ODESSA NATIONAL MEDICAL UNIVERSITY
DEPARTMENT OF DRUGS TECHNOLOGY

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«27» august 2021 y.

METHODICAL DEVELOPMENT OF THE LECTURE

Course: 5 Faculty: Pharmaceutical

Course : **Biopharmacy**

Lecture № 1 Topic: **"Biopharmacy as a scientific field and its importance in the development of composition and technology of dosage forms. Stages of biopharmacy development. Basic terms of biopharmacy. "**

The lecture was developed by:
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The lecture was discussed at the methodical meeting of the department
«27» august 2021y.
Protocol № 1

Odessa – 2021

Lecture: "Biopharmacy as a scientific field and its importance in the development of composition and technology of dosage forms. Stages of biopharmacy development. Basic terms of biopharmacy."- 4 hours.

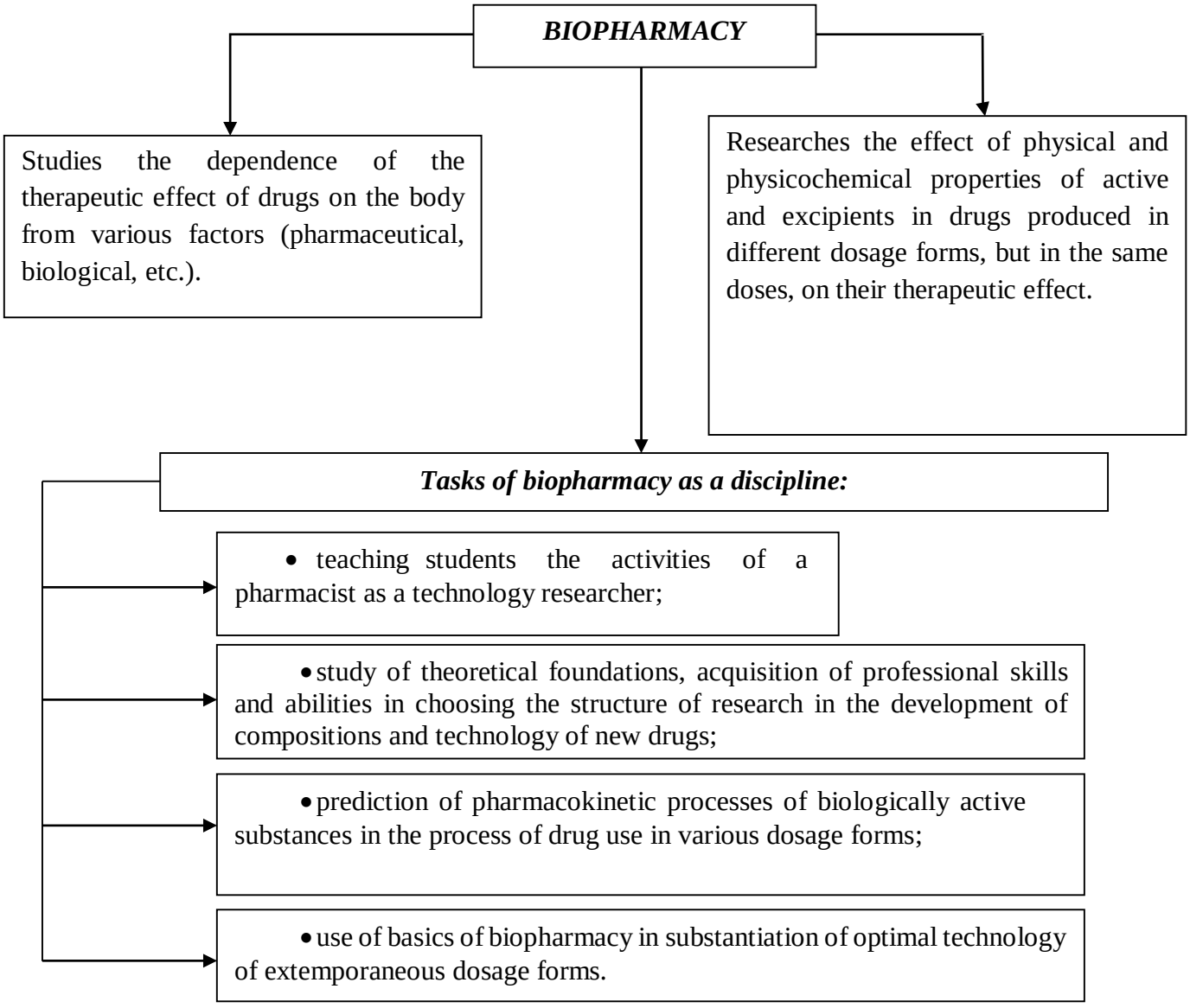
The purpose of the lecture: to get acquainted with the concept of biopharmacy.

