Federal State Budgetary Educational Institution of Higher Education
"Volgograd State Medical University" of the Ministry of Health of the Russian Federation
Department of Management and Economics of Pharmacy, Medical and Pharmaceutical Commodity Science

Modern pharmaceutical market, characteristics, trends, prospects

Lecture № 7

Discipline: medical and pharmaceutical commodity science

3 course, 5 semester

Volgograd -2022

LECTURE PLAN

1. Introduction. Basic concepts.
2. Original, generic , biological medicines in the modern pharmaceutical market.
3. The choice of the reference drug to establish bioequivalence.
4. Biodrift .
5. Biological drugs. Biosimilars (bioanalogs).
6. The main trends in the development of the global pharmaceutical market.
7. Forecasts of the development of the world pharmaceutical market.
8. Analysis and main trends in the development of the Russian pharmaceutical market.

BASIC DEFINITIONS

Medicinal products - **substances or their combinations that come into contact with the human or animal body, penetrate the organs, tissues of the human or animal body, used for prevention, diagnosis (with the exception of substances or their combinations that are not in contact with the human or animal body), treatment diseases, rehabilitation, for the preservation, prevention or termination of pregnancy and obtained from blood, blood plasma, organs, tissues of the human or animal body, plants, minerals by synthesis methods or using biological technologies.**

Medicinal products include pharmaceutical substances and drugs

Medicines - medicines in the form of dosage forms used for the prevention, diagnosis, treatment of a disease, rehabilitation, for the maintenance, prevention or termination of pregnancy

Orphan medicinal products - medicinal products intended solely for the diagnosis or pathogenetic treatment (treatment aimed at the mechanism of the development of the disease) of rare (*orphan*) diseases

Biological medicinal products are medicinal products, the active substance of which is produced or isolated from a biological source and a combination of biological and physico-chemical methods is necessary to determine the properties and quality of which. Biological medicinal products include immunobiological medicinal products, medicinal products derived from blood, human and animal blood plasma (excluding whole blood), biotechnological medicinal products, gene therapy medicinal products. *(Clause 12.1 as amended by the Federal Law of December 27, 2019 N 475-FZ)*

Immunobiological medicinal products - medicinal products intended for the formation of active or passive immunity or the diagnosis of the presence of immunity or the diagnosis of a specific acquired change in the immunological response to allergenic substances.

Immunobiological medicinal products include vaccines, toxoids, toxins, sera, immunoglobulins and allergens.

(Clause 12.1 as amended by the Federal Law of December 27, 2019 N 475-FZ)

Biotechnological medicinal products - medicinal products, the production of which is carried out using biotechnological processes and methods (including recombinant DNA technology, technology for controlled expression of genes encoding biologically active proteins in prokaryotes and eukaryotes, including modified mammalian cells), hybridoma method and monoclonal method antibodies

Gene therapy medicinal products - medicinal products, the pharmaceutical substance of which is a recombinant nucleic acid or includes a recombinant nucleic acid that allows regulation, repair, replacement, addition or removal of a genetic sequence.

Original medicinal product - a medicinal product with a new active substance, which is the first registered in the Russian Federation or in foreign countries on the basis of the results of preclinical studies of medicinal products and clinical trials of medicinal products confirming its quality, efficacy and safety *(clause 12.1 as amended by the Federal Law dated December 27, 2019 N 475-FZ)*

Reference medicinal product - a medicinal product that is used to assess the bioequivalence or therapeutic equivalence, quality, efficacy and safety of a generic medicinal product or a biosimilar (biosimilar) medicinal product (biosimilar). An original medicinal product is used as a reference medicinal product for medical use, or, if the original medicinal product is not registered or is not in circulation in the Russian Federation and is not in circulation in foreign countries, a generic medicinal product or a bioanalogue (biosimilar) medicinal product (biosimilar) , which is the first registered among those in circulation in the Russian Federation, bioequivalence or therapeutic equivalence, the quality, efficacy and safety of which were evaluated in relation to the original medicinal product, as well as the quality, efficacy and safety of which are confirmed by the results of pharmacovigilance and conformity checks of medicinal products that are in civil circulation, established requirements for their quality. As a reference medicinal product for veterinary use, a medicinal product for veterinary use is used, registered in the Russian Federation on the basis of the results of preclinical studies of medicinal products and clinical trials of medicinal products confirming its quality, efficacy and safety.

Generic medicinal product - a medicinal product for medical use that has an equivalent qualitative composition and quantitative composition of active substances in an equivalent dosage form as a reference medicinal product, or a medicinal product for veterinary use that has the same qualitative composition and quantitative composition as the reference medicinal product. the composition of active substances in the same dosage form, the bioequivalence or therapeutic equivalence of which to the corresponding reference medicinal product is confirmed by appropriate studies

Bioanalogue (biosimilar)
medicinal product (biosimilar) - a biological medicinal product similar in terms of quality, efficacy and safety to a reference biological medicinal product in the same dosage form and having an identical route of administration

Interchangeable medicinal product - a medicinal product with proven therapeutic equivalence or bioequivalence in relation to the reference medicinal product, which has equivalent qualitative composition and quantitative composition of active ingredients, composition of excipients, dosage form and method of administration.

Medicinal herbal product - a medicinal product produced or manufactured from one type of medicinal plant raw materials or several types of such raw materials and sold in packaged form in secondary (consumer) packaging.

Homeopathic medicinal product - a medicinal product produced or manufactured from a pharmaceutical substance or pharmaceutical substances in accordance with the requirements of the general pharmacopeial articles for homeopathic medicinal products or in accordance with the requirements of the pharmacopoeia of the country of manufacture of such medicinal product.

Bioequivalence of medicinal products is the achievement of comparable rates of absorption, the degree of entry to the site of action and the rate of excretion of one or more active substances with pharmacological activity when using medicinal products for medical use that have one international non-proprietary (or chemical, or grouping) name, in equivalent dosages and with the same route of administration.

Therapeutic equivalence of drugs is the achievement of clinically comparable therapeutic effect and indicators of efficacy and safety when using drugs for medical use that have one international non-proprietary (or chemical, or grouping) name, in equivalent dosages for the same indications for use and with the same route of administration in the same group of patients.

International non-proprietary name of a medicinal product - the name of the active ingredient of a pharmaceutical substance recommended by the World Health Organization;

Trade name of a medicinal product - the name of a medicinal product assigned by its developer, holder or owner of the registration certificate of a medicinal product

Grouping name of a medicinal product - the name of a medicinal product that does not have an international non-proprietary name, or a combination of medicinal products, used to combine them into a group under a single name based on the same composition of active ingredients

MAIN TRENDS IN THE DEVELOPMENT OF THE WORLD PHARMACEUTICAL MARKET

- The state, insurance companies and patients are putting forward more and more specific requirements for what and how doctors should prescribe.
- The protocols governing the prescription of drug therapy for a particular disease have been replaced by individualized treatment.
- This has made the target audience of pharmaceutical companies more consolidated and influential , which, in turn, cannot but affect the sales of companies and their marketing strategy.
- Under these conditions, to make a profit, much more effort will have to be made - to establish interaction with payers and suppliers, to prove the benefits of the drug for the patient.

MAIN TRENDS IN THE DEVELOPMENT OF THE WORLD PHARMACEUTICAL MARKET

- We can single out the main socio-economic reasons that affect the development of the pharmaceutical industry as a whole:
- The prevalence of chronic diseases such as diabetes is increasing.
- Governments in many countries are raising the retirement age, bringing chronic diseases into the economically active part of life , which will further increase the pressure on health care costs.
- Accordingly, the social and economic value of treating these diseases will increase .
- However, pharmaceutical companies will be forced to reduce prices for drugs used to treat chronic diseases, and revenue growth will be ensured by increasing the physical volume of sales.

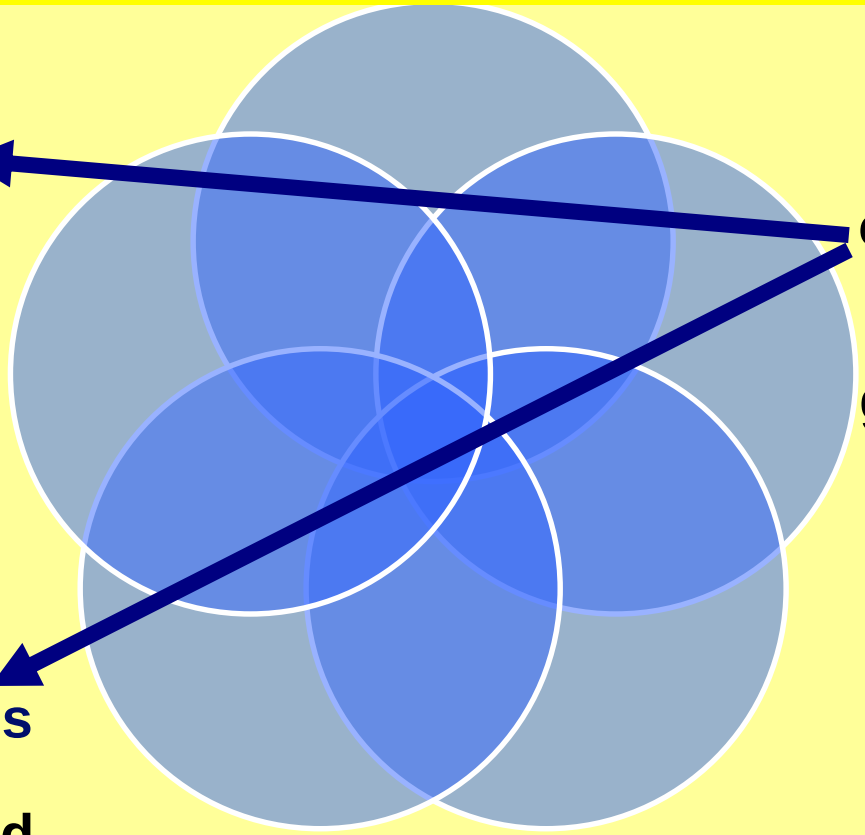
Original, generic , biological medicines in the modern pharmaceutical market

GENERICS - GUARANTEE OF THERAPEUTIC EQUIVALENCE? PROBLEMS OF INTERCHANGEABILITY OF DRUGS

A generic drug is a drug intended to be interchangeable with the innovator, usually produced without a license from the innovator, and placed on the market after the expiration of the patent or other exclusive rights .

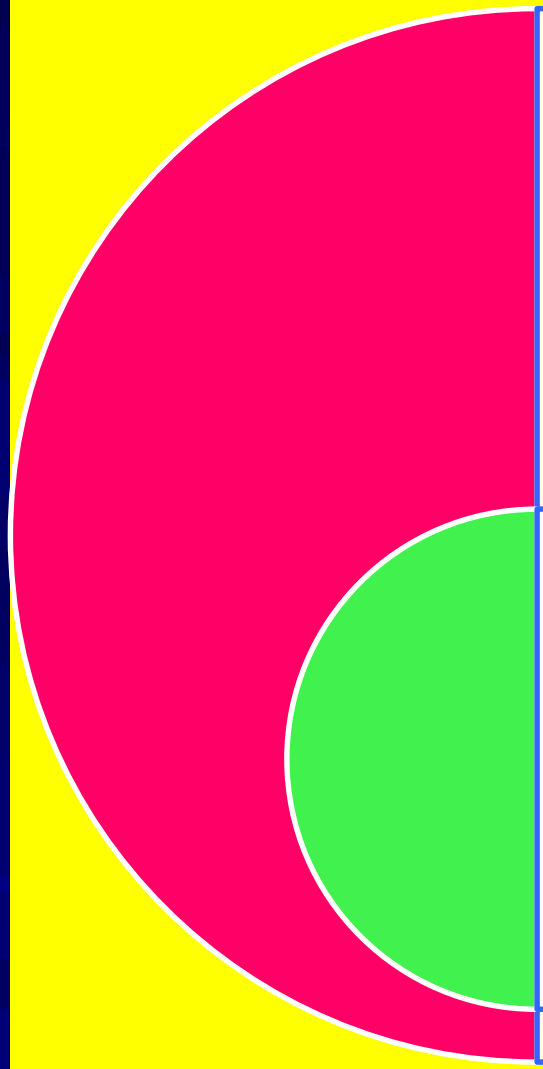
(WHO, 2010).

proper generics (including umbrella generics) .



