

МИНОБРНАУКИ РОССИИ

**Федеральное государственное автономное образовательное
учреждение высшего образования "Пермский
государственный национальный исследовательский
университет"**

Кафедра микробиологии и иммунологии

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Рабочая программа дисциплины

IMMUNOLOGY

Код УМК 98193

Утверждено
Протокол №9
от «17» мая 2021 г.

Пермь, 2021

1. Наименование дисциплины

Immunology

2. Место дисциплины в структуре образовательной программы

Дисциплина входит в обязательную часть Блока « С.1 » образовательной программы по направлениям подготовки (специальностям):

Специальность: **33.05.01** Фармация

направленность Программа широкого профиля (для иностранных граждан)

3. Планируемые результаты обучения по дисциплине

В результате освоения дисциплины **Immunology** у обучающегося должны быть сформированы следующие компетенции:

33.05.01 Фармация (направленность : Программа широкого профиля (для иностранных граждан))

ПК.5 Способен к информированию и консультированию населения и медицинских работников о лекарственных препаратах и других товарах аптечного ассортимента

Индикаторы

ПК.5.1 Оказывает консультативную помощь при выборе лекарственных препаратов посетителями аптек и медицинскими работниками по ассортименту лекарственных препаратов, медицинским показаниям, способу приема, побочным действиям, взаимодействию с другими группами лекарственных препаратов

4. Объем и содержание дисциплины

Направления подготовки	33.05.01 Фармация (направленность: Программа широкого профиля (для иностранных граждан))
форма обучения	очная
№№ триместров, выделенных для изучения дисциплины	6
Объем дисциплины (з.е.)	3
Объем дисциплины (ак.час.)	108
Контактная работа с преподавателем (ак.час.), в том числе:	42
Проведение лекционных занятий	14
Проведение практических занятий, семинаров	28
Самостоятельная работа (ак.час.)	66
Формы текущего контроля	Итоговое контрольное мероприятие (1) Письменное контрольное мероприятие (2)
Формы промежуточной аттестации	Зачет (6 триместр)

5. Аннотированное описание содержания разделов и тем дисциплины

Immunology. First semester

The subject and tasks of immunology, history. Basic concepts and definitions. Innate and adapted immunity

Modern immunology as a science that studies the structure and functions of the immune system. Determination of immunity. The concept of antigens. Immunity as the major function of the immune system, aimed at maintaining the genetic constancy of the body internal environment. The concept of immune surveillance. The role of the immune system in controlling the processes of cell proliferation and differentiation, regeneration, morphogenesis, etc. General features of the structural and functional organization of the immune system. The concept of antigen-independent and antigen-dependent differentiation of T- and B-lymphocytes. Subsystems of innate immunity (synonyms: paleoimmunity, constitutional immunity, primordial immunity, preimmune response, natural resistance) and adaptive immunity (synonyms: neoimmunity, acquired immunity, T- and B-lymphocytic immunity), differences and a brief description of recognizing structures. Recognition of "alien" and "modified innate", their elimination and immunological memory. Main features of the immune system that distinguish it from other body systems.

Origins of immunology as a science and discovery of major immunological phenomena. Variolation. The method of vaccination for prevention of infectious diseases (E. Jenner, L. Pasteur). Discovery of antibodies (Emil Behring et al.), the use of antibodies for the prevention and therapy of infectious diseases. Discovery of main serological reactions. Paul Ehrlich and his side chain theory. The complement system (works of J. Borde). Discovery of delayed hypersensitivity reactions (R. Koch). The phenomenon of phagocytosis. Phagocytic theory of immunity and inflammation by I.I. Metchnikov.

Discovery of anaphylaxis and immediate allergic reactions (S. Richet and P. Portier, M. Artyus, G.P. Sakharov). Origins of non-infectious immunology (I.I. Mechnikov, K. Landsteiner, etc.).

Discovery of transplant immunity reactions (P. Medawar, P. Gorer, J. Snell). The phenomena of second set and immunological enhancement. Adaptive transfer of transplant immunity and delayed hypersensitivity reactions (K. Landsteiner, M. Chase, M. Michison). The clonal-selection theory of immunity (F. Burnet) and its major provisions. The clonal-breeding theory of immunity at the modern stage of development.