Basic concepts: Biopharmacy, LADMER, efficacy, equivalence, pharmacokinetics.

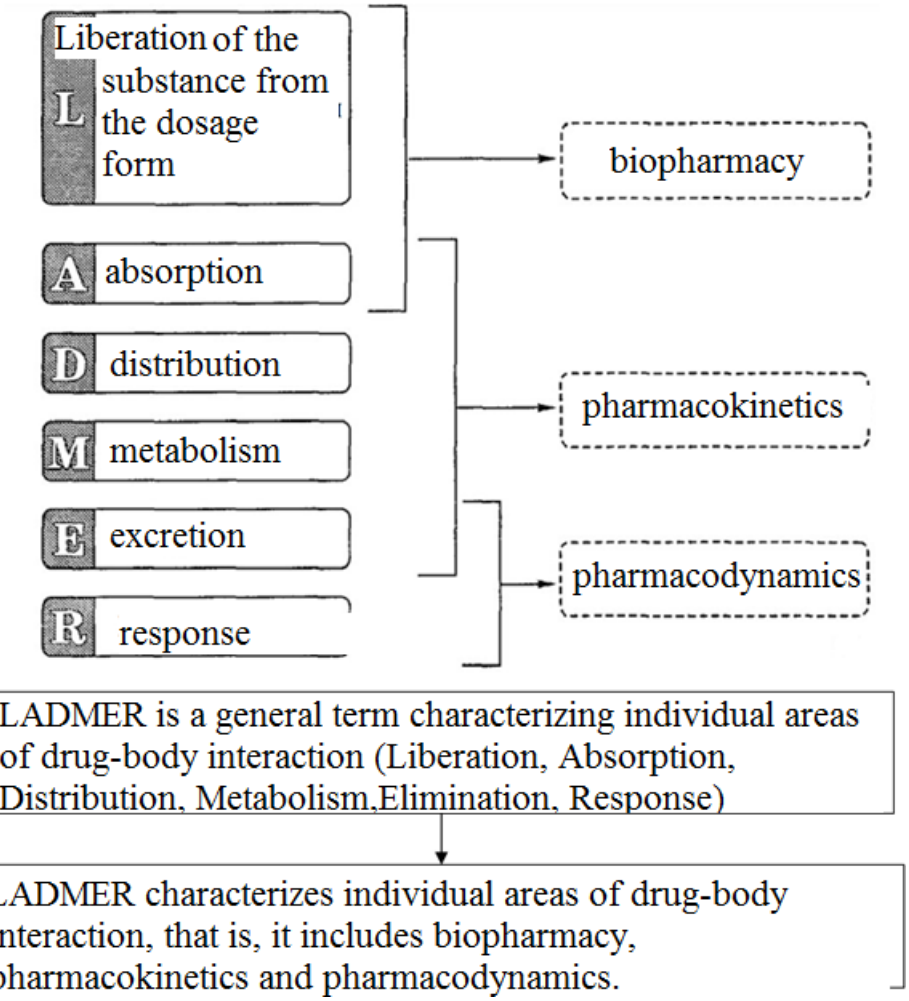
Plan:

1. Biopharmacy as a scientific direction and its importance in the development of the composition and technology of dosage forms.
2. Stages of biopharmacy development.
3. Basic terms of biopharmacy.

1. Biopharmacy as a scientific direction and its importance in the development of the composition and technology of dosage forms.



The main task of biopharmacy in drug technology is to maximize the therapeutic efficacy of drugs and minimize their possible side effects on the body.