For a more complete analysis of the generic segment, 2 large groups have been identified:

branded generics (including umbrella branded generics)



The split occurred because the contribution of branded generics in the overall segment of generics is prevalent.

Actually generics (including umbrella generics) - generics , in the name of which the name of the manufacturer of this drug is fully or partially present .

Generic generics are generic drugs whose trade name is the same as the international nonproprietary name or the name of the active ingredient.

Branded generics are generic drugs, the marketing development of which is carried out by the manufacturing company under a specific brand (their trade name differs from the international generic and the name of the active active substance).

For example, everyone knows that paracetamol is an anti-inflammatory and antipyretic agent.

Among the many trade names of paracetamol , the consumer prefers a specific brand, which, obviously, inspires confidence in him (due to the promotional activity of the manufacturing company).

Multisource medicinal product

(multisource pharmaceutical product - a drug manufactured by several companies).

The term generic drug should be understood as a drug that is intended:

- **for a possible replacement of an innovative drug**
- **produced without a license from the company that produces the innovative drug**
- **placed on the market**

after the expiration of the patent or other exclusive rights.

Multisource medicinal products are pharmaceutically equivalent medicinal products that may or may not be therapeutically equivalent.

Multisource medicines that are therapeutically equivalent are interchangeable (WHO).

SHARE OF REPRODUCED DRUGS

GENERIC SECTOR IN THE PHARMACEUTICAL MARKET:

- EU countries - from 45 to 70%
- Canada - 64%
- Japan - 45%
- Russia - about 75%

According to the Budget Office
US Congress, using generics,
Americans save over $10 billion a year.

TYPES OF EQUIVALENCE

- **Pharmaceutical** - full reproduction of the composition and dosage form of the original drug by a generic drug.
- **Pharmacokinetic** (bioequivalence) - the similarity of pharmacokinetic parameters.
- **Therapeutic** - similar to the original drug, the efficacy and safety of a generic drug in pharmacotherapy.

DEFINITION

A medicinal product is essentially the same as the original product if it meets the criteria for the same quantitative and qualitative composition with respect to active substances, the same dosage form and is bioequivalent, unless it is scientifically obvious that it differs from the original drug. regarding safety and efficacy.

(EU Directive 2001/83)

When evaluating generic drugs, the following should be kept in mind:

- A generic contains the same active drug substance (substance) as the original (patented) drug.
- A generic drug differs from the original drug in excipients (inactive ingredients, fillers, preservatives, dyes, etc.).
- Differences are also observed in the technological process of production of generics .

DEFINITION

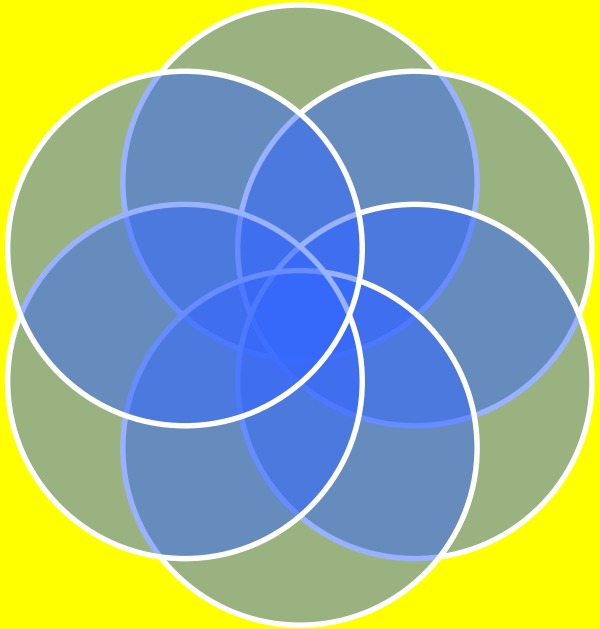
" Pharmaceutical alternatives are drugs containing the same pharmacological substance, presented in the form of different salts, esters or complexes, or in different doses."

(FDA, Electronic Orange Book . 23rd Edition , 2003).

REQUIREMENTS FOR THERAPEUTICAL EQUIVALENT DRUGS

Therapeutically equivalent medicinal products must meet the following requirements:

produced under GMP conditions.

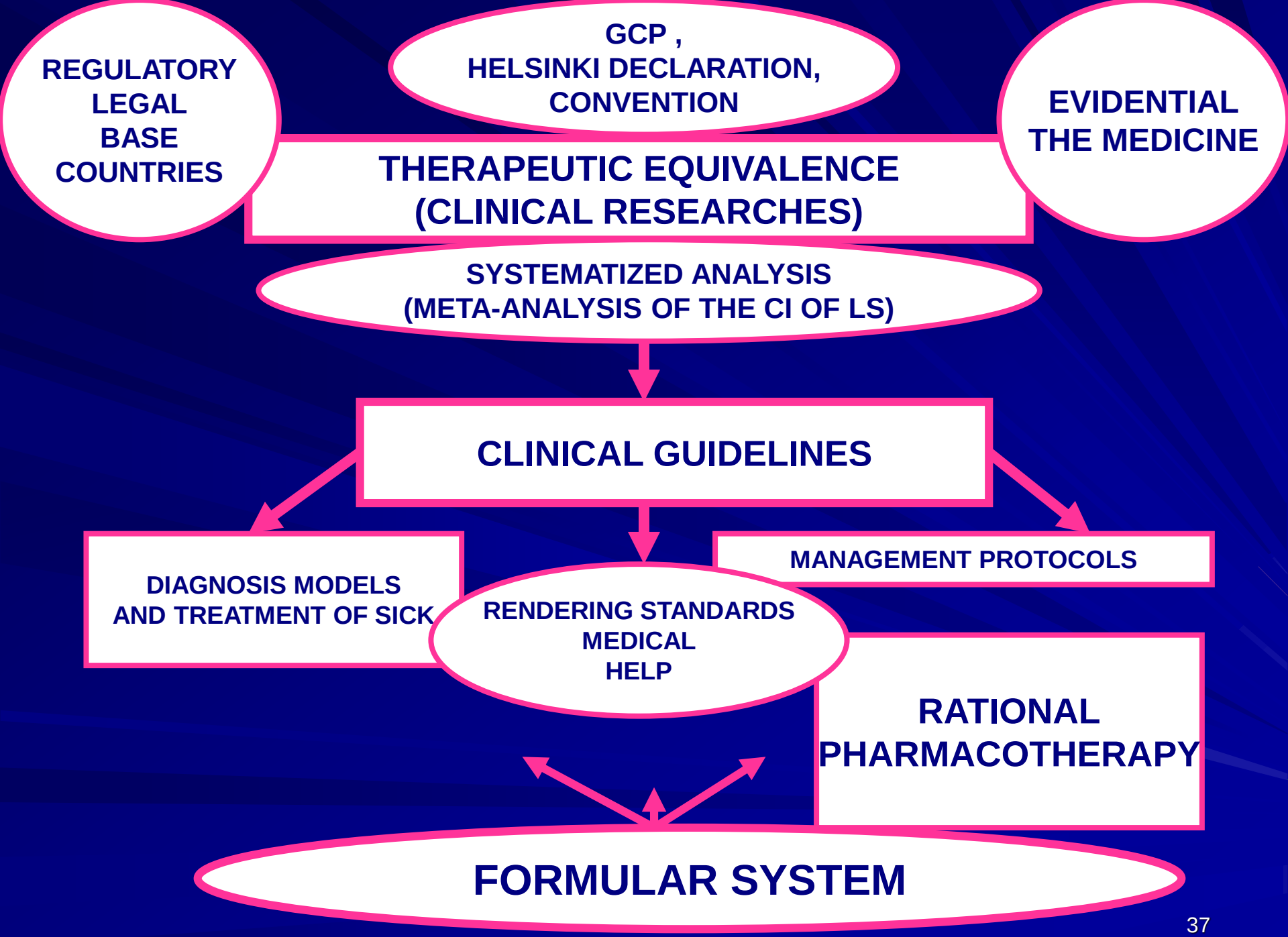


have proven efficacy and safety in clinical practice;

have similar instructions for use;

be pharmaceutically equivalent ;

be bioequivalent ;


REGULATORY
LEGAL
BASE
COUNTRIES
GCP ,
HELSINKI DECLARATION,
CONVENTION
EVIDENTIAL
THE MEDICINE
THERAPEUTIC EQUIVALENCE
(CLINICAL RESEARCHES)
SYSTEMATIZED ANALYSIS
(META-ANALYSIS OF THE CI OF LS)
CLINICAL GUIDELINES
DIAGNOSIS MODELS
AND TREATMENT OF SICK
MANAGEMENT PROTOCOLS
RENDERING STANDARDS
MEDICAL
HELP
RATIONAL
PHARMACOTHERAPY
FORMULAR SYSTEM

Interchangeability issues

- Original drugs and equivalent generic drugs are listed in the FDA publication

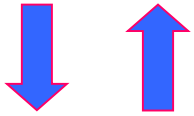
<Registered Medicinal Products with Evaluation of Their Therapeutic Equivalence>, often referred to as the <Orange Book>.

Doubts about the identity of original drugs and generics (Germany, Great Britain, Spain, Canada, France, 2005)

Criteria for evaluation	PATIENTS	DOCTORS
TOLERABILITY	66%	44%
EFFICIENCY	69%	45%
EFFECT OF CHANGES IN COMPOSITION ON EFFICIENCY	88%	89%

COMPARATIVE ANALYSIS OF THE INNOVATIVE DRUG CLARITHROMYCIN (CLACID, ABBOTT) AND 40 GENERALS

(Asia and Latin America)

- 8 PREPARATIONS - CONTENT OF THE ACTIVE SUBSTANCE 
- 28 GENERICS - DISSOLUTION TEST (WORSE)
- 24 DRUGS - EXCEED (UP TO 10 times) FOREIGN IMPURITIES

Nightingale. 2004

CLINICAL EFFICACY OF ENALAPRIL DRUGS (target BP level)

BIOEQUIVALENCE
PHARMACOKINETICALLY
EQUIVALENT

	HELL
RENITECH	12 mg/day
ENAP	15 mg/day
EDNIT	15.6 mg/day
INVORIL	20.6 mg/day
ENAM	36.6 MG/day

CONCLUSION: THERAPEUTICALLY NON-EQUIVALENT

V.I. Petrov, S.V. Nedogoda, 2005

In order to guarantee interchangeability, the generic drug must be a therapeutic equivalent to the reference drug.

Therapeutic equivalence can be achieved when the generic drug is pharmaceutically and biologically equivalent to the reference drug .

Evaluation of bioequivalence usually requires in vivo studies or justification that such studies are not required in a particular case, for example, in the case of a BSC biowaiver .