The phenomenon of immunological tolerance, its discovery and characterization (P. Owen, 1945; F. Burnett, 1949; P. Medawar, L. Brent, R. Billingham, 1953; L. Felton, 1949; D. Dresser, 1963). Classification of the phenomena of immunological tolerance. Natural (innate) and adaptive (acquired) immunological tolerance. Tolerance induction in the neonatal period, the concept of the adaptive period. Tolerance induction in adulthood, the value of properties and dose of the antigen, the duration of its stay in the body. Phenomena of immunological paralysis and low-dose tolerance. Drug-induced tolerance. Tolerance "breakdown" and autoimmune diseases. Autoantigens. Modern ideas and conceptions about the mechanism of immunological tolerance.

The current stage of immunology development. Neonatal thymectomy and neonatal bursectomy (by J. Miller et al.). Discovery of T- and B-lymphocytic systems, lymphocyte subpopulations.

Advances in the study of molecular mechanisms of the immune system functioning. Immunogenetics.

Immunobiotechnology. Nobel Prizes in Immunology – history of the development of immunology from the section of applied microbiology (infectious immunology) to the interdisciplinary fundamental biological science

Organs of the immune system, phylogeny of immunity

Central and peripheral organs of the immune system. Functional morphology of the central organs of the immune system (thymus, Bursa of Fabricius, bone marrow). The central organs (zones of antigen-independent differentiation of immunocompetent cells. Peripheral lymphoid organs as the site of final stages of antigen-independent differentiation of T- and B- lymphocytes and their role in various forms of immune response. General patterns of the structure of peripheral lymphoid organs, T- and B-cell domains (zones), changes in their morphology after contact with the antigen.

Main types of the immune system cells, their functional purpose. Definition of the term "immunocompetent cell", general characteristics of receptors and clonal diversity of T- and B-lymphocytes. NK cells as a phylogenetically ancient population of lymphocytes, occupying an intermediate position between nonspecific effector cells and immunocompetent lymphocytes. The main functions of NK cells, the general characteristics of their membrane recognition molecules. Main stages of interaction of natural killers with target cells. Mechanisms of cytolysis of target cells (perforins, granzymes, apoptosis). The role of killer inhibiting and killer activation receptors. Main effector cells of innate immunity, their role in natural resistance and immune reactions. A role of receptors for the Fc fragment of immunoglobulins, complement components and cytokines in the involvement of nonspecific effector cells in the immune response. Cells of the microenvironment of the immune system organs. Dendritic cells and their functions. Lymphoid formations associated with mucous membranes, features of their structure and function. Features of the subpopulation composition of T- and B-lymphocytes in mucous membranes. The role of gamma/delta T-lymphocytes and secretory IgA in providing local immunity of mucous membranes. Recycling of immunocompetent cells. The phenomenon of "homing", the role of postcapillary venules, the concept of cell adhesion molecules. Features of cell recycling and migration during antigenic exposure.

Complement system

Complement system, modern nomenclature. Serum and membrane components of complement. Classic and alternative pathway of complement activation membrane attack complex (MAC). Regulators of complement activation (RCA). Main functions: cytolytic, opsonic, regulation of adaptive immunity, induction and control of inflammation. Complement participation in the elimination of immune complexes. Complement and pregnancy. Interaction of microorganisms with the complement system. Complement as a pathogenic factor. Deficiencies of complement components.

General characteristics of immune system cells. Phagocytosis: neutrophils, macrophages

Recognition mechanisms in the innate immunity subsystem (synonyms: paleoimmunity, constitutional immunity, primordial immunity, pre-immune response, natural resistance). The concept of pathogen-associated molecular patterns (PAMP). Pattern-recognizing receptors. Toll and Toll-like receptors (TLR1-TLR13), their structure, specificity, participation in triggering signaling pathways of activation of cytokine and other genes. Membrane pattern-recognizing plant receptors. Intracellular pattern-recognizing receptors (NOD family; 2'-5'-oligoadenylate synthase; protein kinase activated by double-stranded RNA). Pattern-recognizing receptors involved in phagocytosis: scavenger receptors (scavenger receptors, SR-A, MARCO), macrophage mannose receptor, beta-glucan receptors. Secreted pattern-recognizing receptor molecules: collectins (mannose-binding protein (MBP), surfactant proteins A and D), pentraxins (C-reactive protein and serum amyloid A), proteins of the lipid transferase family (lipopolysaccharide binding protein, etc.), peptidoglycan-recognizing proteins.