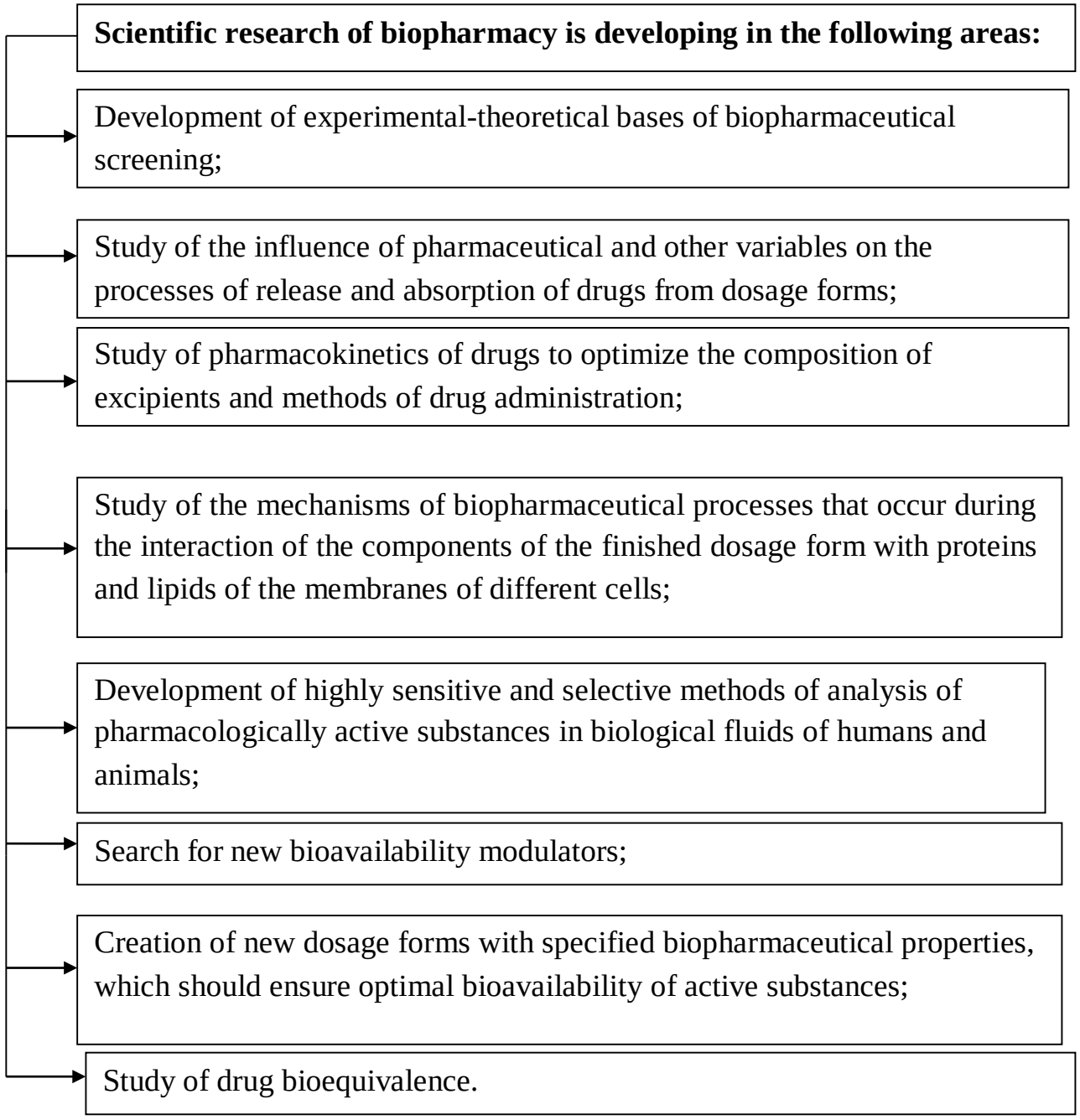


Biopharmacy is now the theoretical and practical basis for the development of new drugs, allowing to predict the type and strength of the expected pharmacological activity and possible side effects, taking into account the type of dosage form, excipients, method of manufacture and more.

Biopharmacy is based on knowledge of mathematics, physics, inorganic and organic chemistry, pharmaceutical chemistry, physiology, anatomy, biochemistry, pharmacology, drug technology, so its terminology often uses pharmacological, chemical and technological terms.

Unlike pharmacology, biopharmacy does not study the mechanisms of action and site of administration of a drug or excipient.