BIOVAVER - The term (waiver) is applicable to the regulatory process of drug registration, when the dossier (application) is approved on the basis of a certificate of equivalence other than bioequivalence testing.

(21 CFR 320.22) are performed for solid oral forms of biowavers .

Choice of Comparator Drug for Establishing Bioequivalence

Lists of reference drugs

Reference drugs are drugs that are used as standard to prove the equivalence of a new drug being introduced to the market and the original (reference).

The drugs on these lists are comparators for marketing approval of other generic drugs in a particular market . That is, when a new generic drug appears on the pharmaceutical market, regulatory authorities use a list of reference drugs.

Comparator lists are created to assist regulators and pharmaceutical companies in selecting appropriate reference products for the multisource (generic) marketing authorization process.

In developed markets, when compiling lists of reference drugs, regulators may be guided by recommendations:

World Health Organization (World Health Organization - WHO),

U.S. Food and Drug Administration (Food and drug Administration - FDA)

British National Formulary (British National Formulary - BNF).

It should be noted that the recommendations of these organizations have some differences.

WHO recommends striving to use, first of all, an innovative product as a comparator.

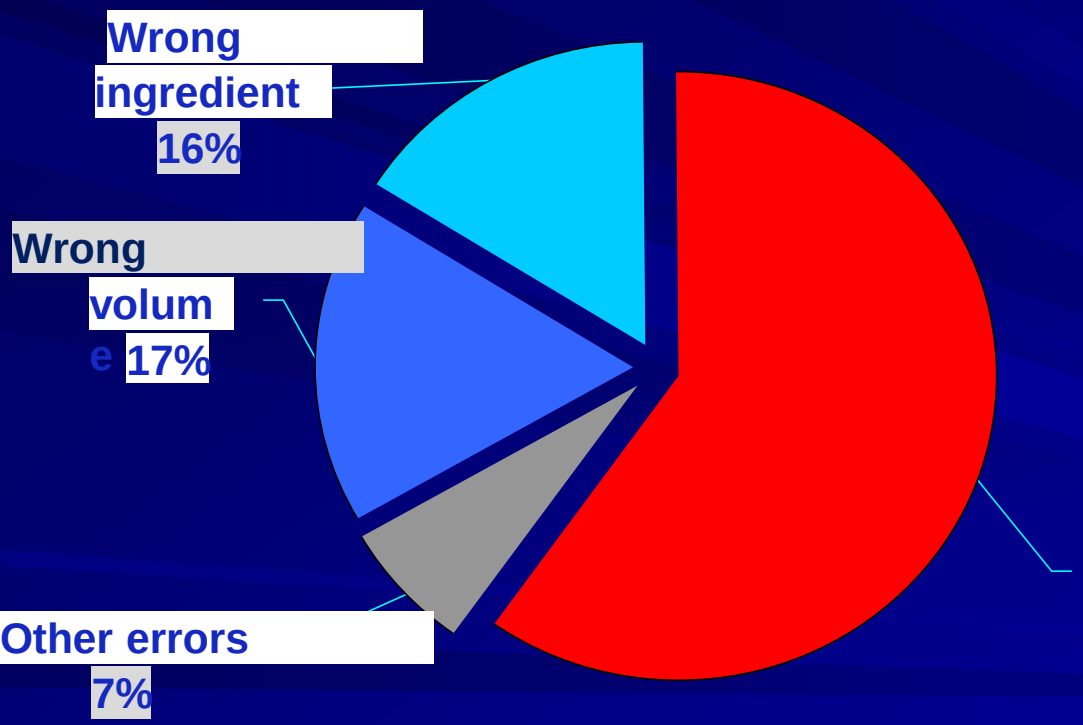
Only if it is not possible to identify or obtain one, should a market-leading product (comparator) be used, and a comparator selection scheme with established quality, efficacy and safety (*wqlibdoc.who.int/trs/WHO_TRS_902.pdf) should be used* .

* Note to Applicants … ..project prequalification

generics

QUALITY

Quality problems ?!



Percentage distribution of data for 325 cases of substandard medicines - data collected from around the world in the WHO database

Comparator

Acquaintance with the comparator drug :
*** drug with which the multisource drug must be interchangeable in clinical practice**
*** selection of the comparator drug is usually done at the national level by the relevant drug regulatory authority .**

Comparator drug

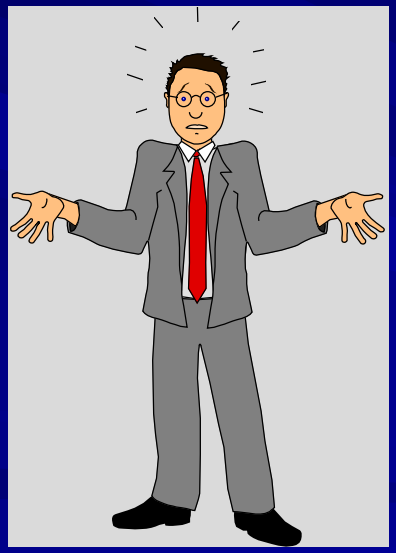
Acquaintance with the comparator drug :
original medicinal product with all approved documents :

- **Quality**
- **Preclinic**
- **Clinic**

- established safety and efficacy

Comparator drug

Choice of comparator drug :



Comparator drug

Choice by drug regulatory authority :

choice in favor of an original drug that is officially registered in a given country and whose quality , safety and efficacy have been proven (original drug authorized in a given country)

choosing a WHO comparator drug from the comparator list (WHO comparator drug)

choice in favor original drug of the country where drug regulation is up to the mark (ICH International Council for Harmonization)

if it is impossible to choose the original drug , then the choice must be justified

Comparator drug

necessary to justify if it is impossible to choose the original drug :

- **approval in ICH (International Council for Harmonization…) countries and associated countries**
- **WHO**
- **widespread use in clinical trials , which should be documented**
- **long-term observation of the drug on the market without identified problems**

List A and B

WHO provides a list with comparators

- information from regulatory authorities / pharmaceutical companies

List A: WHO Model List of Essential Medicines

- ' best ' original designs in domestic markets

List B : Drugs for which you can not find original drugs

- then it is impossible to carry out an equivalence analysis

- quality , safety and efficiency based on local , national or regional pharmacopoeias

- for original medicines enough information

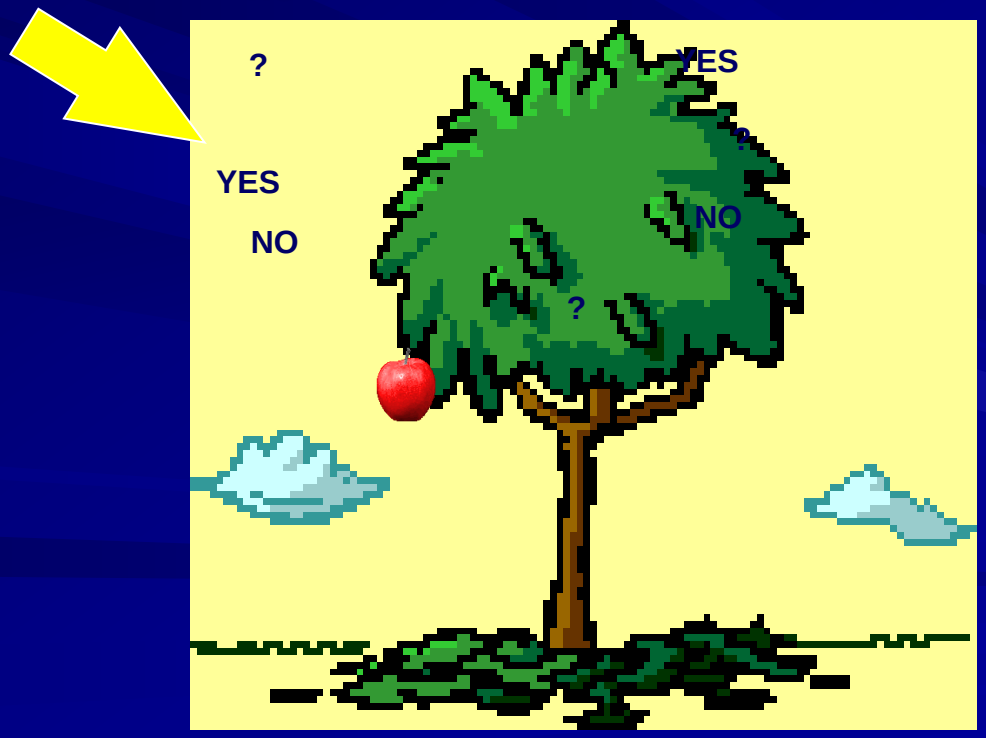
There is no original drug , but there is a leader on the market !

decision tree

The choice of a complex of comparators.

The criteria are provided by WHO-

decision tree



decision tree

Pharmaceutical comparator of known quality , safe and effective

Is the original development known ?

Is it sold in the market of this country ?

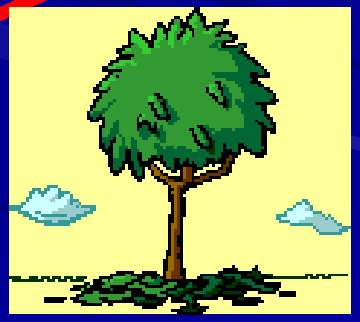
Consider the originator drug as a comparator

Is it possible to get the originator drug : Schedule A

Is it possible to get the original drug ?

Consider the originator drug as a comparator

Consider a drug leader in your market



decision tree

Pharmaceutical Comparator Known

quality , safe and effective

Is it on the B list ?

Is the original development a well-known drug ?

Adhere to normative standard approaches

Consider a drug leader in your market

Is the quality drug market leader known ?

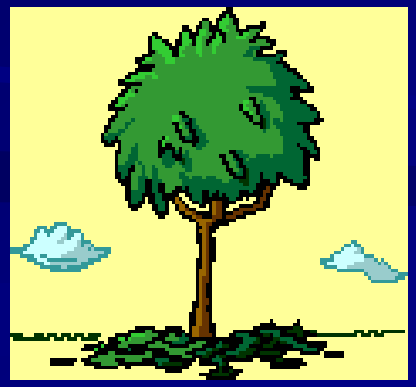
Consider the market leader as a comparator

Conduct comparative normative analyzes across multi -source drug and drug market leader

the results acceptable ?

