Introduction to Pathologic Anatomy

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Pathology (Pathologic Anatomy) is fundamental biomedical science that studies the structural basis of pathological processes of human disease.
Pathology studies:

- Cell pathology
- Molecular basis, etiology, pathogenesis, morphology and morphogenesis of pathological processes and disease
- Thanatogenesis
- Pathomorphosis of disease
- Abnormal embryogenesis
- Develops classifications of disease
Pathomorphosis

- persistent and significant changes in quantity and quality of the disease under the influence of various factors (treatment, environmental factors, characteristics of infectious agent, economic level of society)
Morphological basis of the clinical diagnosis

Modern pathology

Theory of medicine
Pathology is divided into...

- **General**
  - studies alteration, inflammation, hemodynamic disorders, tumours, adaptation etc.

- **Special**
  - studies organ pathology (kidney, liver, GIT, lung, heart, thyroid, CNS etc.)
Problems of general pathology

- Synthesis of evidence obtained through a variety of medical and biological research methods
- Etiology, pathogenesis, and morphogenesis of human diseases
- Study of typical pathological processes
- Theoretic basis of medicine
Methods of Pathological Anatomy

- **Biopsy** - removal of tissue from a *living subject* to determine morphological changes;

- **Autopsy** - post-mortem examination of a *corpse* to determine the cause and manner of death and to evaluate any disease or injury that may be present

- **Experiment** - modelling of pathological process on animals and subsequent post-mortem examination
Types of biopsies

- diagnostic
- during surgery
  - puncture (needle biopsy)
  - aspiration
  - excisional
  - incisional
  - scrape
Needle biopsy
Needle biopsy
Objectives of autopsy

- examination of the correctness of the diagnosis and treatment
- establish the cause of death
- research
- teaching students and physicians
Legal authority of autopsy (in Belarus)

- **Autopsy is performed mandatory:**
  - Suspicion of violent death;
  - Death less than 1 day after admission to hospital;
  - Death during surgery, diagnostic manipulations and/or anesthesia;
  - Death from infection;
  - Suspicion of overdose or drug intolerance;
  - Pregnant women, women in/after childbirth
  - Children under 1 year.

- **Autopsy can be not performed on religious grounds**
Iatrogeny

- (pronounced ĭ-a-tra-je-nē)
- is “pathology of treatment” - any unwanted or adverse effects of preventive, diagnostic, therapeutic or surgical interventions
- (preventable harm resulting from medical treatment or advice to patient)
Levels of study

- organismal
- organ
- tissue
- cellular
- ultrastructural
- molecular
Modern methods in morphology

- Immunohistochemistry (IHC)
- Electron microscopy
- In situ hybridization (ISH)
- Polymerase chain reaction (PCR)
Immunohistochemical techniques

- It is based on specific interaction of tissue and cellular antigens with a specially derived antibodies bearing the different labels.

- Immunohistochemistry
- Immunofluorescence
Opportunities IHC

- Determination of cells belonging to a particular tissue;
- Identification of individual products (e.g. abnormal proteins), routes of cellular and intercellular signals, synthesis of certain proteins, glyco-and lipoproteins
Electron microscopy

- Used to study the details of cell structure, detection of viruses, bacteria, immune complex deposits

- Examples of use:
  - Oncology - Birbeck granules in histiocytosis X
  - Oncology - Z-discs in rhabdomyosarcoma cells
  - Nephrology - diagnosis of glomerulonephritis
In situ hybridization (ISH)

- Method for detection of specific sequences of DNA or RNA in situ (i.e. directly in tissue specimens)
- It is based on principle of complementary interaction of DNA or RNA in specimen with labelled nucleotide sequence (probe)
In situ hybridization (ISH)

- Is used for:
  - Detection of viral genomes
  - Detection of mutant genes
  - Detection of active protein synthesis (unlike IHC which allows to determine the presence of a protein)
  - IHC data validation
Polymerase chain reaction

- Method for detection of specific sequences of DNA or RNA in any biological sample
- PCR is *in vitro* amplification (i.e. increase in the number of copies) of nucleic acids triggered by synthetic oligonucleotide primers
Polymerase chain reaction

- Differences from the in situ hybridization:
  - Because of amplification it is more sensitive (about 1 million times)
  - Usually not combined with morphology
Historical periods of pathology

1. Anatomical (before XIX century)
   - J. Morgagni (1685-1777)
   - K. von Rokitansky (1804-1878) performed nearly 30,000 autopsies, wrote an outstanding monograph on diseases of arteries and congenital heart defects

2. Microscopic (XIX century - mid-XX century)
   - R. Virchow (1821-1902) – “father of cellular pathology”

3. Ultramicroscopic (mid-XX century)

4. Modern - pathology of a living person
Moscow School

- A.I. Polunin (1820-1888)
- M.N. Nikiforov (1858-1915)
- A.I. Abrikosov (1875-1955) - author of fundamental multivolume handbook in special pathology, published a lot of works about pathological morphology of tuberculosis and tumors
- M.A. Skvortsov (1876-1963)
Moscow School

- I.V. Davidovsky (1887-1968) - one of the founders of pathology services in USSR, author of manual in pathology
- V.T. Talalaev (1886-1947)
- N.A. Krajewski (1905-1985)
- A.I. Strukov (1901-1988)
- V.V. Serov
  - authors of main textbook for medical students in USSR
Belarusian school

- Titov, Ivan T. (1875-1949)
- Gulkevichi Yuri V. (1905-1974)
- Lazyuk Gennady I.
- Kravtsova Garina I.
- Nedzved Michael K.
- Cherstvoy Eugene D.