Mononuclear phagocyte system. Features of the mononuclear phagocyte histogenesis (differentiation scheme), a variety of macrophages (Kupffer cells, microglia, etc.). Main function of mononuclear phagocytes (removal of dying cells and biological "garbage"). Variants of macrophage activation (classic, alternative). Secretion of biologically active mediators and cytokines by activated macrophages; their action. The role of mononuclear phagocytes in inflammation and tissue repair (TR).

Participation of macrophages and cytokines produced by them in the induction of immune responses and other protective and adaptive reactions (fever, synthesis of acute phase proteins, stress reactions, etc.). Macrophages in the effector phase of the immune response.

Neutrophils. Maturation, migration into the blood. Their movement in the blood, mechanisms of exit from the vascular bed and migration to the foci of inflammation. Dependence of the directed movement of neutrophils on chemoattractants. Oxygen-dependent and oxygen-independent mechanisms of microbicidal activity. Purulent inflammation as a protective reaction.

Exocytosis: eosinophils, mast cells, basophils. Antiparasitic immunity

Exocytosis as a form of protection of the organism against multicellular objects, significantly exceeding the size of immunocompetent cells.

Histogenesis of eosinophils, the role of cytokines. Recognizing receptors and granules of eosinophils. Primary, secondary, small granules and lipid droplets. Secretion, partial degranulation, cytolysis. Secretory products of eosinophils. Lipid mediators and cytokines of eosinophils. Histogenesis of blood basophils and mast cells. Mast cell populations. Secretory products of mast cells and basophils, their effector functions in reactions of antiparasitic immunity and in allergy reactions.

Atopic reactions as the reverse side of antiparasitic immunity.

Acute phase reactants and cytokines

Acute phase reactants as reflection of systemic inflammation. The role of cytokines in their production.

C-reactive protein: structure, functions, diagnostic value. Pentraxin 3: participation in antifungal immunity and removal of apoptotic cells. Fibronectin: structure, functions, diagnostic value. Secretory phospholipases A2 as cationic proteins. Lipids as protective factors. Chronic inflammation: proatherogenic shifts. Secondary amyloidosis.

Cytokines. The concept of the cytokine network. General characteristics of the manifestation of cytokine network effects: redundancy, synergy, antagonism, pleiotropism. Autocrine, paracrine and endocrine effects. Classification of cytokines. Cytokine receptors. Soluble receptors, the phenomenon of transsignaling. Chemokines and their families. Cytokines as drugs.

Antigens, from properties. Major histocompatibility complex, superantigens

The concept of antigens. A definition of the term 'antigen'. Classification of antigens by origin. The chemical nature of antigens. Antigens as biological markers. Specificity and immunogenicity: major characteristics of antigens as participants in the immune process. Complete antigens and haptens. Haptens as substances lacking immunogenicity, but possessing specificity. Complex antigens (haptens + carrier). A role of the carrier.

Obtaining antibodies to biologically important haptens and their use in biological research.

The relationship of immunogenicity with the features of the chemical structure of antigens and their ability to catabolism in the body. Thymus-dependent and thymus-independent antigens. Immunogenicity of natural and artificially synthesized proteins and polypeptides, polysaccharides, lipids, nucleic acids and their complexes.

Blood group antigens of the ABO system as an example of glycopospholipid antigens and the role of glycosyltransferases in their inheritance. The concept of adjuvants and their role in increasing the immunogenicity of antigens. Practical application of adjuvants (examples).

Antigenic specificity. The concept of antigenic determinants. The role of different levels of antigen structural organization in the formation of antigenic specificity, sequence and conformational determinants. Physical and chemical bases of the interaction of antigens with antibodies and T-cell receptors. K. Landsteiner's works on antigenic determinants and antigenic specificity.

Antigenicity and immunogenicity. Properties that determine the immunogenicity of antigens. Adjuvants.

Presentation of antigens. Molecules of the major histocompatibility complex, their structure and inheritance: MHC I and II.

