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# **ПАТОФИЗИОЛОГИЯ**

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**P.F. Litvitsky, S.V. Pirozhkov, E.B. Tezikov**

# **PATHOPHYSIOLOGY**

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**CONCISE LECTURES, TESTS,  
CLINICO-PATHOPHYSIOLOGICAL SITUATIONS  
AND CLINICO-LABORATORY CASES**

**STUDENT MANUAL**



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# **1. THE SUBJECT MATTER OF PATHOPHYSIOLOGY. GENERAL NOSOLOGY**

The human being is the common object of studies of all medical disciplines. Some of them (for instance, anatomy and physiology) study and describe human activity in normal conditions or develop «normology» of a human being. Most of the medical disciplines study the nature and mechanisms of a patient's vital activity or a human being's pathology. Pathophysiology is among them.

Pathophysiology is the part of medicine and biology which investigates and describes actual causes, mechanisms and regularities of onset, development and outcomes of pathological process and disease; formulates principles and methods of their diagnostics, treatment and prophylaxis; develops the doctrine of a disease and an ailing body; formulates theoretical guidelines in medicine and biology.

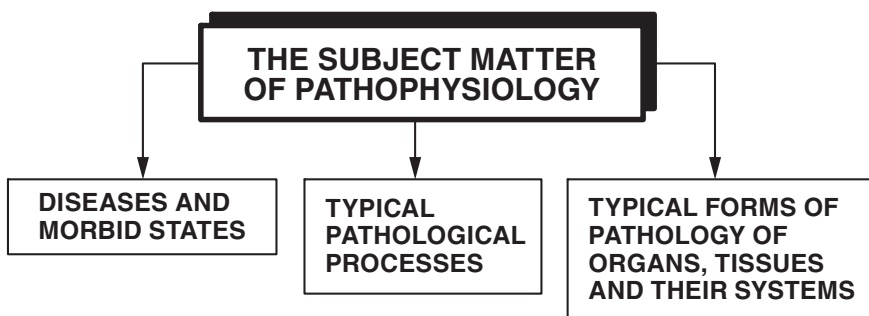
The above is presupposed by the etymology of the term «pathophysiology»: from Greek *pathos* — suffering, illness; *physis* — nature, essence; *logos* — doctrine, science. In other words, pathophysiology is the doctrine of the nature of a pathological process and disease.

## **COMPONENTS OF THE SUBJECT MATTER OF PATHOPHYSIOLOGY**

The object of pathophysiology studying and teaching covers the following three components (fig. 1):

- 1) disease;
- 2) typical (stereotypical) pathological processes (e.g. inflammation, fever, hypoxia, extreme conditions, etc.);
- 3) typical forms of organ and tissue pathology (e.g. anemia, abnormal heart rhythms, respiratory insufficiency, etc.)

Pathophysiology consists of three parts.

**Fig. 1**

- I. Nosology.
- II. Studies of typical pathological processes. Typical are pathological processes that contribute to the pathogenesis of many diseases and syndromes, and serve as their significant and inseparable part.
- III. Studies of typical forms of pathology of specific organs and organ systems. Similar to typical pathological processes typical forms of pathology of specific organs and organ systems are also components of various diseases.

Nosology is a science dealing with the description and classification of diseases.

Nosology comprises three divisions:

1. Study of disease which includes:
  - a) general concepts and categories of pathology;
  - b) classification and nomenclature of diseases;
  - c) special aspects of pathology.
2. General etiology which includes:
  - a) general features of pathogenic agents;
  - b) main groups of pathogenic factors;
  - c) the role of conditions and reactivity of the body in the initiation of disease;
  - d) principles of etiotropic prevention and treatment.
3. General pathogenesis which includes:
  - a) mechanisms of the body resistance to the effects of pathogenic factors;
  - b) general mechanisms of diseases;
  - c) mechanisms of convalescence;
  - d) pathogenesis of dying;
  - e) general principles of disease prevention and treatment.



## **NOSOLOGY**

### **The notion of disease**

A disease is a dynamic state of the body characterized by a loss of the well-being which essentially implies a decrease of the biological and social potentials of the individual.

### **Basic concepts of nosology**

#### **Pathological process**

Pathological process is a natural progression of changes caused in the body by the action of pathogenic factors. These events include damage with the ensuing dysfunction, accompanied by adaptive reactions. A unique combination of these two processes determines the form of disease and its course.

«Pathological process» is a more general category than «disease». One and the same pathological process, such as thrombosis, hemolysis, or edema, may contribute to the pathogenesis of various diseases.

Some of the complex pathological processes contributing to the pathogenesis of many diseases are called typical. Typical pathological processes are inflammation, allergy, hypoxia, tumor growth, fever, and infection.

#### **Pathological state**

Pathological state is a relatively persistent and stable abnormality of the body limiting its adaptive potential.

#### **Pathological reaction**

Pathological reaction is an inadequate and harmful reaction of the body or some of its systems to the ordinary (e.g. some foods) or extraordinary (pathogenic) stimuli. Pathological reaction is inadequate in quantitative or qualitative sense and outruns the limits of the individual norm. The examples of pathological reactions are an anaphylactic reaction (a form of allergy), pathological reflexes, inadequate behavioral reactions, etc.

#### **Remission**

Remission is a temporary subsidence of symptoms of a disease or improvement of state.

**Recurrence**

Recurrence means reappearance or exacerbation of symptoms of a disease. In chronic illnesses the recurrence follows the period of remission, and also represents the natural stage in the course of a disease.