Consider the market leader as a comparator

Consider another drug market leader



Bio - drift

Documents regulating the possibility of bio - drift compiled for a single market

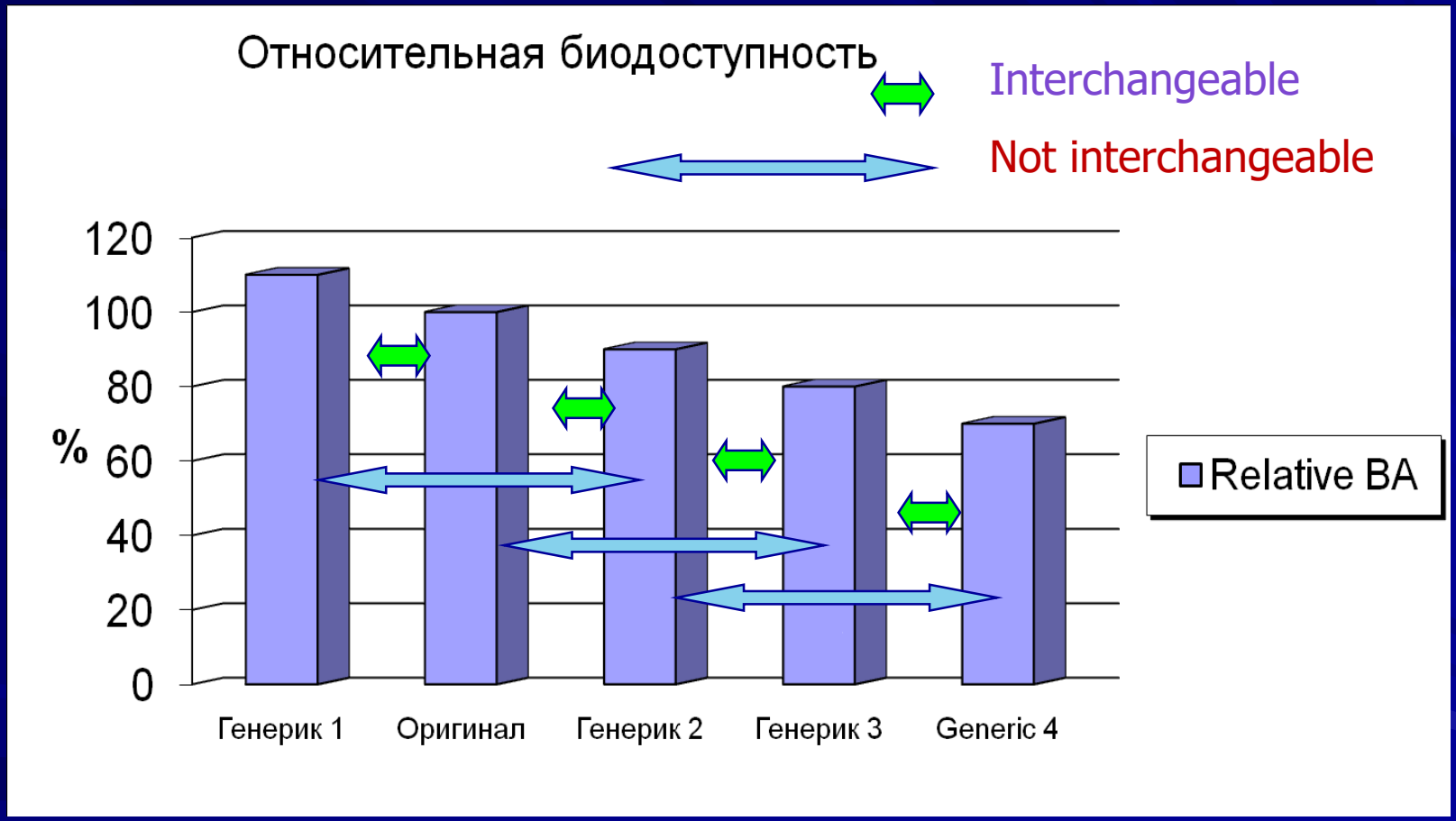
- does not apply to other countries

- Comparator drug in this country can simultaneously be the market leader

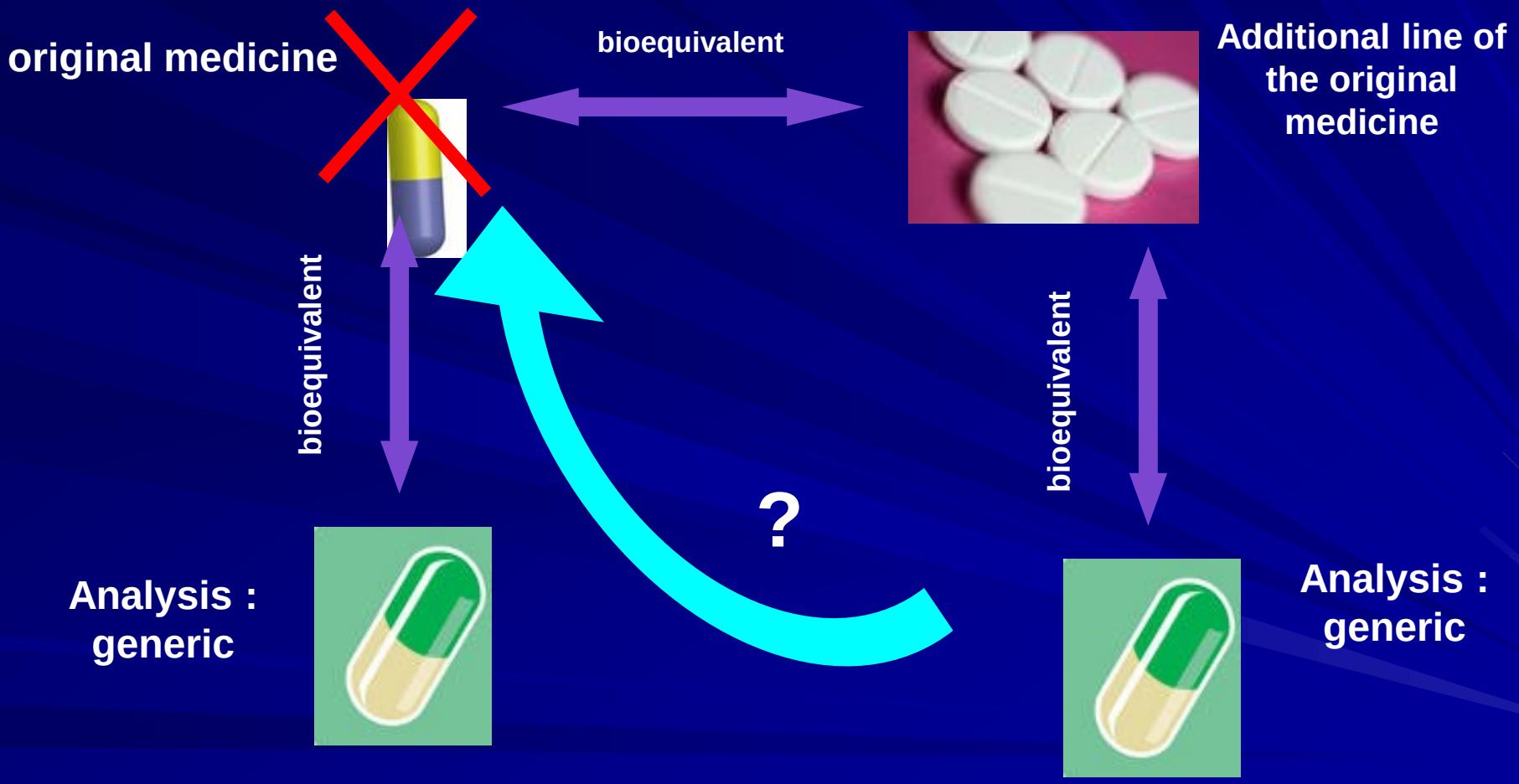
no problem in this market.

but what about the others !?

Bio - drift


Относительная биодоступность
Interchangeable
Not interchangeable
120
100
80
%
60
40
20
0
Генерик 1
Оригинал
Генерик 2
Генерик 3
Generic 4
Relative BA

Bio - original drug drift



Conclusion

- Let quality rule the show

- Comparative drugs are a guarantee of maintaining your quality

- Don't fall into bio - drift

Biopreparation - a biological drug

biological substance -

produced or released from a biological source

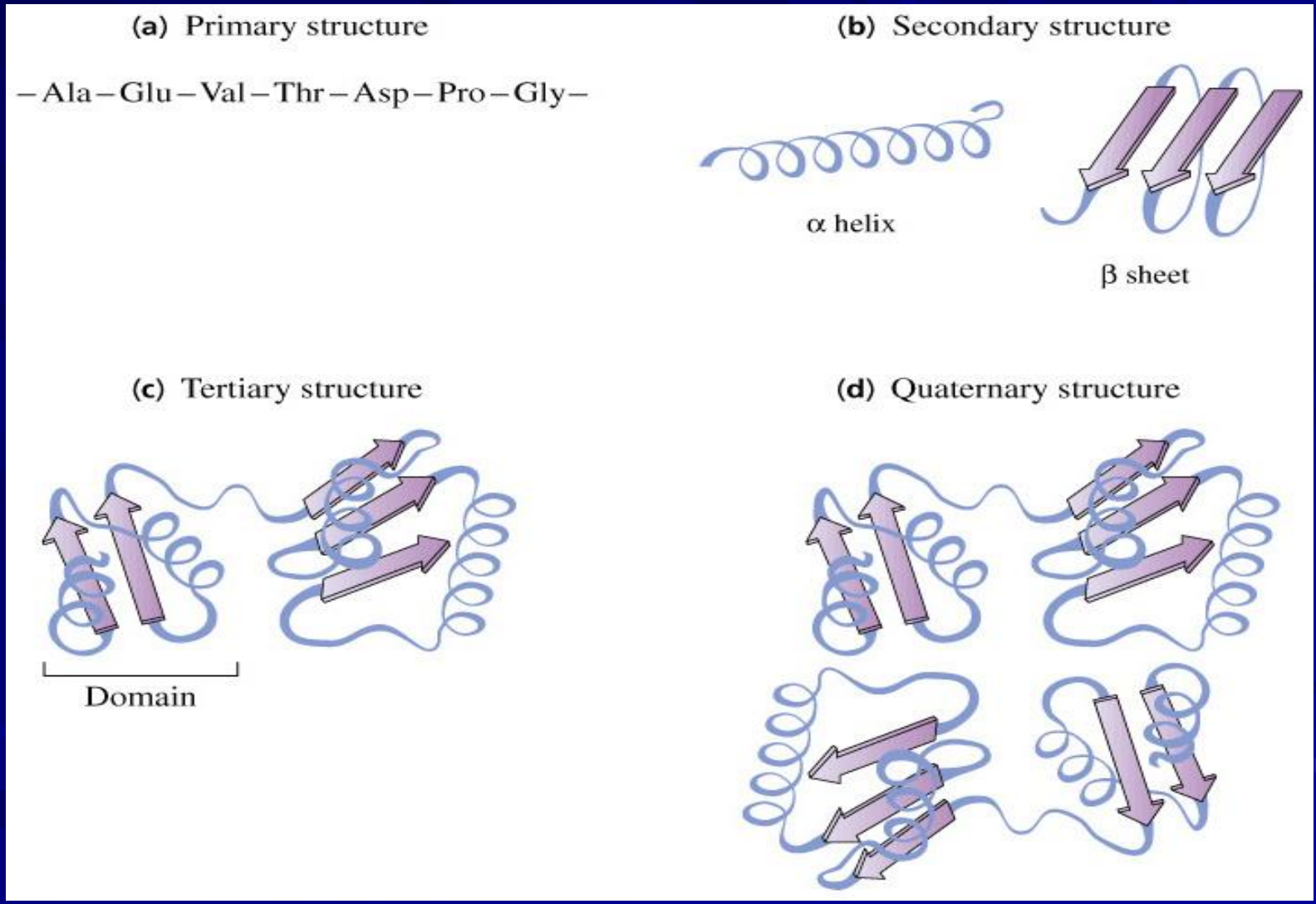
- **immunobiological drugs;**
- **medicinal products produced by biotechnological processes:**
  - **recombinant DNA technology;**
  - **controlled expression of genes encoding the production of biologically active proteins,**
  - **hybridoma and monoclonal antibody methods**
- **gene therapy and somatotherapy drugs**

How do biologics differ from low molecular weight drugs?