Polymorphism and polygeny. HLA and diseases. Nonclassical MHC molecules. Formation of antigen presenting structures: proteosomal and endosomal pathways. Antigen presenting cells. Cross-presentation. CD1 presentation. Superantigens. Effects of viruses on the MHC expression.

Antibodies, structure, functions. Applied value: diagnosis and treatment of diseases

Structure of antibodies: heavy and light chains, constant and variable regions of immunoglobulin chains.

Effector functions of antibodies and their characteristics. Receptors to the Fc fragment of antibodies, their structure, distribution, role in the effector functions of antibodies. Molecular mechanisms of transduction of regulatory signals from receptors to the Fc fragment of antibodies.

Homocytotropism (cytophilicity) of IgE class antibodies and main stages in the development of immediate-type allergic reactions. The phenomenon of opsonization during phagocytosis, the role of receptors for the Fc fragment of antibodies and for the C3b component of complement.

Antibody-dependent cellular cytotoxicity and the role of natural killers, monocyte-macrophage cells, eosinophils in it.

Transport of IgG across the placenta and provision of passive immunity in a newborn baby. The role of secretory IgA of breast milk in the formation of passive immunity of a nursing. Changes in the concentration of immunoglobulins of different classes during the first year of a baby's life. The concept of serological reactions and quantitative immunochemical methods, their use in biology. Reactions based on the phenomena of agglutination, precipitation, lysis, neutralization; method of local hemolysis in agarose gel to determine the number of antibody-forming cells according to Jerne, options for carrying out a precipitation reaction in gels, a hemagglutination reaction. Methods based on the use of antibodies and antigens labeled with isotopes, enzymes and luminescent dyes using the example of immunofluorescence reaction, liquid phase radioimmunoassay (RIA) and enzyme-linked immunosorbent assay (ELISA). Flow laser cytometry.

The concept of monoclonal antibodies and hybridoma biotechnology.

Clonal selection theory of F. Burnet. B-lymphocytes, maturation, characteristics

Lymphocytes, the cells of adaptive immunity. Clonal selection theory of F. Burnet. Discovery of B-lymphocytes. Methods for their identification. Main functions.

Genesis and development of B lymphocytes in the central organs of the immune system. Receptors of mature lymphocytes. Immunoglobulins, classes, subclasses, types, allotypes, idiotypes. Genetic nature of antibody diversity, gene recombinations, alternative splicing

T-lymphocytes, their formation in the thymus. T-cell receptor, T-cell subpopulations, their characteristics

Development and formation of T-lymphocytes in the thymus. T-cell receptor selection processes: beta selection, positive and negative selection. Promiscuity gene expression, its role in the deletion of reactive autoimmune clones.

Formation of regulatory T-lymphocytes, their importance in the control of autoimmune reactions.

Formation of helper and cytotoxic T cells. Naive T-lymphocytes and memory T-cells

Features of T-cell recognition of antigens, the role of molecules of the main histocompatibility complex of classes I and II in this process.

The structure of the CD3 complex and its role in the transmission of the activation signal into the cell, immunoreceptor tyrosine activation motif. The role of tyrosine protein kinases in activation of T-lymphocytes.

Molecular genetic mechanisms of formation of the diversity of T-cell receptors. □□Alpha/beta and gamma/delta receptors.

Antigen-recognizing receptor complex of T-lymphocytes, its structural organization. CD4 and CD8 as main co-receptor molecules of T-lymphocytes, their structure, functions and role in cell activation. Subpopulations of mature T-lymphocytes that differ in the expression of CD4 and CD8. Other T-lymphocyte molecules involved in the regulation of their activation (CD28, CD152, CD2, integrins and other cell adhesion molecules, cytokine receptors, etc.), their structure, functions and role in cell activation.

Immunity as a whole

The concept of serological reactions and quantitative immunochemical methods, their use in biology. Reactions

based on the phenomena of agglutination, precipitation, lysis, neutralization; method of local hemolysis in agarose gel to determine the number of antibody-forming cells according to Jerne, options for carrying out a precipitation reaction in gels, a hemagglutination reaction.

