MODERN MEDICINE AND PRACTICE
https://inovatus.es/index.php/ejmmp

EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE
Vol. 4 No. 10 (Oct - 2024) EJMMP ISSN: 2795-921X

MODERN VIEWS ON THE MORPHOLOGICAL STRUCTURE OF BACTERIAL SPECIES

Murodov Komil Baxtiyorovich
Department of Clinical Sciences of the Asian International University, Bukhara, Uzbekistan

Annotation: Microbes are living creatures that can only be observed using optical instruments, since their sizes are extremely small. According to the principle of cellular organization, all microbes are divided into two types – prokaryotes and eukaryotes. The main distinguishing features of prokaryotes from eukaryotes are the following. Prokaryotes do not have a decorated nucleus, that is, their nuclear apparatus (nucleoid) is not separated from the cytoplasm by a nuclear membrane.

Keywords: microorganisms, bacteria, prokaryotes, eukaryotes, strain culture.

The morphology of microorganisms studies their appearance, shape and structural features, the ability to move, sporulation, and reproduction methods. Morphological features play an important role in the recognition and classification of microorganisms. Since ancient times, the living world has been divided into two kingdoms: the kingdom of plants and the kingdom of animals. When the world of microorganisms was discovered, they were isolated into a separate kingdom. Thus, until the 19th century, the entire world of living organisms was divided into three kingdoms. In the beginning, morphological features were used as the basis for the classification of microorganisms, since people knew nothing more about them. By the end of the 19th century, many species had been described; various scientists, mainly botanists, divided microorganisms into groups accepted for plant classification. In 1897, for the systematics of microbes, along with morphological, and physiological signs began to be used. As it turned out later, for a scientifically based classification, some signs alone may not be enough. Therefore, a set of signs is used:

- morphological (cell shape, size, mobility, reproduction, sporulation, Gram staining);
- cultural (the nature of growth on liquid and dense nutrient media);
- physiological and biochemical (the nature of accumulated products);
- genotypic (physico-chemical properties of DNA).

Genosystematics makes it possible to determine the type of microorganisms not by similarity, but by kinship. It has been established that the nucleotide composition of the total DNA does not change during the development of microorganisms under different conditions. The S- and R-forms are identical in DNA composition. Microorganisms have also been found that have a similar nucleotide composition of DNA, although they belong to different systematic groups: E. coli and some corynebacteria. This indicates that the taxonomy of microbes should take into account different characteristics.

Until recently, all living beings of cellular structure, depending on the relationship of the nucleus and organelles with the cytoplasm, the composition of the cell wall and other features, were divided into two groups (kingdoms):

1.1 Prokaryotes are pre-nuclear (referred to as organisms that do not have a clearly defined nucleus, represented by a DNA molecule in the form of a ring; the cell wall includes peptidoglycan (murein) and teichoic acids; ribosomes have sedimentation constants of 70; the energy centers of the cell are located in mesosomes and there are no organelles).

1.2 Eukaryotes are nuclear (with a clearly defined nucleus separated from the cytoplasm by a shell; there is no peptidoglycan and teichoic acids in the cell wall; cytoplasmic ribosomes are larger; sedimentation constant 80; energy processes are carried out in mitochondria; there is a Golgi complex from organelles, etc.).

Later it turned out that there are non-cellular forms among microorganisms-viruses and therefore the third group (kingdom) was singled out - Vira.

To designate microorganisms, a double (binary) nomenclature has been adopted, which includes the name of the genus and species. The generic name is written with a capital letter (uppercase), specific (even derived from the surname)- with a lowercase (small). For example, the anthrax bacillus is called Bacillus anthracis, E. coli is called Escherichia coli, Aspergillus black is called Aspergillus niger.

The main (lowest) The taxonomic unit is the species. Species are grouped into genera, genera into families, families into orders, orders into classes, classes into departments, departments into kingdoms.