**Complication**

Complication is a pathological process accompanying a disease. It is in fact not obligatory for this disease, but it is caused by the same pathogenic factors, or arises from alterations developed in a primary disease. The examples of complications include nephrotic syndrome in chronic glomerulonephritis, infections after surgical interventions, myocardial infarction in patients with diabetes mellitus, arrhythmia due to coronary insufficiency. Pathological processes that are casually associated with the primary disease or the remote consequences of the disease are usually not viewed as complications.

## **CLASSIFICATION AND NOMENCLATURE OF DISEASES**

Nomenclature is a structured catalogue of diseases and other nosological forms. Classification of diseases is a system of grouping diseases and pathological processes into nosological units. The grouping criteria are different and use various approaches:

- etiology of diseases. For example, infectious diseases, traumas, intoxication, etc.;
- anatomical/topographic features. For example, diseases of the heart, diseases of the respiratory tract, diseases of the gastrointestinal tract, etc.;
- sex and age. For example, diseases of children or adults; diseases of women;
- natural course — acute, subacute, and chronic diseases;
- pathogenic mechanisms. For example, allergies, tumors, malformations, etc.;
- social characteristics. For example, occupational diseases.

## **ETIOLOGY**

Etiology is a science that studies causes and conditions of diseases. There are two major classes of etiological factors: intrinsic or genetic, and acquired

(e.g. infectious, nutritional, chemical, physical). A deficit of specific essential substances (such as vitamins or amino acids) or normal conditions of living may also be pathogenic.

## **Reactivity**

Reactivity of the body is defined as a constellation of features that determine the quantitative and qualitative pattern of reaction to a specific stimulus. One and the same stimulus causes a broad range of reactions from severe damage to only minimal changes depending on the age, gender, race/ethnicity, and constitution of the individual.

## **Stages of disease**

There are four stages in the course of diseases: the latent stage, the prodromal stage, the peak stage, and the outcome. This division is more attributable to infectious diseases. The course of chronic diseases, such as cardiovascular or endocrine disorders, or tumors may be divided into three stages: the onset, the stage of overt manifestations, and the outcome.

## **Pathogenesis**

The term «pathogenesis» describes the study of mechanisms of a disease onset, development, and outcome. It refers to the sequence of events in response of the cells or tissues to an etiologic agent, from the initial signs of disorder to the ultimate expression of the disease.

## **«Vicious cycles» in pathogenesis of a disease**

In this case the initial disorder becomes an etiologic factor of the subsequent disorder which in turn maintains and enhances the original defect forming a positive feedback loop.

## **Methods of pathophysiology**

The main and specific method of pathophysiology (both as medico-biology science and as an academic discipline) is the method of modeling of pathological process and disease, as well as modeling of patient as a whole. It's important to stress that pathophysiologists were the ones who developed and implemented pathological process modeling in medicine.

The very emergence of pathophysiology was necessitated by the need to describe the essence of what was concealed from a doctor, namely mechanisms of onset, development and outcome of a disease. And it was necessary to simulate those mechanisms with the help of «artificial copies» — of their models — and describe them in pathophysiological terms.

1. Modeling of diseases, pathological states, various forms of pathological processes, and pathological reactions:
  - a) physical modeling (in laboratory animals, isolated organs or cells);
  - b) nonphysical modeling (logic simulation of diseases, pathological processes, or the patient).
2. Methods of clinical investigation.
3. Analysis of results, elaboration of concepts and theories.

General approaches used in pathophysiology to modeling pathology (fig. 2).

Formalized or nonmaterial modeling is the form of intellectual modeling and realized as a logic, mathematical, computer, etc. modeling.

The intellectual modeling is widely used in the process of teaching students to solve situational, laboratory and other tasks. One of the forms of intellectual modeling is analysis of clinical situation. Students master the skill of clinical analysis by training in pathophysiological analysis of

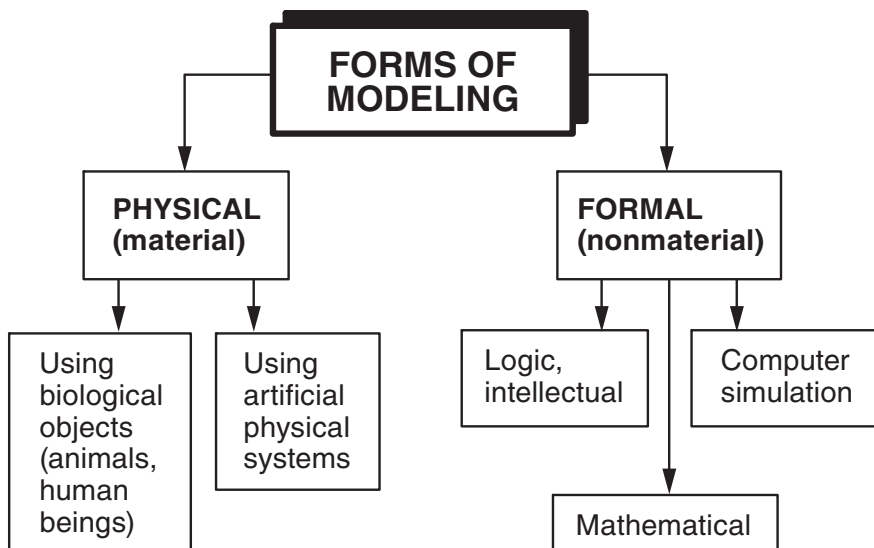


Fig. 2

experimental and clinical data when they solve case problems during their class work. In the process of pathophysiological analysis students simulate doctor's behavior. It is well known that after the evaluation of all relevant information about a patient, that is parameters of physical, laboratory or special instrumental investigation, a doctor creates a disease model of a particular patient. Taking into account all the data concerning the patient's disease a doctor designs a scheme of diagnostic research and selects methods of therapy and prophylactic strategy.