Methods based on the use of antibodies and antigens labeled with isotopes, enzymes and luminescent dyes using the example of immunofluorescence reaction, liquid phase radioimmunoassay (RIA) and enzyme-linked immunosorbent assay (ELISA). Flow laser cytometry. The concept of monoclonal antibodies and hybridoma biotechnology.

Modern theories of immunity

Theories of innate and adaptive immunity. What are theories for? Their importance for practice. Self vs. non-self in immunology. The theory of infectious "foreign" and non-infectious "self". Response to tissue destruction - the "danger-signal" theory. A modern view of the immune system.

Secondary immune response. Memory cells. The creation of vaccines, their role in preventing infections

Immune response and its forms. Humoral immune response. Kinetics of antibody production, main phases and periods, features of switching the synthesis of immunoglobulins of different classes and kinetics during primary and secondary immune responses. Interaction (cooperation) of cells in the humoral immune response. Study of the cooperation effect in antibody production in cultures in vivo and in vitro. The modern scheme of cell interaction in the humoral immune response, the participation of cytokines and contact interaction molecules. The concept of the cytokine profile of regulatory T-lymphocytes. Th1, Th2 and Th0 lymphocytes, the role of the cytokine microenvironment in their maturation. Secondary immune response. The role of memory cells, their properties, localization, life expectancy. Creation of vaccines. The role of vaccination in infection control.

HIV infection is a socially significant, incurable disease, ways of transmission, prevention

HIV infection is an incurable, widespread infectious disease.

Ways of transmission, its natural reservoir. Mechanisms of development of disease. Prevention of HIV infection. The role of drugs in the spread of the disease. What is AIDS? Treatment of HIV infection. Why is it important to know your HIV status? The role of the state\government in the fight against HIV infection. Social movements against AIDS.

Organization of scientific research in the field of immunology, methodology, data processing, writing articles, preparing presentations

Basic methodological approaches to assessing the function of the immune system in experiments and clinic.

Modeling the influence of various factors on the humoral and cell-mediated immune response, antigen-independent and antigen-dependent differentiation of T- and B-lymphocytes, their interaction during the immune response, functional activity of subpopulations, functions of innate immunity cells.

Features of evaluation of the human immune system. Research planning, work with literature, investigations.

Statistical processing of the obtained results. Preparation of illustrative material. Rules for the design of figures and tables. Basic rules for writing a scientific article. Preparation of a scientific report (poster and oral presentation)

6. Методические указания для обучающихся по освоению дисциплины

Освоение дисциплины требует систематического изучения всех тем в той последовательности, в какой они указаны в рабочей программе.

Основными видами учебной работы являются аудиторские занятия. Их цель - расширить базовые знания обучающихся по осваиваемой дисциплине и систему теоретических ориентиров для последующего более глубокого освоения программного материала в ходе самостоятельной работы. Обучающемуся важно помнить, что контактная работа с преподавателем эффективно помогает ему овладеть программным материалом благодаря расстановке необходимых акцентов и удержанию внимания интонационными модуляциями голоса, а также подключением аудио-визуального механизма восприятия информации.

Самостоятельная работа преследует следующие цели:

- закрепление и совершенствование теоретических знаний, полученных на лекционных занятиях;
- формирование навыков подготовки текстовой составляющей информации учебного и научного назначения для размещения в различных информационных системах;
- совершенствование навыков поиска научных публикаций и образовательных ресурсов, размещенных в сети Интернет;
- самоконтроль освоения программного материала.

Обучающемуся необходимо помнить, что результаты самостоятельной работы контролируются преподавателем во время проведения мероприятий текущего контроля и учитываются при промежуточной аттестации.

Обучающимся с ОВЗ и инвалидов предоставляется возможность выбора форм проведения мероприятий текущего контроля, альтернативных формам, предусмотренным рабочей программой дисциплины. Предусматривается возможность увеличения в пределах 1 академического часа времени, отводимого на выполнение контрольных мероприятий.

Процедура оценивания результатов обучения инвалидов и лиц с ограниченными возможностями здоровья по дисциплине предусматривает предоставление информации в формах, адаптированных к ограничениям их здоровья и восприятия информации.

При проведении текущего контроля применяются оценочные средства, обеспечивающие передачу информации, от обучающегося к преподавателю, с учетом психофизиологических особенностей здоровья обучающихся.