- molecular weight
- structure complexity
- characteristics:
  - structural and physico-chemical properties
  - degree of protein purification
  - biological activity
- stability
- immunogenicity

Crommelin DJA , et al. Int J Pharm 2003;266:3-16.

protein structure

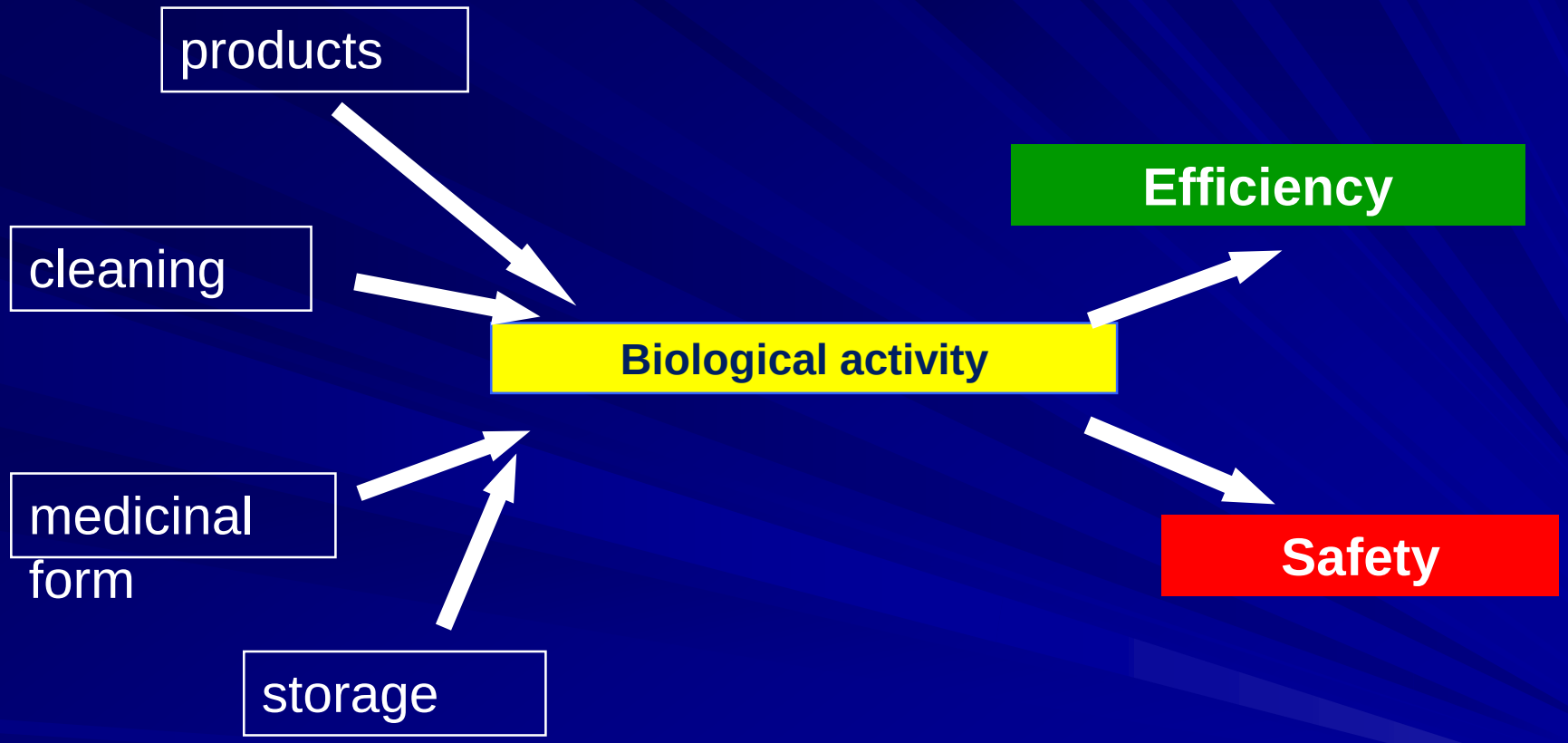


Horton H.R., et al. Principles of Biochemistry. 3rd ed. 2002.

Stages of the production process of biological products

1. **Accumulation of cell mass**
2. **Creation of a cell bank**
3. **Protein production**
4. **Protein Purification**
5. **Analysis of the quality of the resulting drug**
6. **Creating a dosage form**
7. **Storage and transportation**

Each stage can have a significant impact on the quality of the resulting drug.



Summary : **Biologicals are significantly different from small molecular weight drugs**

Summary: Biologicals are significantly different from low molecular weight drugs

- The production process of biologics or their biosimilars is much more complicated than that of conventional drugs or their generics
- Any minor change in production technology can significantly affect the clinical efficacy and safety of the drug.
- The production of biological products is a very expensive and lengthy (8-9 months) process.

What's in a name?

Biotech drugs:
- **recombinant DNA technology;**
- **controlled expression of genes,**
- **methods of hybridomas and monoclonal antibodies**

Generic -

an exact chemical and therapeutic copy of a low molecular weight drug whose patent has expired

biosimilar

"Biotechnological medical product similar to the first produced (original) drug and submitted for registration after the expiration of the patent of the original drug"

EMEA

WORLD PHARMACEUTICAL MARKET

From an economic point of view, the drug market is one of the largest consumer markets in the world.

Global pharmaceutical sales are estimated at US$1.25 trillion in 2019, which is more than the annual volume of crude oil exports of about US$1 trillion over the same period.

Over the past two decades, the global pharmaceutical market has been characterized by continuous progressive growth dynamics.

Large transnational corporations play a key role in the global pharmaceutical market .

According to the analytical agency Evaluate Pharma , only the top 15 pharma corporations accounted for more than US$500 billion

Medicines are one of the **world's most important exports, and the pharmaceutical industry is highly export-oriented** .

The volume of world exports of **pharmaceutical products in 2019 amounted to US$392.9 billion.**

The main exporting countries of these high-tech products are the **leading technologically developed countries** (see next slide)

Top 15 main pharmaceutical exporting countries in 2019

Rating	Country	Export volume, US $ billion	Export share
one	**Germany**	**56.9**	**14.5%**
2	**Switzerland**	**47.8**	**12.2%**
3	**Netherlands**	**31.1**	**7.9%**
four	**Belgium**	**29.0**	**7.4%**
5	**France**	**26.6**	**6.8**
6	**Italy**	**24.8**	**6.3%**
7	**USA**	**24.3**	**6.2%**
eight	**Great Britain**	**18.3**	**4.7%**
9	**Ireland**	**17.9**	**4.6%**
ten	**Denmark**	**15.5**	**4.0%**
eleven	**India**	**14.8**	**3.8%**
12	**Spain**	**10.1**	**2.6%**
13	**Sweden**	**8.2**	**2.1%**
fourteen	**Canada**	**7.5**	**1.9%**
fifteen	**Austria**	**5.8**	**1.5%**

Top 15 main pharmaceutical importing countries in 2019

Rating	Country	Import volume, US $ billion	Import share
one	USA	78.9	18.7%
2	Germany	30.9	7.3%
3	Belgium	24.0	5.7%
four	China	21.5	5.1%
5	Switzerland	21.3	5%
6	Great Britain	18.8	4.5%
7	Netherlands	17.5	4.2%
eight	Italy	17.3	4.1%
9	Japan	17.0	four%
ten	France	15.8	3.8%
eleven	Spain	11.0	2.6%
12	Russia	10.2	2.4%
13	Canada	8.3	2%
fourteen	Australia	5.3	1.3%
fifteen	Poland	5.2	1.2%

It is noteworthy that some of the leading exporting countries can simultaneously be the world's key importers of pharmaceutical products .

Russia is one of the world's largest drug importers, ranking 12th in this ranking with US $10.2 billion in imports in 2019.

Key figures and facts

- **US$1.25 trillion: global pharmaceutical sales in 2019** (compared to about US$1.0 trillion in annual crude oil exports in 2019).
- **• US$11.1 billion: 2019 sales of the cancer immunotherapy pembrolizumab (Keytrude) from Merck &** Co and Otsuka Holdings , the current world record for pharmaceutical blockbusters.
- **The total sales of top 10 pharmaceuticals exceeded US$50 billion in 2019.**
- **• US $74 billion: the size of the largest deal between pharmaceutical companies in 2019: the purchase of Celgene by Bristol- Myers Corporation Squibb .**
- **• US$6.9 billion: the size of the largest licensing deal in the global pharmaceutical market in 2019: AstraZeneca's purchase of an innovative anticancer drug candidate in phase 3 clinical trials from Daiichi Sankyo .**
- **• US$392.9 billion: global pharmaceutical exports. The main exporters are the leading technologically advanced countries**

CONCLUSION ON THE ANALYSIS OF THE MODERN PHARMACEUTICAL MARKET

The main conclusion from the presented data is that the **modern global pharmaceutical market is one of the largest consumer markets on the planet, with high positive growth dynamics.**

It is dominated by powerful transnational giant corporations, multi -billion dollar mega-transactions take place, and annual sales of even individual blockbuster drug products can be comparable to the budgets of not the smallest states.

The pharmaceutical market is largely export-oriented , and current trends indicate not only its large-scale economic, but also its growing **political role in the modern world.**

Innovative drug development in the world

Yes, stability and education are very important, I won't argue with that, But the real engine of progress is innovation. Bill Gates

- **total global pharmaceutical market sales in 2019 (US$1.25 trillion), 48.7% came from the North American market** , which is unquestionably dominated by the **US , according to** Statista , an analytics group .
- For this reason, most of **the largest pharmaceutical manufacturers strive to bring their drugs to the US market** , which makes this market not only the largest in the world, but also the most **innovative.**
- Given these circumstances, **US FDA statistics are often regarded as the most representative of the** entire global pharmaceutical industry.
- Based on its analysis, it is possible to draw quite adequate conclusions about the current status and development trends **of the entire global innovative pharmaceutical industry.**

The number of new drugs approved annually by the FDA is quite conservative and is usually kept within the 20-40 range.

Only in recent years, there has been a noticeable **upward trend in this quantitative indicator, which may be due to a number of factors, in particular, the active introduction of new technologies that increase the efficiency of drug development, as well as the outstripping growth in the number of new biotechnological drugs.**

Attention is drawn to the fact that since 2014 there has been a noticeable upward trend in the number of biotechnological preparations brought to the market.

The increase in the relative share of biotechnological drugs relative to traditional chemical-pharmaceuticals is a characteristic feature of the modern development of the global pharmaceutical industry.

In accordance with the modern glossary of terms in medicinal chemistry, “ first-in-class ” is the first approved drug compound in a number of drugs that act on a biotarget , for which no drugs were known to act on it until now. »

In other words, this is a drug compound with the highest degree of innovation and potentially giving rise to a new class of drugs by the type of target-oriented action.

What can be said about the innovativeness of drugs approved in 2019 by the US FDA? The proportion of these highly innovative drugs brought to the US market each year is quite high, averaging 36 % between 2013 and 2019. Obviously, this is due to the maximum margin that these highly innovative drugs are able to provide in the modern world market.

Global Pharmaceutical Industry Spending in 2020 by Key Therapeutic Categories

Therapeutic category	Costs at the stage of clinical development, billion US$
Oncology	82.0
central nervous system	26.5
Immunomodulators	15.9
Musculoskeletal system	14.0
The cardiovascular system	13.8
Digestive system	12.7
Infectious diseases	11.9
Circulation	8.4
Respiratory system	7.3
Endocrine system	7.2
Dermatology	6.9
sense organs	4.4
Gynecology, urology	2.5
Other	5.8
Total 219.3	

Number of new drug compounds approved by the US FDA in 2016-2019, as well as unit development costs per drug compound

Year	2016	2017	2018	2019
Number of new drug compounds	27	55	62	53
Cost per connection, US$ bn	5.9	3.1	2.9	3.5

- **The question of the cost of creating drugs is currently the subject of lively discussions.**
- **The development and introduction of innovative medicines to the world market is an extremely expensive and risky business.** But it is no less obvious that this activity is quite justified from an investment point of view.
- **At the development stage, sometimes long before the drug product actually enters the market, drug candidates are valuable targets for commercialization**, the cost of which can reach billions of US dollars.

