

# VOLGOGRAD STATE MEDICAL UNIVERSITY

## DEPARTMENT OF PHARMACOLOGY AND BIOINFORMATICS

Methodological recommendations for students for practical classes  
«Immunobiological and gene therapy drugs»

Thematic block: **Immunobiological drugs**

### **Class topic:**

Immunobiological drugs. Live (attenuated), inactivated, adjuvant vaccines. Advantages and disadvantages of immunobiological drugs group.

### **Pharmaceutical faculty**

#### **1. Class aims**

- learn to analyze the action of immunobiological drugs (vaccines) based on their pharmacological properties, mechanisms and localization of action;
- learn the general principles of the immunological basis of vaccination;
- learn to evaluate the effectiveness of first-generation vaccines: live (attenuated), killed, adjuvant, depending on their type and method of administration;
- learn to evaluate the advantages and disadvantages of this group of immunobiological drugs;
- become familiar with the need to conduct educational work with the population on issues of vaccination - as a significant factor in the fight against infectious diseases

#### **2. TASKS**

- For first generation vaccines: study:
  - classification;
  - composition of live (attenuated), killed (inactivated), adjuvant vaccines;
  - main mechanisms of action and application in medicine of first-generation vaccines.
- Study the features of development and production of first-generation vaccines.
- Study the main terms and definitions used in the process of creating vaccines
- Study the general requirements for production, transportation and storage of vaccines.

#### **3. THE FOLLOWING PRACTICAL SKILLS AND ABILITIES ARE PRACTISED IN THE CLASS**

- ability to classify vaccines based on their mechanism of action and methods of application;
- ability to analyze the possibilities of using vaccines based on the type of vaccine and source of antigen, the speed of the immune response;
- ability to analyze the advantages and disadvantages of live (attenuated), killed (inactivated), adjuvant vaccines.

#### **4. Class timetable:**

Venue: classroom of the Department of Pharmacology and Bioinformatics.

Time of event: part 1 –2 AH

Formed competencies: YK-1.1.3, YK-1.2.1, YK-1.2.2, YK-1.2.3., YK-1.3.1, YK-1.3.2., YK-6.1.1., YK-6.2.1, YK-6.2.2, YK-6.3.1, YK-6.3.2, YK-6.3.3, YK-6.3.4, ОПК-1.1.1., ОПК-1.2.1, ОПК-1.2.2., ОПК-1.3.1, ОПК-6.1.1, ОПК-6.2.1, ОПК-6.3.1, ПК-7.1.1, ПК-7.2.1, ПК-7.3.1.

#### **4.1 Technological map of the lesson**

Part	№	Class stage	Time
1	1	Checking the students present at the lesson, lesson mode, lesson topic.	5 min
	2	Checking the initial level of students' knowledge (written survey).	10 min
	3	Survey on the topic of the lesson.	45 min

4	Independent work of students (on prescriptions with analysis of the most complex prescriptions (if any in the topic), analysis of errors in medical prescriptions written by students; work with synonyms).	15 min
5	Checking independent work	5 min
6	Summing up the lesson. Assignment for the next lesson.	5 min
7	Cleaning of workplaces.	5 min

## 4.2 Demonstrations

1. Demonstration of advertising brochures on this topic during a survey on the topic of the lesson.

## 4.3 Lesson plan

### 4.3.1 The lesson begins with an introductory speech by the teacher, a statement of the purpose of the lesson and answers to students' questions.

In nature, the only reason for the development of adaptive immunity against a pathogen is a previous illness. Humanity has invented a way to make the body "believe" that it was sick, although in fact it remained healthy.

Both bacteria and viruses can be "live" in vaccines. The main problem in developing such drugs is to neutralize the pathogen that is going to be used for vaccination. The very first vaccine against smallpox, invented by Edward Jenner, was a "live" cowpox virus. We should be grateful to the great pioneer of vaccination not only for the idea of the procedure itself, but also for the principles of weakening pathogens that are still used today. As a rule, weakened vaccines are created against viruses, since they allow for the development of a broader immune response.

But there are also examples of attenuation (weakening) of bacteria - for example, the BCG vaccine against tuberculosis, poliomyelitis, seasonal flu, yellow fever, measles, mumps, rubella, chickenpox and several other diseases. The main method used to weaken the virus is to infect cell cultures or chicken and quail embryos. Normally, the virus adapts to its host quite accurately, and infecting cells of another species will be difficult or even impossible. But if such an infection is still possible, at least in a small number of cases, then the virus adapts to the new host over several generations and ceases to be dangerous to humans. The frequency of mutations in the viral genome is usually high enough to ensure rapid adaptation. At the same time, there remains a sufficient number of unchanged areas to cause a full immune response to the original virus.

Some live (attenuated) viral vaccines can partially regain their properties and infect other people during prolonged circulation in the body of the vaccinated person. So far, this is known only for polio vaccine viruses. To prevent this possibility, children are recommended to first be given a killed vaccine (in Russia this is done twice) and only then a live one. In many countries, only killed polio vaccine is used. For other live viral vaccines, the phenomenon of returning virulence has not been described, and there is usually no alternative in the form of "killed" drugs. What is the advantage of live vaccines? Why can't we limit ourselves to "killed" ones? The main reason is a stronger immune response. The fact is that when a live vaccine is administered, the body is faced not just with a set of antigens, but with a real disease, albeit a greatly weakened one, and can select more specific defense mechanisms. Such an immune response is not only more powerful, but often longer. Another advantage of live vaccines is their more convenient use. This is especially clear in the example of the polio vaccine. The killed vaccine most often has to be administered by painful injections, while live polio vaccines are simply dripped into the mouth. The disadvantages, of course, include all the problems inherent in live pathogens that we are forced to preserve and use. These are serious requirements for storage and transportation, as well as maximum caution in use in patients with immunodeficiencies.

### *The importance of the topic in the system of training and activities of a pharmacist:*

- informing the population on vaccination issues in accordance with the National Vaccination Calendar;

- drawing the attention of pharmacists to the prohibition of dispensing medicinal products by pharmacies (clause 5, 6 of the RF Government Resolution of 22.12.2011 No. 1081 "On licensing pharmaceutical activities")

#### **4.3.2 Checking the initial level of knowledge (written survey).**

#### **4.3.3 Analysis of theoretical material**

*Plan for analyzing theoretical material*

##### **1 Vaccines:**

- *classification;*
- *general characteristics of live (attenuated), killed (inactivated), adjuvant vaccines;*
- *composition of first-generation vaccines;*
- *features of the immune response when using first-generation vaccines.*

##### **Live (attenuated) vaccines:**

- *the main technique used to attenuate the virus in the production of a live vaccine;*
- *the phenomenon of reversion of virulence after the use of live virus vaccines;*
- *the advantage of using live vaccines;*
- *requirements for storage and transportation of live vaccines.*

##### **2 Inactivated vaccines:**

- *methods for inactivating a pathogen for the production of vaccines against poliomyelitis, hepatitis A, influenza, typhoid, cholera, plague, whooping cough, etc.*

##### **3 The role of adjuvant in the formation of immune response.**

#### **4.3.2 Independent work:**

1. Conduct a search and write down the names of first-generation vaccines: live (attenuated), killed, adjuvant. Fill in the table of the National Immunization Calendar in the Russian Federation for diseases prevented by first-generation vaccines. The information is entered into students' workbooks.
2. Working with advertising brochures of medicines on this topic.

#### **4.3.3 Checking the completion of independent work.**

#### **4.3.4 Summing up the lesson. Answers to questions.**

#### **4.3.5 Concluding remarks by the teacher.**

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