It investigates the exceptional effect of variables on the pharmacodynamics and pharmacokinetics of drugs.



2. Stages of biopharmacy development.

From the history of pharmacy it is known that in 1838 Professor AA Iovsky first applied the concept of "technology" in the science of drug manufacturing, meaning by this term the science designed to enrich the production of drugs. At the beginning of the last century there was a great importance of the technology of the production process, the process of converting the original drugs into a dosage form designed to help the body weaken, destroy or prevent disease.

By the 1950s, the improvement of industrial technology made it possible to intensify various stages of pharmaceutical production (micronization, ultraemulsification, ultrasonic, and other types of sterilization, etc.), which also

affected the surface properties and formation of metastable modifications of drugs and excipients. It is the introduction into practice of new highly active drugs, excipients and advanced technological processes and formed the material basis of the unusual phenomenon, which in the scientific literature is called "Therapeutic inequality or inadequacy of drugs." The essence of such inequality (inadequacy) is that the same doses of (often highly active) drugs, prescribed in identical dosage forms prepared by different companies, have a different pharmacotherapeutic effect. for example, tablets containing the same doses of chloramphenicol, phenyl butazone, digoxin, tetracycline, prednisolone, thyroidin, etc., produced by one plant, have a therapeutic effect, produced by another plant - toxic, and the third - do not have the proper effect.

Careful study of known cases of therapeutic drug inequality,
showed that the activity of the active substance, its behavior in the process of release from the dosage form, diffusion to the site of absorption, and the process of absorption are closely dependent on the nature and amount of excipients and technological operations that take place in obtaining drugs.

Studies of cases of therapeutic non-equivalence of drugs have greatly contributed to the establishment of new ideas, biopharmaceutical, based on the recognition of biological (medical) significance of all components of the dosage form and consideration of drugs as a complex physicochemical system consisting of dialectical unity of factors and changes that accompany the preparation of drugs.

In the late 50's and a new direction in pharmacy was launched - biopharmaceutical. Biopharmacy is defined as the science that studies the biological action of drugs depending on the physicochemical properties, type of dosage form, cooking technology, and others. variables.

Biopharmacy - a science that studies the dependence of the therapeutic effect of drugs on the body from various factors (pharmaceutical, biological, etc.).

Biopharmacy is a scientific discipline of pharmacy that studies the effect of physical and physicochemical properties of active and excipients in drugs produced in different dosage forms, but in the same doses, on their therapeutic effect.

The emergence of biopharmacy was prepared throughout the progressive development of pharmacy, medicine, chemistry and other sciences. It is at the junction of several branches of knowledge and biopharmacy originates.

It appeared after establishing the facts of therapeutic non-equivalence of drugs, ie drugs of the same composition, but prepared by different pharmaceutical companies, differed in therapeutic efficacy. This was due to a number of reasons: the degree of grinding of drugs, the selection of excipients and the difference in technological processes, the so-called pharmaceutical factors. In the special literature, the term "pharmaceutical factors" has become widespread primarily in connection with the

clinical confirmation of experimental data on the existence of a relationship between the effectiveness of drugs and methods of obtaining them.

The founders of biopharmacy are considered to be the American scientists Levy and Wagner, thanks to whose work the term "biopharmacy" was adopted, which is used in most European countries as the equivalent of the English term "biopharmaceutics".

The term "biopharmacy" first appeared in scientific pharmacy in the United States in the 60s of XX century and soon gained general international recognition.

The word "pharmaceutics", used in English literature, is not synonymous with "pharmacy", its designation - galenic pharmacy. "Biopharmaceutics" and the adjective "biopharmaceutical" formed from it are literally translated as "biogalenics" and "biogalenic".

The addition of the prefix "bio" to the term "pharmaceutics" does not mean that we are talking about the biological evaluation of products of galenic pharmacy or biological pharmacy in general.

This capacious word "biopharmacy" successfully and fully defines the complex of dependencies that exist between the drug substance and the therapeutic effect of the prepared drug.

Despite the fact that the term "biopharmacy" is not quite accurate, it is used both in our country and abroad and is introduced into a single standard international biopharmaceutical terminology.

3. Basic terms of biopharmacy.

Modern biopharmacy has its own internal terms that denote its basic concepts.