7. Перечень учебно-методического обеспечения для самостоятельной работы обучающихся по дисциплине

При самостоятельной работе обучающимся следует использовать:

- конспекты лекций;
- литературу из перечня основной и дополнительной учебной литературы, необходимой для освоения дисциплины (модуля);
- текст лекций на электронных носителях;
- ресурсы информационно-телекоммуникационной сети "Интернет", необходимые для освоения дисциплины;
- лицензионное и свободно распространяемое программное обеспечение из перечня информационных технологий, используемых при осуществлении образовательного процесса по дисциплине;
- методические указания для обучающихся по освоению дисциплины.

8. Перечень основной и дополнительной учебной литературы

Основная:

1. Cruse, J. M., Lewis R. E. Robert E. Atlas of Immunology/Cruse, J. M., Robert E. Lewis R. E..-Boca Raton;Heidelberg:Springer,1999, ISBN 3-540-64807-0.-450.
2. Clinton B. Mathias. Pharmacology of Immunotherapeutic Drugs / Clinton B. Mathias, Jeremy P. McAleer, Doreen E. Szollosi // Publisher Name: Springer, Cham. — 2020. — 399 p. — ISBN 978-3-030-19922-7. — [Электронный ресурс]. <https://link.springer.com/book/10.1007/978-3-030-19922-7>

Дополнительная:

1. Заморина С. А., Раев М. Б., Храмцов П. В. Иммунология: миелоидные супрессорные клетки: учебное пособие для студентов, обучающихся по направлению подготовки бакалавров «Биология»/С. А. Заморина, М. Б. Раев, П. В. Храмцов.-Пермь:ПГНИУ,2019, ISBN 978-5-7944-3413-2.-88.
<https://elis.psu.ru/node/601744>
2. Долгих, В. Т. Иммунология : учебное пособие для вузов / В. Т. Долгих, А. Н. Золотов. — Москва : Издательство Юрайт, 2019. — 248 с. — (Высшее образование). — ISBN 978-5-534-09294-3. — Текст : электронный // ЭБС Юрайт [сайт]. <https://www.urait.ru/bcode/427581>
3. Мечников, И. И. Иммунология. Избранные работы / И. И. Мечников. — Москва : Издательство Юрайт, 2022. — 274 с. — (Антология мысли). — ISBN 978-5-534-12700-3. — Текст : электронный // Образовательная платформа Юрайт [сайт]. <https://www.urait.ru/bcode/506329>

9. Перечень ресурсов сети Интернет, необходимых для освоения дисциплины

<http://www.columbia.edu/itc/hs/medical/pathophys/immunology/readings/ConciseHistoryImmunology.pdf> Сайт Колумбийского университета, США

<https://ru.scribd.com/document/346671775/Basic-Immunology-Functions-and-disorders-of-the-immune-system-5e-Abbas-2016-pdf> Описание клеток и органов иммунной системы

10. Перечень информационных технологий, используемых при осуществлении образовательного процесса по дисциплине

Образовательный процесс по дисциплине **Immunology** предполагает использование следующего программного обеспечения и информационных справочных систем:

List of required licensed and (or) free software:

- 1) office suite applications (word processor, program for preparing electronic presentations);
- 2) a program for demonstrating video materials (player);
- 3) an application ащк viewing and playing the media content of PDF files;
- 4) programs for viewing and editing digital images;
- 5) programs for viewing and editing DjVu-files.

The discipline does not provide for the use of any specialized software.

При освоении материала и выполнения заданий по дисциплине рекомендуется использование материалов, размещенных в Личных кабинетах обучающихся ЕТИС ПГНИУ (**student.psu.ru**).

При организации дистанционной работы и проведении занятий в режиме онлайн могут использоваться:

система видеоконференцсвязи на основе платформы BigBlueButton (<https://bigbluebutton.org/>).

система LMS Moodle (<http://e-learn.psu.ru/>), которая поддерживает возможность использования текстовых материалов и презентаций, аудио- и видеоконтент, а так же тесты, проверяемые задания, задания для совместной работы.

система тестирования Indigo (<https://indigotech.ru/>).