Key figures and facts

• **US $186 billion : The amount that global pharmaceutical companies spent on drug development in 2019. This is approximately 15% of the total sales of pharmaceutical products on the world market.**

• **4.2% is the average annual growth in R&D spending in the global pharmaceutical industry from 2012 to 2019 . In the period from 2020 to 2026, this indicator is projected at 3.2%.**

• **36% share of highly innovative "first-in-class" drugs introduced annually to the US market (average for 2013-2019) .**

• **16.2 thousand drug candidates were studied in the world in 2019 , including 8.5 thousand drugs in the preclinical phase and 6.0 thousand in the clinical phases of research.**

Key figures and facts

- Between 20 and 80 projects in phase II clinical trials, as well as 15–30 projects in phase III clinical trials, were in the innovation portfolios of the top 10 global pharmaceutical developers in 2018.

- US $7.832 billion estimated market value (NPV) of Tirzepatide drug candidate (Eli Lilly), which is in phase III clinical trials.

- **US$58 billion - the total estimated value (NPV) of the top 10 medicines in development in 2020;**

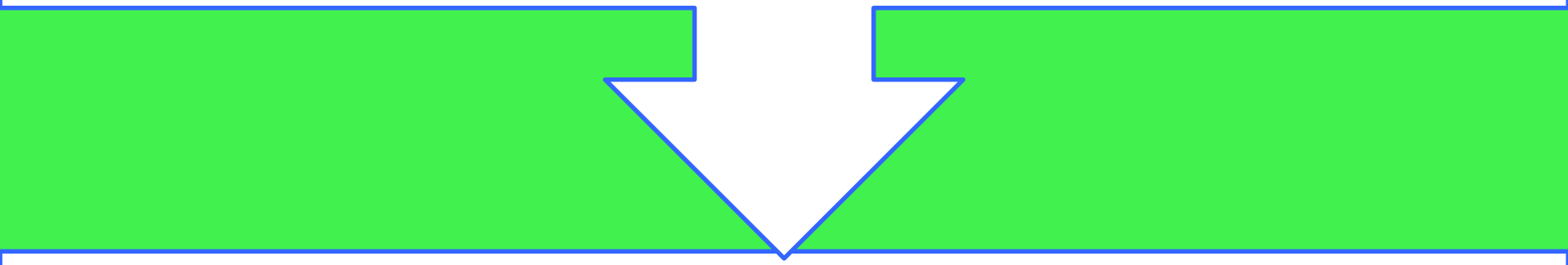
the estimated cost of all drug candidates being developed in the world is US$565 billion.

- **46% of drug development companies were located in the US in 2019.**

Top 10 global pharma companies by sales volume in 2020 (estimated as of mid-2020)

	Company	Sales in 2020 (US$ billion)
one	**Roche**	**48.6**
2	**Johnson & Johnson**	**43.7**
3	**AbbVie**	**42.8**
four	**Bristol-Myers Squibb**	**41.0**
5	**Pfizer**	**39.9**
6	**Merck & Co**	**39.6**
7	**Novartis**	**39.5**
eight	**Sanofi**	**31.7**
9	**GlaxoSmithKline**	**1.7**
ten	**Takeda**	**28.8**

blockbuster drugs can be very significant –



at the level of US$8–10 billion , which is comparable to the state budgets of such countries as Lebanon, Azerbaijan, Iceland, Latvia, and Estonia.

Top 10 leading drugs in global sales in 2019

Leading among them is the antitumor **immunotherapeutic agent pembrolizumab (Keytrude) from Merck & Co and Otsuka . Holdings with annual sales of over US$11.1 billion.**

The two following drugs, the **cancer immunotherapy nivolumab (Opdivo) and the anticoagulant apixaban (Eliquis), each sold approximately US$8 billion.**

The total sales of this "magnificent ten" exceeded US $50 billion in 2019.

Top 10 leading drugs in global sales in 2019

- **1 . Keytruda (pembrolizumab),** Merck & Co + Otsuka Holdings , Oncology - (immunotherapy)
- **2. Opdivo (nivolumab)** Bristol-Myers Squibb + Ono Pharmaceutical , Oncology - (Immunotherapy)
- **3. Eliquis (apixaban),** Bristol-Myers Squibb , Anticoagulants
- **4. Biktarvy (bictegravir sodium; emtricitabine; tenofovir alafenamide fumarate)** Gilead Sciences , HIV
- **5. Imbruvica (ibrutinib)** , AbbVie + J&J , Oncology (chronic lymphocytic leukemia, macroglobulinemia Waldenström)

Top 10 leading drugs in global sales in 2019

- 6. **Ibrance (palbociclib)** Pfizer , Oncology (HR+/HER2 negative breast cancer subtype)
- 7. **Tagrisso , (osimertinib mesylate (,** AstraZeneca , Oncology (non-small cell lung cancer)
- 8 **. Dupixent (dupilumab**), Sanofi , Atopic dermatitis, asthma
- 9. **Trikafta (elexacaftor ; ivacaftor; tezacaftor),** Vertex Pharmaceuticals , Cystic fibrosis
- 10. **Ozempic (semaglutide),** Novo Nordisk , Diabetes

Individual therapeutic areas have different "weight" from an economic point of view.

In Table. (next slide) presents global drug sales in key therapeutic areas (forecasts for 2020).

The largest sales of US $157 billion are provided by anticancer drugs, which have an almost twofold advantage over the next group of drugs .

This is followed by a rather compact group of medicines in four therapeutic areas (CNS, musculoskeletal, endocrine and circulatory diseases) with sales of US$60–80 billion per year.

Global drug sales in 2020 in major therapeutic areas

	Therapeutic area	Sales in 2020 (US $ billion)
one	**Oncological diseases**	**157.0 2**
2	**Pathologies of the central nervous system**	**82.7**
3	**Diseases of the musculoskeletal system**	**71.6**
four	**Endocrine diseases**	**64.3**
5	**Diseases of the circulatory system**	**63.0**
	Total	**303.7**

These differences in sales volumes are due to a number of factors, of which the most important are:

the severity of the disease, both in terms of health care and other socio-economic and even political consequences;

features of the technological cycle of drug development in this therapeutic area;

availability of solvent demand in the target market segment;

regulatory requirements, etc.

FORECASTS OF DEVELOPMENT OF THE WORLD PHARMACEUTICAL MARKET

Specialists of the analytical company "IQVIA Institute for human Data Science " predict a slowdown in the growth rate of the global pharmaceutical market of the

Moreover, such a picture is expected both in developed and developing pharmaceutical markets .

What factors will act as drivers, and what, on the contrary, will determine the containment of an increase in the cost of medicines in the context of certain markets?

- **At the end of 2018, global drug spending amounted to $1.2 trillion . USA.**
- **By 2023, this figure may reach $1.5 trillion .**
- **Average annual growth rates (compound annual growth rates - CAGR) of the global pharmaceutical market during the forecast period is expected to be 3-6%.**
- **For comparison, the CAGR for the previous 5 years (2016-2018) was at 6.3%.**

(Report " The Global use of Medicine in 2019 and Outlook to 2023" analytical company IQVIA Institute for human Data Science »)

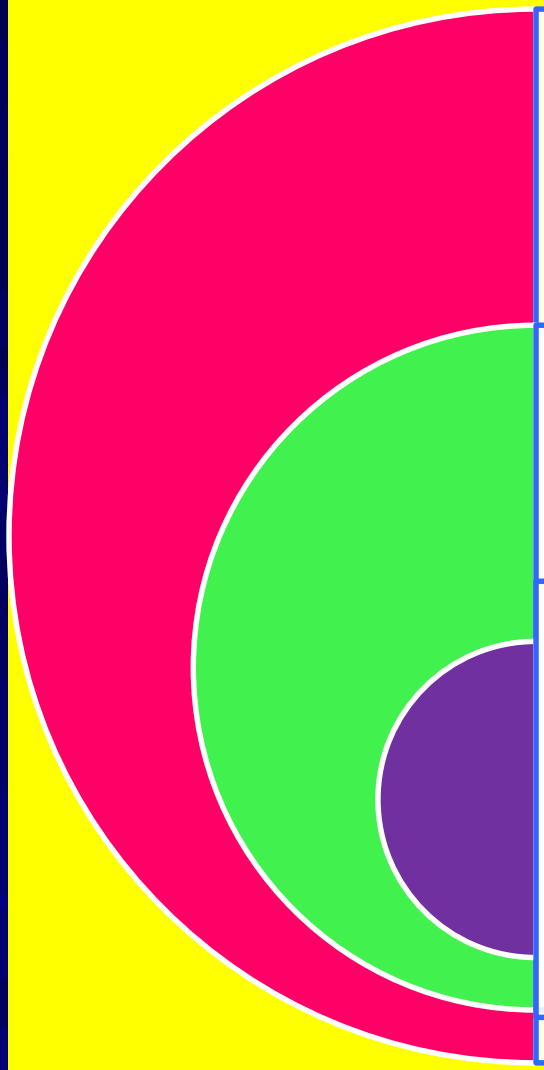
The top 4 best-selling medicines in the global market in 2024 are expected to form

- **Humira,**
- **keytruda ,**
- **Revlimid,**
- **Opdivo**

The key growth drivers of the global pharmaceutical market remain

- USA,

- a group of fast-growing pharmaceutical markets (pharmerging markets).



Factors hindering market growth include the expiration of patent protection for some original drugs and the emergence of new generics.

The main drivers of growth are a significant increase in the number of launches of new drugs.

In previous years, the prices of innovative drugs (announced at the time of introduction to the market) were of great concern to regulators and the public in the United States , especially given the shift in development towards such areas as orphan and oncological diseases.

During the forecast period (2019-2023), the following factors will act as deterrents in terms of pricing for new drugs:

- price competition between innovative brands;

- conducting an independent review of prices by bodies such as, for example, the Institute of Clinical and Economic Expertise (Institute for Clinical and economic Review -ICER);

- there is little chance that in the next 5 years there will be a breakthrough in innovation at the same level as the recent launch of drugs for CAR-T cell therapy, immune checkpoint inhibitors, etc.

Measures to contain the growth in drug costs in EU member states are bearing fruit.

In general, for the top 5 largest pharmaceutical markets in the EU (Great Britain, Germany, Italy, France, Spain), the average annual growth rate is predicted to slow down to 1-4% in the period 2019-2023. (for comparison, over the previous 5 years, the CAGR was 4.7%)

Japan is characterized by the

Ministry of Health and Welfare. of Labor Health and Welfare).

Prices are reviewed every 2 years.

Greater savings from the use of generics are expected to allow reallocation of costs towards drugs for the treatment of chronic or rare diseases, which are expensive (specialty medicines), without a significant impact on the budget.

According to forecasts, the share of this group of drugs in the total structure of expenditures on medicines in Japan for 2019–2023 is can increase from 30 to 41%.

Shift in spending towards specialty medicines , as well as an aging population, are expected to be the main factors driving the growth of the Japanese

Despite a decline in the overall population, high per capita drug consumption among older patients is mitigating the deterrent effect of increased generic competition .