Factors - simultaneously acting forces, states or other circumstances that affect the final result of the studied processes, data or parameters.

The active *substance* is a biologically active part of the drug that is responsible for the therapeutic effect.

Efficacy - the ability of a drug or drug to achieve the desired effect.

Due to the fact that the therapeutic efficacy is significantly influenced by variable biological (physiological, biochemical) factors, biopharmacy also pays attention to their study using the bioavailability test.

Thus, the definition of biopharmacy at the first stage of its development can be formulated as follows: *science, the subject of which is the study of the influence of a wide range of variables (pharmaceutical and biological) factors on the interaction of drugs and the body.*

The main purpose of biopharmacy is to obtain a lasting effect, maximize the effectiveness and minimize the adverse effects of drugs on the body.

Numerous international symposia on biopharmacy and pharmacokinetics which regularly took place due tothe organizational skills of the Slovak scientist L. Zathurecky, as well as due to regional scientific quorums, contributed to the rapid development of biological pharmacy and the formation of new thinking. devoted to this problem.

The influence of pharmaceutical and biological variables on the degree of efficacy of drugs can be traced according to a typical pharmacokinetic scheme:

the amount of active substance in the drug

↓

release and amount of substance at the site of absorption

↓

absorption, biotransformation and the amount of active substance in the bloodstream and tissues

↓

excretion of the active substance (metabolites) from the body

Before the process of absorption of the active substance, it must be released from the pharmaceutical system (tablets, suppositories, ointments), diffuse to the absorption surface. The absorption process itself is also diffusion and depends on many factors: the amount, properties and physical state of the active substance, the overall composition and properties of the pharmaceutical system, as well as technological factors and the physiological state of the absorption surface.

Therefore, the effectiveness of drugs can be determined only by careful study of both pharmaceutical and biological variables, each of which determines the dominant influence at certain stages of "life" of the pharmaceutical drug, from creation and production to rational use, including the possibility of its interaction with exogenous, endogenous components and elements of the organism.

Clinical factors - factors that occur during pharmacotherapy in a clinical setting (choice of dosing regimen, time of drug administration, side effects, interaction of simultaneously or sequentially administered drugs, bedriddenness, physical activity, severity of the disease, gastrointestinal disorders tract, liver, kidneys, heart, etc.).

Equivalence - the correspondence of the amount of drug (drug) or drug indicated in the analytical regulations or the identity of the effect of the studied drug of comparison.

The pharmaceutical equivalent is a drug that contains the same amount of therapeutically similar substance in a particular dosage form and meets the requirements set by technological standards.

Clinical equivalent - the equivalent of a drug, which after the use of the same doses gives the same therapeutic effect, tested on any symptom or treatment of the disease.

Bioequivalence - the equivalent of drugs prepared by different manufacturers or the same plant, but different series, after the introduction of which in the same dosage form to the same patients in the same doses, the same biological (therapeutic) effect.

Therapeutic non - equivalence - the inequality of therapeutic action of the same drugs in the same doses, prepared by different manufacturers or the same plant, but different series.

Bioavailability is a condition that allows a drug substance introduced into the body to reach the site of exposure.

Relative bioavailability - expressed as a percentage of the amount of drug released from the dosage form, which after administration reaches the receptor in an amount sufficient to cause a biological effect.

Absolute bioavailability is the amount of drug administered intravenously or intravascularly that enters the bloodstream without the effect of the first pass effect or after correlation to this effect, and the rate of this process.

Physiological availability is synonymous with "bioavailability" or "bioavailability".

Systemic availability is the part of the total absorbed dose of the drug that enters the circulatory system after oral administration. Synonymous with "bioavailability" and "bioavailability".

Absorption (absorption) - the process of transition of the drug from the place of reception into the bloodstream.

Resorption is synonymous with "absorption".

The release rate constant is a general constant that determines the rate of penetration of a drug substance from the site of ingestion through the biological membrane.

Biotransformation - a complex process in which lipoid-soluble molecules of the drug in the process of biochemical reactions are replaced by catalytic enzymes (oxidation, reduction, hydrolysis, synthesis) into metabolites.

Purity - the hypothetical volume of the body, which was deprived of the corresponding substance per unit time.