11. Описание материально-технической базы, необходимой для осуществления образовательного процесса по дисциплине

Equipment and facilities required for lectures:

a classroom equipped with specialized furniture, demonstration equipment (projector, screen, computer / laptop) with appropriate software, chalk board and/or white board.

Equipment and facilities required for practical work:

a classroom equipped with specialized furniture, demonstration equipment (projector, screen, computer / laptop) with appropriate software, chalk board and/or white board.

Equipment and facilities required for ongoing control and intermediate assessment activities, group and individual consultations:

a classroom equipped with specialized furniture, chalk board and/or white board.

Equipment and facilities required for independent work:

the Scientific Library of Perm State University which provides access to local and global networks.

Помещения научной библиотеки ПГНИУ для обеспечения самостоятельной работы обучающихся:

1. Научно-библиографический отдел, корп.1, ауд. 142. Оборудован 3 персональными компьютера с доступом к локальной и глобальной компьютерным сетям.

2. Читальный зал гуманитарной литературы, корп. 2, ауд. 418. Оборудован 7 персональными компьютерами с доступом к локальной и глобальной компьютерным сетям.

3. Читальный зал естественной литературы, корп.6, ауд. 107а. Оборудован 5 персональными компьютерами с доступом к локальной и глобальной компьютерным сетям.

4. Отдел иностранной литературы, корп.2 ауд. 207. Оборудован 1 персональным компьютером с доступом к локальной и глобальной компьютерным сетям.

5. Библиотека юридического факультета, корп.9, ауд. 4. Оборудована 11 персональными компьютерами с доступом к локальной и глобальной компьютерным сетям.

6. Читальный зал географического факультета, корп.8, ауд. 419. Оборудован 6 персональными компьютерами с доступом к локальной и глобальной компьютерным сетям.

Все компьютеры, установленные в помещениях научной библиотеки, оснащены следующим программным обеспечением:

Операционная система ALT Linux;

Офисный пакет Libreoffice.

Справочно-правовая система «КонсультантПлюс»

**Фонды оценочных средств для аттестации по дисциплине
Immunology**

**Планируемые результаты обучения по дисциплине для формирования компетенции.
Индикаторы и критерии их оценивания**

ПК.5

Способен к информированию и консультированию населения и медицинских работников о лекарственных препаратах и других товарах аптечного ассортимента

Компетенция (индикатор)	Планируемые результаты обучения	Критерии оценивания результатов обучения
<p>ПК.5.1 Оказывает консультативную помощь при выборе лекарственных препаратов посетителями аптек и медицинскими работниками по ассортименту лекарственных препаратов, медицинским показаниям, способу приема, побочным действиям, взаимодействию с другими группами лекарственных препаратов</p>	<p>Knows the basic principles of the organization and functioning of the innate immune system, methods of enzyme immunoassay. Able to provide advice on the choice of immunological preparations. Proficient in enzyme immunoassay.</p>	<p align="center">Неудовлетворител Does not know the basic principles of the innate immune system organization and functioning, methods of enzyme immunoassay. Cannot provide advice on the choice of immunological medicines. Does not possess the skills of enzyme immunoassay</p> <p align="center">Удовлетворительн Partially knows the basic principles of organization and functioning of the innate immune system organization and functioning, enzyme immunoassay methods. Cannot provide advice on the choice of immunological medicines. Does not possess the skills of enzyme immunoassay</p> <p align="center">Хорошо Knows the basic principles of the innate immune system organization and functioning, methods of enzyme immunoassay. Partially can provide advisory assistance on the choice of immunological medicines. Partially possess the skills of enzyme immunoassay analysis</p> <p align="center">Отлично Knows the basic principles of the innate immune system organization and functioning, methods of enzyme immunoassay. Able to provide advice on the choice of immunological medicines. Proficient in enzyme immunoassay</p>

Оценочные средства текущего контроля и промежуточной аттестации

Схема доставки : Базовая

Вид мероприятия промежуточной аттестации : Зачет

Способ проведения мероприятия промежуточной аттестации : Оценка по дисциплине в рамках промежуточной аттестации определяется на основе баллов, набранных обучающимся на контрольных мероприятиях, проводимых в течение учебного периода.