A species is a collection of individuals of the same genotype with a pronounced phenotypic similarity.

Culture - microorganisms obtained from an animal, human, plant or substrate of the external environment and grown on a nutrient medium. Pure cultures consist of individuals of the same species (offspring obtained from a single cell is a clone).

A strain is a culture of the same species isolated from different habitats and characterized by minor changes in properties. For example, E. coli isolated from the human body, cattle, reservoirs, soil, can be different strains.

Prokaryotes (bacteria and actinomycetes). Bacteria (prokaryotes)-this is a large group of microorganisms (about 1600 species), most of which are unicellular. The shape and size of bacteria. The main forms of bacteria are spherical, rod-shaped and convoluted. Spherical cocci bacteria have the usual shape of a ball, there are flattened, oval or bean-shaped ones. Cocci can be in the form of single cells — monococci (micrococci) or connected in various combinations: in pairs — diplococci, four cells each — tetracocci, in the form of more or less long chains - streptococci, as well as in the form of clusters of cubic shape (in the form of packages) of eight cells arranged in two tiers one above to others, sarcines. There are clusters of irregular shapes resembling bunches of grapes - staphylococci. Rod—shaped bacteria can be single or connected in pairs - diplobacteria, chains of three to four or more cells — streptobacteria. The ratios between the length and thickness of the sticks are very different. Convoluted, or curved, bacteria vary in length, thickness, and degree of curvature. Sticks slightly curved in the form of a comma are called vibrions, sticks with one or more corkscrew curls are called spirillae, and thin sticks with numerous curls are called spirochetes. Thanks to the use of an electron microscope to study microorganisms in natural substrates, bacteria with a special cell shape have been discovered: closed or open rings (toroids); with outgrowths (prosthetics); worm—shaped - long with curved very thin ends; and also in the form of a hexagonal star.

The size of bacteria is very small: from tenths of a micrometer (microns) to several micrometers. On average, the body size of most bacteria is 0.5—1 microns, and the average length of rod-shaped bacteria is 2-5 microns. There are bacteria that are much larger than the average size, and some are on the verge of being visible in conventional optical microscopes. The body shape of bacteria, as well as their size, can vary depending on age and growth conditions. However, under certain relatively stable conditions, bacteria retain their inherent size and shape. The mass of the bacterial cell is very small, approximately 4-10-1:!g.

The structure of the bacterial cell. The cell of prokaryotic organisms, which include bacteria, has fundamental features of the ultrastructure. The cell wall (shell) is an important structural element of most bacteria. The cell wall accounts for 5 to 20% of the dry matter of the cell. It has elasticity, serves as a mechanical barrier between the protoplast and the environment, and gives the cell a certain shape. The cell wall contains a heteropolymer compound specific to prokaryotic cells - peptidoglycan (murein), which is absent in the cell walls of eukaryotic organisms. According to the coloring method proposed by the Danish physicist X. Gram (1884), bacteria are divided into two groups: gram-positive and gram-negative. Gram-positive cells retain the dye, while gram-negative cells do not retain it, which is due to differences in the chemical composition and ultrastructure of their cell walls. Gram-positive bacteria have thicker, amorphous cell walls, they contain a large amount of murein (from 50 to 90% of the dry mass of the cell wall) and teichoic acids. The cell walls of gram-negative bacteria are thinner, layered, they contain a lot of lipids, little murein (5-10%) and no teichoic acids.