RAPIDLY DEVELOPING PHARMACEUTICAL MARKETS

For the group of fast-growing pharmaceutical markets , CAGR is expected to slow down to 5-8% during the forecast period.

For comparison, this figure for the previous 5 years was 9.3%.

Such a forecast of analysts is connected, among other things, with expectations that the contribution of factors such as economic growth and expanding the population's access to healthcare services will not be as significant as in the period 2014–2018.

During the forecast period (2019-2023), growth in pharmerging markets will be driven by an increase in per capita consumption of medicines and, in some countries, an increase in the consumption of innovative medicines.

Turkey, Egypt and Pakistan will demonstrate the highest CAGR.

The largest market in the pharmerging group markets (and second in the world after the US) is China.

At the end of 2018, drug spending in this country reached $137 billion. And by 2023, the volume of the Chinese pharmaceutical market may reach 140-170 billion dollars.

The growth rate of the Chinese pharmaceutical market is also slowing down, and quite significantly.

According to CAGR forecasts during 2019-2023 this figure will be 3-6%. For comparison, in the period 2008-2013. the average annual growth rate was at the level of 19%.

R&D

The number of R&D projects is growing rapidly, with the number of successful ones breaking previous records.

Over the next 5 years (until 2024), even more new drugs are expected to be launched than was recorded in previous years .

Thus, according to forecasts, an average of 54 new active substances will be introduced to the market annually (new active substance - NAS). At the same time 2 / 3 launches will be specialty category medicines .

R&D. COMPETITION FROM GENERIC AND BIOSIMILARS

By 2023, 18 of the current top 20 best-selling drug brands are expected to face competition from generics and biosimilars .

In 5 years, the level of competition from biosimilars in the market of biological products will be almost 3 times higher than now.

Moreover, on European markets, where this segment is more mature, competition from biosimilars will affect earlier and more significantly.

In 2018, a positive recommendation from the European Medicines Agency (European Medicines Agency - EMA) received a biosimilar adalimumab (originator - Humira)

In 2023 biosimilar Adalimumab may also enter the US market, which, according to analysts, will be the biggest “event” in the biosimilar market in the next 5 years.

R&D COSTS

At the end of 2017, the volume of global R&D spending by pharmaceutical and biotech companies amounted to $165 billion, an increase of 3.9% compared to the previous year.

During the forecast period (2018-2024), this indicator will increase by an average of 3.1% annually. This is slightly lower compared to the 3.6% CAGR during 2010-2017.

R&D COSTS

Analysts at Evaluate Pharma suggest that this may indicate an increase in the efficiency of R&D or the distribution of less revenue to replenish development.

It should be noted that the pharmaceutical industry is increasingly focusing on the use of Big Data and predictive analytics in order to improve the efficiency of R&D and develop development in accordance with consumer demand.

Roche is expected to lead in 2024 in R&D spending with $11.7 billion. (table).

Second place will be taken by Johnson & Johnson , ahead of Novartis .

Celgene is expected to show the most intensive growth with an average annual growth rate of R&D expenses in 2018-2024. at the level of 6%.

Top 15 pharmaceutical companies by R&D spending in 2024

No. p / p	Company	R&D expenses in 2017, USD bln USA	Projected R&D spending in 2024, billion dollars USA	Average annual growth rate, %
one	Roche	9.2	11.7	3
2	Johnson & Johnson	8.4	10.0	3
3	Novartis	7.8	9.0	2
four	Merck & Co	7.6	8.3	one
5	Sanofi	6.2	8.2	four
6	Pfizer	7.6	8.0	one
7	GlaxoSmithKline	5.0	6.2	3
eight	AstraZeneca	5.4	6.1	2
9	AbbVie	4.8	5.9	3
ten	Bristol-Myers Squibb	4.8	5.7	2
eleven	Eli Lilly	5.0	5.4	one
12	Celgene	3.0	4.5	6
13	Amgen	3.5	4.1	2
fourteen	Boehringer Ingelheim	3.1	4.1	four
fifteen	Bayer	3.3	4.0	3

MOST PROMISING R&D PROJECTS

The combination of VX-659 + tezacaftor + ivacaftor (Vertex) is expected to be the most promising net present value (Net present value - NPV) 13 billion dollars.

(table).

NPV shows the amount of funds that an investor expects to receive from the project after the cash inflows pay off its initial investment and the periodic cash outflows associated with the implementation of the project.

AbbVie and Biogen , upadacitinib and aducanumab , will take second and third place .

Top 10 most promising drugs by sales volume on the global market in monetary terms in 2024

No. p / p	A drug	Company	Status	Pharmacological group	Sales forecast for 2024, mln USD USA
one	VX-659 + tezacaftor + ivacaftor	Vertex Pharmaceuticals	Phase III clinical trials	Cystic fibrosis transmembrane regulator	3485
2	Upadacitinib	AbbVie	Phase III clinical trials	Janus kinase 1 (JAK1) inhibitor	2570
3	Aducanumab	Biogen	Phase III clinical trials	Monoclonal antibody targeting aggregated forms of beta-amyloid	2245
four	Brolucizumab	Novartis	Phase III clinical trials	Humanized antibody fragment with high affinity for all isomorphs of vascular endothelial growth factor A (VEGF-A)	1800
5	GSK2857916	GlaxoSmithKline	Phase III clinical trials	Monoclonal antibody targeting B cell maturation antigen (BCMA)	1367

Leaders and drivers: development of the global pharmaceutical industry until 2024

Analytical company " Evaluate " Pharma has updated its forecast for the development of the global drug market, taking into account the latest trends.

In 2018, the U.S. Food and Drug Administration (Food and drug Administration - FDA) approved 59 new drugs, breaking the previous year's record (42 of 59 received regulatory approval in the US earlier than in other countries).

More than half of them are for the treatment of rare diseases.

RISK AND REWARD

According to the forecast in 2019–2024. In the risk zone associated with the expiration of the patent protection of some medicines and increased competitive pressure from generics or biosimilars , there will be drugs with a total global sales of 198 billion dollars.

This could result in a $114 billion loss in profits from the sale of such medicines. during this period.

Recently, the first gene therapy for the treatment of children under 2 years of age with spinal muscular amyotrophy , Zolgensma , received market approval .

The cost of 1 bottle of the drug is estimated at a record amount - 2 million dollars.

But even with high price pressures, the huge unmet need for innovative therapies is likely to continue to drive R&D and sales growth.

Increasingly, modern technologies are used in the healthcare system, providing new opportunities for the development of the pharmaceutical industry , for example:

usage:

- evidence obtained in real clinical practice (Real World Evidence - R.W.E.)

- machine learning methods.

It is suggested that a data-centric approach can help reduce R&D costs and failure rates.

New opportunities are constantly emerging, new approaches in research, including whole genome sequencing and wearable devices, ushering in a new era of healthcare.

Will Pharma be able to take advantage of this “wave of innovation” and achieve the projected growth?

The world market of wearable technologies can reach 54 billion dollars. USA in 2023

According to GlobalData estimates , in 2018 the wearable technology market was worth almost $23 billion. USA.

Over the next 5 years, according to analysts, this indicator will increase by an average of 19% annually, and by the end of 2023 it may reach $54 billion.

The results of the study, which are reflected in the report " Wearable technology in Healthcare - Thematic Research " show that healthcare organizations are prioritizing investments in wearable technology.

The potential for using wearable technologies in this area is quite large.

In the near future, specialists from the analytical company GlobalData predict a significant transition: from the use of digital devices for tracking and storing data in the field of fitness and health control to the use of technologies for the purpose of remote monitoring of patients.

GlobalData analysts suggest that wearable devices have the potential to transform the healthcare industry with the ability to remotely measure and analyze patient health data in real time, helping to move towards a preventive healthcare model , as well as optimize costs.

This is especially true against the background of such problems as rising health care costs, an aging population, and an increase in the burden of chronic diseases.

The ability to remotely collect a variety of health data will speed up the development of new medicines without sacrificing efficacy or safety.

(Data of expert analysts)

PHARMACEUTICAL MARKET OF THE RUSSIAN FEDERATION

Russian pharmaceutical market

The Ministry of Industry and Trade has developed the Strategy for the Development of the Pharmaceutical Industry until 2030 (Pharma-2030).

The tasks prescribed in this document are more ambitious. Among them:

- strengthening the state policy to support innovation,

- development of local competencies in the chemical and biological synthesis of active substances and pharmaceutical substances.

Russian pharmaceutical market

One of the directions of development should be export. By 2030, the export of Russian medicines should grow 5 times.

For medical products, the main goal is still the growth of domestic production: by 2030, all critical products should be produced in Russia. Production within the country should grow by 3.5 times compared to 2017 - up to 200 billion rubles. by 2030

The Russian Ministry of Finance in 2019 reduced spending in several areas, including healthcare.

459.5 billion rubles were allocated for it, while in 2018 the budget for this item was 479.7 billion.

Expenses in 2020 should amount to 563.2 billion rubles, in 2021 - 572.5.

The health care budget for 2019 was focused on improving the availability and quality of medical care.

For this, old medical institutions were reconstructed and new ones were built.

SOME OF THE MOST IMPORTANT DATA FOR THE DEVELOPMENT OF THE RUSSIAN PHARMACEUTICAL MARKET IN 2018

The main result of 2018 for the Russian pharmaceutical community was the minimal market growth.

The retail pharmacy market accounts for more than two-thirds of the entire pharmaceutical market in Russia, and the lack of growth in household income has a negative impact on it.

SOME OF THE MOST IMPORTANT DATA FOR THE DEVELOPMENT OF THE RUSSIAN PHARMACEUTICAL MARKET

The main discussion topic of the year was the "digital future" of the pharmaceutical industry .

Experts give the most favorable forecast: despite the presence of constraining factors, the main of which is the unresolved issue of state regulation of online sales of medicines, there are opportunities for explosive growth in the e-commerce market .

Overview of the pharmaceutical market of the Russian Federation: for 8 months of 2020

Imports of medicines are falling

Over the eight months of 2020, the supply of imported medicines to Russia decreased by a third. The reason for this negative dynamics was the labeling of drugs, which started in July (analytical company RNC Pharma).

Analysts note that the determining factor in the dynamics of deliveries this year was not the demand for certain drugs, but the administrative procedures associated with the introduction of the drug labeling system.

That is why the import of foreign medicines peaked in June 2020, the last month before the start of mandatory labeling.

OVERVIEW OF THE RUSSIAN PHARMACEUTICAL MARKET

Over the past 10 years, all the largest transnational pharmaceutical corporations have built their factories in Russia.

At present, already 80% of the range of vital and essential drugs can be replaced by analogues from domestic manufacturers.

Import substitution is especially fast in hospital purchases, where the state purposefully gives preference to Russian suppliers.

All routine vaccinations are now made on the basis of domestic vaccines.