Purity of the whole body - the purity of the hypothetical volume of plasma in milliliters (volume of distribution), through which the body is released from the drug, releasing it through the kidneys, bile, lungs, skin and metabolism.

Distribution is the process by which a drug is distributed or dispersed from the blood into one or more parts, into tissues and organs of the body.

Distribution rate constant - the rate constant of the transition of a drug substance from the circulatory system to any or any part of the body.

The area under the pharmacokinetic curve is the surface, which in the coordinate system is limited by a segment (x-axis and curve), which characterizes the concentration of the drug in the blood (serum, plasma, urine) depending on time. It is limited in time or extrapolated to infinity.

Excretion (excretion) - a process during which the drug (drug) is excreted from the circulatory system through the kidneys into the urine, through bile and saliva into the intestines and feces, through the skin, breast and sweat glands.

Absorption constant is a general constant that determines the rate of penetration of a drug substance from the site of administration through the biological membrane into the body.

Elimination constant - the rate constant of the process during which the effective substance is removed from the body by excretion or biotransformative processes.

Pharmacokinetics - *a* description of changes over time in the concentrations of the administered drug and its metabolites in the body; covers such transport processes of the active substance and its metabolites in the body as absorption, distribution, biotransformation and elimination.

Thus, the main purpose of biopharmacy as a science is a theoretical and experimental justification for the creation of new drugs and improvement of existing ones, taking into account the increase of their therapeutic effect and reduction of side effects on the body.

Significant scientific achievements in the field of biopharmacy include the following:

1. The connection between the type of ointment bases and the effectiveness of antiseptics, antibiotics, biologically active substances of bee products and other chemotherapeutic substances. This allowed to develop and implement in medical practice of the CIS ointments "Levosin", "Levomicol", "dioxicol" and many others.

2. The relationship between the distribution of drug molecules, in particular corticosteroids, in different phases of dispersed dosage forms depending on the structure of these phases and between the release, bioavailability, efficacy and side effects of drugs. The results of these studies were used in the development of ointments and liniments of sinaflan, hydrocortisone and prednisolone ointments, Triacort ointments, Cortonisol aerosols, Trimistin ointments, Cortonitol ointments, and others.

3. The connection between the supramolecular structure of surfactant associations (surfactants), physicochemical properties of dispersed systems, release, bioavailability, activity and the manifestation of toxic effects of various drugs. The results of research have purposefully managed the pharmacological and toxicological properties of drugs in various dosage forms: ointments, foams, suppositories, gels and others - and formed the basis for the creation of drugs such as "Suliodopyrone", suppositories "Propofen", "Polenfen", ointments Lipovit "," Prolidoxide "and others.

4. The correlation between affinity of medicinal and auxiliary substances to different biomembranes, structure of biomembranes, bioavailability and efficiency of pharmacological action of medicinal pre-Paraty is established.

5. The regularities of pharmacokinetic, pharmacokinetic and toxicodynamic interaction of drugs in combined drugs are studied, as well as the influence of excipients and tablet technology on the release of drugs from tablets and their bioavailability is studied. The results of the research formed the basis for the creation of a group of combined preparations with paracetamol, solid dosage forms with bee products (tablets "Propolin", "Propoltin", "Feprogit"), and others.

6. The influence of chemical modification of medicinal substances with the help of amino acids on their bioavailability and efficiency of action has been studied. For example, acelysin (Domestic soluble aspirin) and its dosage forms have been introduced into production and medical practice.

Interest in biopharmacy as a scientific field is becoming deeper, and more and more scientists are engaged in biopharmaceutical research.

To date, biopharmacy has successfully solved a number of problems of scientific pharmacy and medicine and have a significant impact on the further development of the theory of modern drug management.

Questions for self-control

1. What does the scientific discipline of pharmacy - biopharmacy?
2. Define the basic concepts: efficiency, clinical factors, bioequivalence, relative bioavailability, absolute bioavailability, absorption, metabolism.
3. The concept of bioavailability. The main indicators of bioavailability of drugs.
4. Factors affecting the bioavailability of drugs:

1) Influence of drug routes on bioavailability: parenteral, oral, rectal, inhalation route of administration;

2) The influence of body temperature and environment;

3) Influence of a magnetic field and meteorological factors;

4) Influence of age, sex, biorhythms and pathological processes;

5) The effects of alcohol and smoking.

Main:

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