The cell wall of bacteria is often covered with mucus. The mucous layer may be thin, barely distinguishable, but it may also be significant, it may form a capsule. Often, the capsule is much larger than a bacterial cell in size. The licking of the cell walls is sometimes so strong that the capsules of individual cells merge into mucous masses (zoogels), which are interspersed with bacterial cells. The mucous substances formed by some bacteria are not retained as a compact mass around the cell wall, but diffuse into the environment. With rapid reproduction in liquid substrates, mucus-forming bacteria can turn them into a solid mucous mass. This phenomenon is sometimes observed in sugar beet extracts during sugar production. In a short time, sugar syrup can turn into a viscous mucous mass. Meat, sausages, cottage cheese are subjected to licking; the viscosity of milk, brines, pickled vegetables, beer, wine is observed. The intensity of mucus formation and the chemical composition of mucus depend on the type of bacteria and cultivation conditions. The capsule has useful properties, mucus protects cells from adverse conditions — in many bacteria, mucus formation increases in such conditions. The capsule protects the cell from mechanical damage and drying, creates an additional osmotic barrier, serves as an obstacle to the penetration of phages, antibodies, and sometimes it is a source of spare nutrients. The cytoplasmic membrane separates the contents of the cell from the cell wall. This is a mandatory structure of any cell. If the integrity of the cytoplasmic membrane is violated, the cell loses its viability. The cytoplasmic membrane accounts for 8-15% of the dry matter of the cell. The membrane contains up to 70-90% of cell lipids, its thickness is 7-10 nm1. On cell sections in an electron microscope, it is visible as a three—layer structure - one lipid layer and two protein layers adjacent to it on both sides. The cytoplasmic membrane sticks into the cell in places, forming all kinds of membrane structures. It contains various enzymes; it is semi-permeable, plays an important role in the metabolism between the cell and the environment. The cytoplasm of a bacterial cell is a semi-liquid, viscous, colloidal system. In places, it is permeated by membrane structures — mesosomes, which originated from the cytoplasmic membrane and retained a connection with it. Mesosomes perform various functions; in them and in the cytoplasmic membrane associated with them there are enzymes involved in energy processes — in supplying the cell with energy. Well-developed mesosomes are found only in Gram-positive bacteria, in Gram-negative ones they are poorly developed and have a simpler structure. The cytoplasm contains ribosomes, nuclear apparatus and various inclusions. Ribosomes are scattered in the cytoplasm in the form of granules 20-30 nm in size; ribosomes consist of about 60% ribonucleic acid (RNA) and 40% protein. Ribosomes are responsible for cell protein synthesis. Depending on its age and living conditions, a bacterial cell may contain 5-50 thousand ribosomes. The nuclear apparatus of bacteria is called a nucleoid. Electron microscopy of ultrathin sections of a bacterial cell made it possible to establish that the carrier of the genetic information of the cell is a molecule of deoxyribonucleic acid (DNA). DNA has the form of a double helical strand, closed in a ring; it is also called the "bacterial chromosome". It is located in a certain area of the cytoplasm, but is not separated from it by its own membrane.

The cytoplasmic inclusions of a bacterial cell are diverse, mainly they are spare nutrients that are deposited in cells when they develop in conditions of an excess of nutrients in the environment, and are consumed when cells fall into starvation conditions. Polysaccharides are deposited in bacterial cells: glycogen, a starch-like substance of granulose, which are used as a source of carbon and energy. Lipids are found in cells in the form of granules and droplets. Fat is a good source of carbon and energy. Many bacteria accumulate polyphosphates; they are contained in volute granules and are used by cells as a source of phosphorus and energy. Molecular sulfur is deposited in the cells of sulfur bacteria.

The mobility of bacteria. Globular bacteria are usually immobile. Rod-shaped bacteria can be both mobile and stationary. Curved and spiral-shaped bacteria are mobile. Some bacteria move by sliding. The movement of most bacteria is carried out with the help of flagella. Flagella are thin, spirally twisted strands of protein nature that can carry out rotational movements. The length of the flagella varies, and the thickness is so small (10-20 nm) that they can be seen in a light microscope only after special treatment of the cell. The presence, number and location of flagella are constant signs for the species and have diagnostic significance. Bacteria with one flagellum at the end of the cell are called monotrichs; with a bundle of flagella - lofotrichs', with a bundle of flagella at both ends of the cell - amphitrichs; bacteria whose flagella are located on the entire surface of the cell are called peritrichs. The speed of movement of bacteria is great: in a second, a cell with flagella can travel a distance 20-50 times greater than the length of its body. Under unfavorable living conditions, with aging of the cell, with mechanical action, mobility may be lost. In addition to flagella, there are a large number of filamentous formations on the surface of some bacteria, much thinner and shorter than flagella - fimbriae (or pili).

