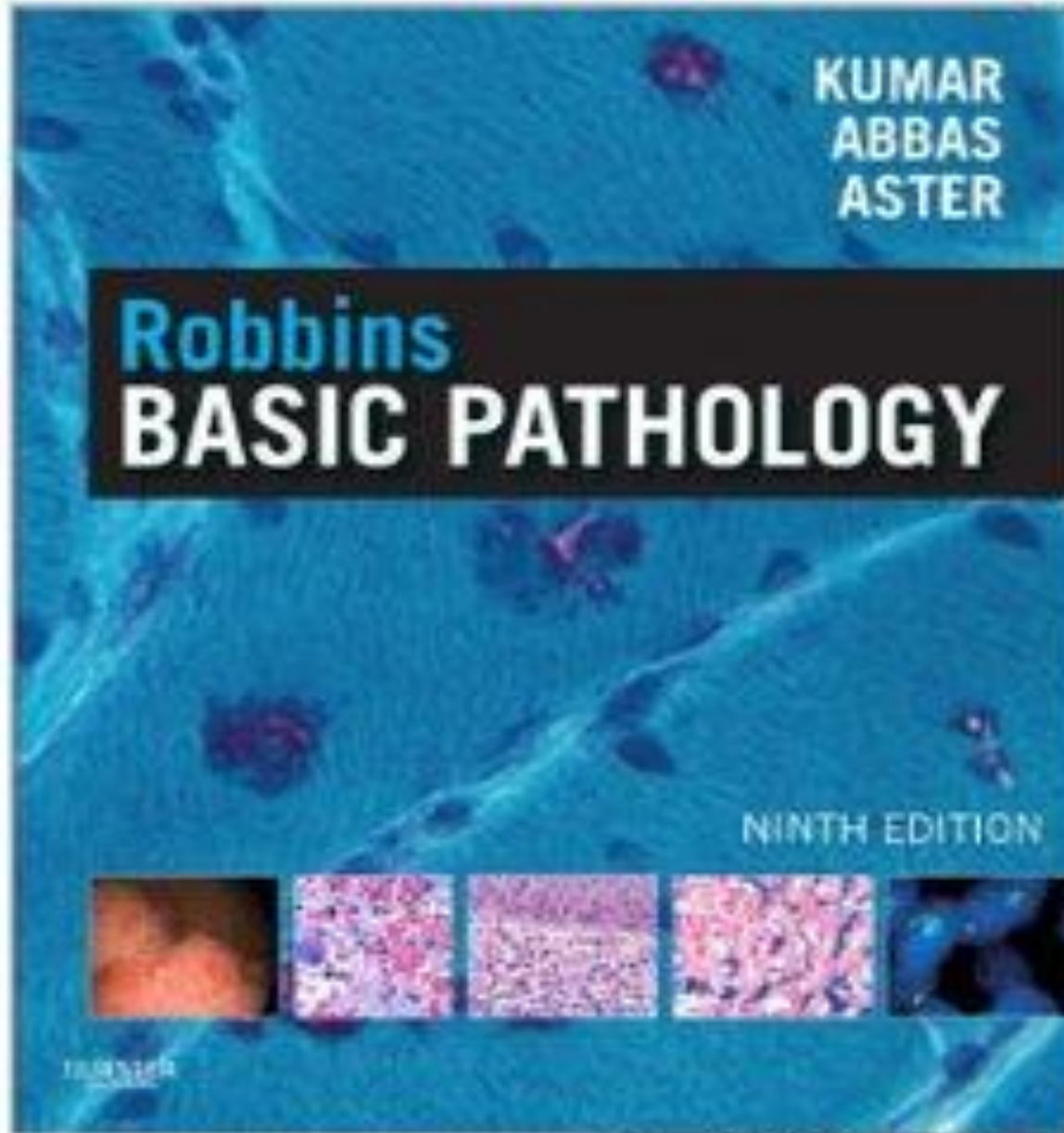
- ◆ **"Functional evidence of disease which can be determined objectively or by the observer" (fever, tenderness, increased respiratory rate, etc.)"**

prognosis

- ✦ **Expected outcome of the disease, It is the clinician's estimate of the severity and possible result of a disease.**



Look inside ↓



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Textbook of **PATHOLOGY**

Sixth Edition

HARSH MOHAN



FREE! Pathology Quick Review and MCQs

Foreword
van Damjanov



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