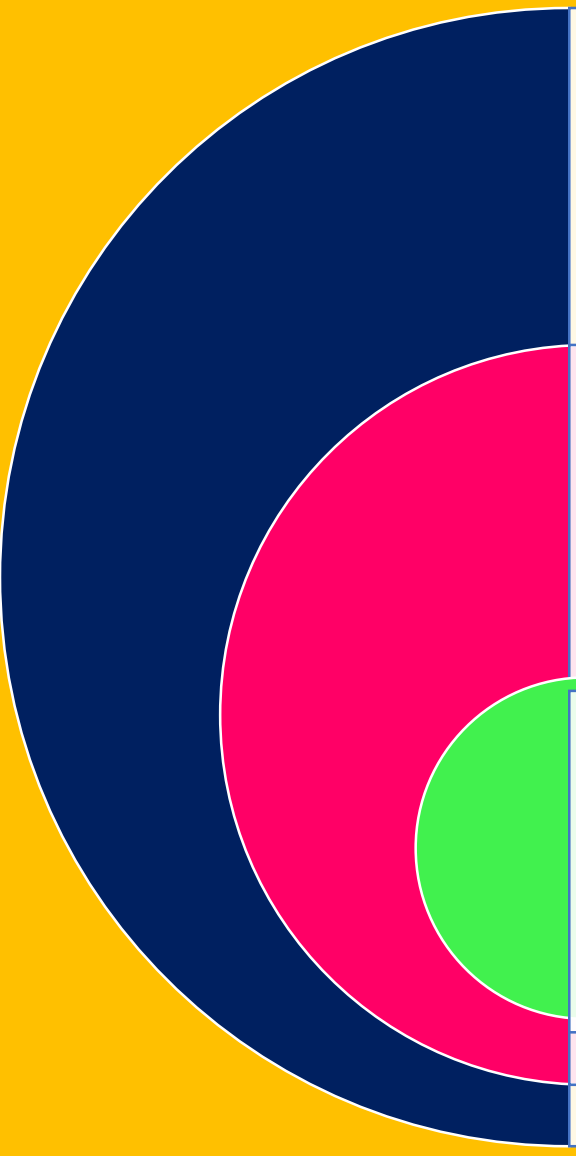
OVERVIEW OF THE RUSSIAN PHARMACEUTICAL MARKET

Domestic oncological drugs and drugs for rare diseases have appeared - for example, an analogue of Soliris , one of the most expensive drugs, the annual course of which in the United States costs more than 600 thousand dollars. The domestic drug is a quarter cheaper and is produced in a full cycle from Russian raw materials.

Domestic medicines are less dependent on dollar or euro fluctuations. During the coronacrisis , when the pandemic was superimposed on a sharp depreciation of the ruble, the price tags in pharmacies would have grown noticeably stronger if Russia had been dependent on drug imports in the same volumes.

The domestic industry began to earn more and then invest what they earned in the creation of modern medicines and industries that produce pharmaceutical substances. Knowledge and experience lost in the 1990s are being accumulated.

PANDEMIC TEST



According to Rosstat, in the first half of 2020, the production of medicines and medical supplies increased by 16% compared to the same period last year. At the same time, the capacities of factories producing antiviral agents were rapidly increased.

As of October 2020, 48 antiviral drugs are produced in Russia, including flu and SARS vaccines.

Domestic factories can produce them in the required volume for the needs of the country and will remain for export supplies.

It is especially important that in the 5 years preceding the epidemic, a huge step forward was made in the production of vaccines. According to the Ministry of Industry and Trade, in real terms it increased from 39% to 89%.

PANDEMIC TEST

Problem: Many types of substances for vaccines and medicines are still imported.

But there is progress here too: the range of domestic substances has increased by 60%.

During the peak of the coronavirus pandemic, some substances became scarce.

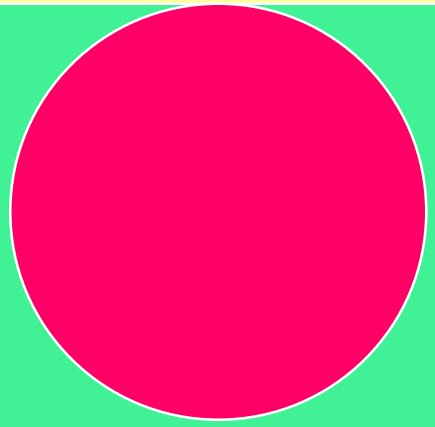
PANDEMIC TEST

The active substance for one antimalarial drug used in the treatment of COVID-19 has risen in price by 10 times! - illustrates the importance of developing domestic synthesis of pharmaceutical raw materials

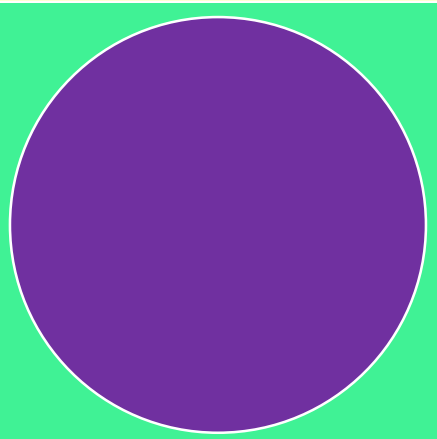
Domestic industry can and must meet the needs of healthcare with the most important modern drugs and substances for their production.

Perspective tasks are the expansion of the export of Russian medicines. This will make the domestic pharmaceutical industry truly competitive and efficient

Focus on novelties



In sales ratings, (according to analysts), foreign companies are still leading.



In the top ten companies whose brands provide the largest cash flow to pharmacies, there is only one Russian by origin - OTCPharm .

Why is this happening?

- Foreign drugs are more modern and more expensive.
- Most Russian factories produce cheap drugs created back in Soviet times.
- At the same time, the number of new drugs, the production of which is mastered in Russia, is constantly growing.
- Of the 324 brands that went on sale in 2019, 77% were offered by domestic companies.

Russian Pharmaceutical Market 2021: Impact of the Pandemic and Development Strategies

Growth rate of the pharmaceutical market in 2020:

The market volume **reached 2,040 billion rubles. against 1,858 billion rubles. a year earlier, and sales revenue doubled.**

The final results of the industry were significantly affected by **the consumer's reaction to the spread of COVID-19 (** by January 2021, the number of pharmacy outlets increased by 1.2 thousand)

Russian pharmaceutical industry during and after the pandemic

During 2020-2021, the whole world is following the news related to the spread of coronavirus infection :

the number of sick people,

treatment methods,

restrictive measures and their impact on the economy,

second and third wave

vaccine development,

drug development,

number of people vaccinated, etc.

In 2020, the profit of the Russian pharmaceutical industry from sales almost doubled - from 126.3 billion to 244.4 billion rubles.

This growth was due to trends that started in 2019 and intensified last year.

Among them **are higher drug prices and a shift in focus to more expensive medicines, driven in part by demand for larger packages.**

Panic caused by quarantine has led to the fact that in order to save money, the population began to stock up on medicines, preferring large packages due to the lower unit cost of the medicine.

As a result, sales in physical terms did not grow, but, on the contrary, decreased during the year.

Sales of medicines in 2020 (1)

The Russian pharmaceutical market consists of two main segments:

commercial

state

The consumption of drugs at the expense of the population's own funds remains one of the main **parts of the drug supply of the healthcare system:**

it accounts for **about 64% in monetary terms and almost 85% in packages.**

Sales of medicines in 2020 (2)

Pharmacies, which are just a sales channel, are subject to increased requirements:

at the beginning of 2020, it was expected that the main task of pharmacies would be the timely and "painless" entry into the process of selling labeled medicines from July 1, 2020;

The **spread of the new coronavirus infection has significantly changed the situation in the entire market. And pharmacies faced a new problem: a shortage of some positions in the pharmacy assortment.**

Until 2020, this process was mainly due to economic factors (pricing for drugs from the Vital and Essential Drug List and the impossibility of price indexation; crowding out positions from public procurement , which made it economically unprofitable to sell drugs only in the pharmacy segment).

In 2020, COVID-19 played a prominent role in this "shortage" of medicines, changing consumer demand.

Sales of medicines in 2020 (3)

In 2020, a prominent role in the "deficit" of drugs played COVID-19, under the influence of which changed consumer demand .

Sales of medicines in 2020. Consumer demand and the pandemic (4)

Any new information about the drugs that were included in the list for the treatment or prevention of " coronavirus " led to a rush demand for them and disappearance from pharmacies.

antimalarial drug with the INN " Hydroxychloroquine " was considered promising in the fight against coronavirus . AT As a result, the volume of monthly sales on average almost doubled in April-December compared to the " pre- Covid " level (about 35-40 thousand packs per month instead of 20 thousand in 2019).

One of the symptoms of COVID-19 is an increase in temperature, which is recommended to be "knocked down" with **paracetamol. At its peak, in March-April 2020, the demand for this group of drugs increased by 1.5 times. And in the future, this led to a change in supply and an increase in prices for cheap items: the weighted average cost of a package of medicines with the INN "Paracetamol" increased from 23 rubles in January to 43 rubles in December 2020.**

Sales of medicines in 2020. Consumer demand and the pandemic (5)

In 2020, there was no seasonality or characteristic patterns inherent in the pharmacy market.

Antivirals and antibiotics have become leaders in consumer demand during the "pandemic".

Even in summer, sales in these categories were noticeably higher than in previous years.

Strategy for the development of the domestic pharmaceutical industry until 2030

- The strategy for the development of the domestic pharmaceutical industry in the horizon of 2030 should be innovative import substitution based on the accelerated, effective implementation of promising drug developments, primarily domestic ones .

- The implementation of the proposed stratagem will make it possible to turn Russian Pharma into a strong, independent, nationally oriented player capable of projecting its strength on the global arena

scientific and technological confrontation.

Strategy for the development of the domestic pharmaceutical industry until 2030 (2)

One of the most knowledge-intensive applied areas in which the most modern technologies are accumulated is pharmaceuticals (chemical and biotechnological).

The drug development industry is as innovative as the aerospace industry.

Therefore, this area is one of the main arenas of technological confrontation between the world's largest players in the 21st century, and only a few of the most technologically advanced regions and countries of the world are able to create their own innovative drugs.

DRUG DEVELOPMENT AGAINST COVID-19

The Engelhardt Institute of Molecular Biology of the Russian Academy of Sciences has created a highly effective **drug based on monoclonal antibodies that neutralizes the SARS-CoV-2 coronavirus , including delta and gamma variants** (November,)2021

The high efficiency of the new drug was proved by laboratory tests, including on animals.

Monoclonal antibodies are produced by immune cells derived from a single progenitor plasma cell.

They can be obtained for almost any natural antigen and used later for its detection or purification.

DRUG DEVELOPMENT AGAINST COVID-19

- Pfizer has presented preliminary results of testing a **new antiviral drug, Paxlovid, against SARS-CoV-2 infection.**
- The new drug, called Paxlovid (PAXLOVID), contains two active substances that suppress the reproduction of the virus: a **coronavirus protease inhibitor under the technical name PF-07321332 and its "amplifier" - the well-known antiretroviral drug ritonavir .**
- The drug based on protease inhibitors showed high efficiency: the risk of hospitalization in those taking the pills was reduced by almost 10 times compared with the placebo group.
- **Paxlovid proved to be more effective than MOLNUPIRAVIR from MSD / Merck & Co.**
- The results of the tests have not yet been evaluated by the specialists of the Food and Drug Administration (FDA), which are involved in the registration of drugs in the United States. The company plans to prepare documents as quickly as possible, FDA experts will be able to consider the issue of emergency registration (EUA), apparently within the next month or two.

DRUG DEVELOPMENT AGAINST COVID-19

- Overall, **PAXLOVID** was much more effective in preventing hospitalization or death than **MOLNUPIRAVIRA** by MSD/ Merck .
- The effectiveness of the drug depends on how long it was taken.
- Outcomes for patients starting five days after symptom onset were not significant, but still worse, than for patients starting three days after symptom onset. Probably, the drug works only in the early stages of the disease, and you need to start taking it as early as possible.

Thank you for your attention