# Design of the structure of synthetic medicinal substances

# Stages of creation and laboratory synthesis of potential drugs

The creation of any new drug in the 20th century (since the advent of the pharmaceutical industry and up to its end) was based mainly on a speculative or empirical study of the way it was designed.

# Stages of creation and laboratory synthesis of potential drugs

This way of creating a potentially useful medicinal substance, from the concept to the pharmacy and the patient, is very difficult and, most importantly, time-consuming.

# Stages of creation and laboratory synthesis of potential drugs

At the first stage, the selection of the basic potentially active one is carried out structures, i.e. the idea of the entire project is being created. Here the chemist decides what to synthesize, why and how to synthesize PLV.

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The implementation of the second stage is carried out by synthetic chemists and specialists in pharmaceutical and medical chemistry.

# Stages of creation and laboratory synthesis of potential drugs

This stage consists in the laboratory development of ways and methods or the synthesis of the target substance and its close structural analogues, their selection by:

1) stability,
2) ease of preparation,
3) yield and selectivity of their preparation,

# Stages of creation and laboratory synthesis of potential drugs

4) toxicity,

5) solubility and

6) technical and economic indicators.

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At the same time, a large set of substances is synthesized (for example, potential enzyme inhibitors of pathogenic bacteria), making a preliminary assessment of the availability, cost and toxicity of the initial and intermediate reagents already at this stage.

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The synthesized compounds are then transferred to biologists for bioscreening in an experiment.

# The primary stages of biotesting

Biotesting is the main sieve on which the bulk of inactive and low–activity synthesized compounds are rejected in the experiment, and the most promising substances with high biological activity remain for the continuation of in-depth tests

# The primary stages of biotesting

The very initial stage of the search for a new LV is called primary biological screening (screening).

# The primary stages of biotesting

Biochemical tests on enzymes are carried out in test tubes, inwell plates and Petri dishes, which contain the enzyme under test, to which the synthesized substance is added.

# The primary stages of biotesting

Substances distinguished by their high activity are called "hits".

# The primary stages of biotesting

Cell tests are carried out on cultures of living cells. The intensity of the selection of substances. These are then used to form a group of "leaders" (hit to lead optimization).

# Animal testing

- The leaders selected in the previous trialsenter the stage of their more in-depth testing –animal testing (in vivo). These more expensive tests are carried out on mammals – mice, rats, rabbits, dogs, guinea pigs and monkeys.

# Animal testing

They are studied at the same time: 1) the effectiveness of potential LV (PLV); 2) its acute and chronic toxicity (in general, the study lasts up to 6-7 years); 3) side effects; 4) oral bioavailability of the leaders and their modified analogues; 5) their compliance with others pharmacokinetic and pharmacodynamic characteristics and requirements; 6) the most suitable forms of application; 7) storage conditions.

# Animal testing

At the same time, a close interactive relationship is established between the pharmacologist and the chemist, which contributes to the fastest chemical modification and the creation of the most effective analogues of lasers.

# Animal testing

Upon achieving satisfactory results that meet the basic requirements, a group of "candidates" for LV is formed, which are transferred to the final stage of experimental testing – in-depth human trials.

# Human clinical trials

This stage of testing (stage 4) is the most important stage. It consists of three phases.

# Human clinical trials

Phase I is a security check IVF is for a healthy adult. This stage is not related to the disease that the tested IVF is intended to treat. It lasts 1-2 years and the IVF dropout rate is up to 30%.

# Human clinical trials

Phase II aims to establish on several hundred patients with a certain disease (with different stages of the disease):

a) the success of her treatment with this IVF;

b) the necessary therapeutic doses;

c) the presence of side effects. The study lasts for 2 years at further elimination of PLV up to 70%.

# Human clinical trials

Phase III testing is designed to study and clarify in several thousand patients:

a) doses and regimens of taking LV;

b) side effects;

c) compatibility of this PLV with other LV;

d) ethnic, seasonal, age and sex dependence of the level of manifestation of the therapeutic effect of IVF.

# Human clinical trials

Science has recently emerged pharmacogenetics is a part of pharmacology that studies the dependence of the therapeutic and toxic effects of the same medicinal substance not only on the sex and age of patients, but also on their genetic characteristics and, in particular in particular, it depends on their ethnicity. This testing continues for 1-2 years with 75% IVF dropout.

# Registration and production technology of a new medicinal product

In the case of positive clinical trials, all documentation on a potential medicinal substance (PLV) is submitted for consideration to The Pharmaceutical Committee of the state, where it is legislatively approved, i.e. passes state registration (stage 5) and receives the official status of a medicinal substance (LV).

# Registration and production technology of a new medicinal product

After that, the stage of development of the technology of industrial synthesis of a new LV begins – the sixth and seventh stages (stages 6 and 7), which include the development of pilot, semi-factory and, finally, the industrial scaling of the production of a new LV.

# Registration and production technology of a new medicinal product

These stages are the most expensive, time-consuming and energy-intensive.

# Registration and production technology of a new medicinal product

Technologists, engineers, chemists, physicochemists and economists are engaged in their implementation.

# Registration and production technology of a new medicinal product

Currently, the general scheme also includes a stage (stage 8) at which the manufactured substance undergoes state validation and certification, where it is given the status of full compliance.

# Registration and production technology of a new medicinal product

At the ninth stage (stage 9), acceptable forms of drug use are studied and created – powders, solutions, ointments, capsules, tablets, applicators, etc. After achieving compliance with the requirements of international GMP standards, the drug goes on sale (stage 10).

# Methods of analysis of organic compounds

- Chemical and physical methods are used to isolate, purify, analyze and identify organic compounds. The end result of these studies is to establish the structure of organic substances. To achieve this goal, each compound must first be isolated from a reaction mixture or from a mixture of natural products and purified, i.e. obtained in a chemically pure state.

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