Максимальное количество баллов : 100

Конвертация баллов в отметки

«отлично» - от 81 до 100

«хорошо» - от 61 до 80

«удовлетворительно» - от 43 до 60

«неудовлетворительно» / «незачтено» менее 43 балла

Компетенция (индикатор)	Мероприятие текущего контроля	Контролируемые элементы результатов обучения
ПК.5.1 Оказывает консультативную помощь при выборе лекарственных препаратов посетителями аптек и медицинскими работниками по ассортименту лекарственных препаратов, медицинским показаниям, способу приема, побочным действиям, взаимодействию с другими группами лекарственных препаратов	Acute phase reactants and cytokines Письменное контрольное мероприятие	Checking the level of knowledge on basic immunological terms. Understanding of key processes and phenomena in immunology.
ПК.5.1 Оказывает консультативную помощь при выборе лекарственных препаратов посетителями аптек и медицинскими работниками по ассортименту лекарственных препаратов, медицинским показаниям, способу приема, побочным действиям, взаимодействию с другими группами лекарственных препаратов	HIV infection is a socially significant, incurable disease, ways of transmission, prevention Письменное контрольное мероприятие	Understanding how adaptive immunity works.

Компетенция (индикатор)	Мероприятие текущего контроля	Контролируемые элементы результатов обучения
ПК.5.1 Оказывает консультативную помощь при выборе лекарственных препаратов посетителями аптек и медицинскими работниками по ассортименту лекарственных препаратов, медицинским показаниям, способу приема, побочным действиям, взаимодействию с другими группами лекарственных препаратов	Organization of scientific research in the field of immunology, methodology, data processing, writing articles, preparing presentations Итоговое контрольное мероприятие	Ability to study independently and report on a specific topic in immunology

Спецификация мероприятий текущего контроля

Acute phase reactants and cytokines

Продолжительность проведения мероприятия промежуточной аттестации: **2 часа**

Условия проведения мероприятия: **в часы аудиторной работы**

Максимальный балл, выставляемый за мероприятие промежуточной аттестации: **30**

Проходной балл: **13**

Показатели оценивания	Баллы
Knows the functions of innate immune cells	10
Knows the fundamental differences between innate and acquired (adoptive) immunity	10
Understands the role of humoral factors of innate immunity in protecting the body	10

HIV infection is a socially significant, incurable disease, ways of transmission, prevention

Продолжительность проведения мероприятия промежуточной аттестации: **2 часа**

Условия проведения мероприятия: **в часы аудиторной работы**

Максимальный балл, выставляемый за мероприятие промежуточной аттестации: **30**

Проходной балл: **13**

Показатели оценивания	Баллы
Comparison of recognition principles in the systems of innate and adaptive immunity. Primary and secondary immune response. Immunological memory. Principles of organization of the adaptive immunity system. Clonal selection theory. Works by F.M.Bernet, S.Tonegawa, and N.K.-Erne. Main types of cells involved in the immune response.	30
Comparison of recognition principles in the systems of innate and adaptive immunity. Primary and secondary immune response. Immunological memory. Principles of organization of the adaptive immunity system. Clonal breeding theories.	25
Comparison of recognition principles in the systems of innate and adaptive immunity. Primary and secondary immune response. Immunological memory. Main types of cells involved in the immune response.	20

Comparison of recognition principles in the systems of innate and adaptive immunity. General ideas about adaptive immunity.	13
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Organization of scientific research in the field of immunology, methodology, data processing, writing articles, preparing presentations

Продолжительность проведения мероприятия промежуточной аттестации: **2 часа**

Условия проведения мероприятия: **в часы аудиторной работы**

Максимальный балл, выставляемый за мероприятие промежуточной аттестации: **40**

Проходной балл: **17**

Показатели оценивания	Баллы
The information on a given topic is analyzed, the oral presentation is performed and a ppt file with the presentation is available. The information is analysed at a high level, answers are givento all questions.	40
The information on a given topic is analyzed, the oral presentation is performed and a ppt file with the presentation is available. The information is analysed at a middle level, answers are given to questions.	33
The information on a given topic is analyzed, the oral presentation is performed and a ppt file with the presentation is available	26
A report (presentation) is presented in a written form. All the required information is presented. Answers to questions do not reveal the topic in full.	17