Reproduction of bacteria. Prokaryotic cells are characterized by simple cell division in two. Cell division begins, as a rule, some time after the division of the nucleoid. Rod-shaped bacteria divide across, spherical shapes in different planes. Depending on the orientation of the division plane and their number, various shapes arise: single cocci, paired, chains, in the form of packages, clusters. The peculiarity of bacterial reproduction is the speed of the process. The rate of division depends on the type of bacteria and cultivation conditions: some species divide every 15-20 minutes, others after 5-10 hours. With this division, the number of bacterial cells per day reaches a huge number. This is often observed in food products: rapid souring of milk due to the development of lactic acid bacteria, rapid spoilage of meat and fish due to the development of putrefactive bacteria, etc.

Sporulation. Bacterial spores are usually formed under unfavorable conditions of development: with a lack of nutrients, changes in temperature, pH, and accumulation of metabolic products above a certain level. The ability to form spores is mainly possessed by rod-shaped bacteria. Only one spore (endospore) is formed in each cell.

Sporulation is a complex process, there are several stages in it: first, there is a restructuring of the genetic apparatus of the cell, the morphology of the nucleoid changes. DNA synthesis stops in the cell. The nuclear DNA is pulled out in the form of a strand, which then separates; part of it is concentrated at one of the poles of the cell. This part of the cell is called the sporogenic zone. In the sporogenic zone, the cytoplasm thickens, then this area is separated from the rest of the cellular contents by a septum. The cut-off area is covered with the membrane of the mother cell, the so-called prospore is formed. A prospore is a structure located inside the mother cell, from which it is separated by two membranes: an outer and an inner one. A cortical layer (cortex) is formed between the membranes, similar in chemical composition to the cell wall of a vegetative cell. In addition to peptidoglycan, the cortex contains dipicolic acid ($C_7H_8O_4Md$), which is absent in vegetative cells. Subsequently, a spore shell consisting of several layers is formed on top of the prospore. The number, thickness and structure of the layers are different for different types of bacteria. The surface of the outer shell can be smooth or with outgrowths of different lengths and shapes. On top of the

shell of the spore, another thin layer is often formed, surrounding the spore in the form of a cover, the exosporium.

The spores are usually round or oval in shape. The diameter of the spores of some bacteria exceeds the width of the cell, as a result of which the shape of the spore-bearing cells changes. The cell takes the shape of a spindle (clostridium) if the spore is located in its center, or the shape of a drumstick (plectridium) when the spore is close to the end of the cell.

After the maturation of the spore, the mother cell dies, its shell is destroyed, and the spore is released. The process of spore formation takes place within a few hours.

The presence of a dense, impenetrable shell in bacterial spores, a low water content in it, a large amount of lipids, as well as the presence of calcium and dipicolinic acid determine the high resistance of spores to environmental factors. Spores can be in a viable state for hundreds or even thousands of years. For example, viable spores have been isolated from the corpses of mammoths and Egyptian mummies dating back thousands of years. The spores are resistant to high temperatures: in a dry state, they die after warming up at 165-170 ° C for 1.5—2 hours, and with superheated steam (in an autoclave) - at 121 ° C for 15-30 minutes.

Under favorable conditions, the spore germinates into a vegetative cell; this process usually lasts several hours.

The germinating spore begins to actively absorb water, its enzymes are activated, and the biochemical processes leading to growth are enhanced. When the spore germinates, the cortex turns into the cell wall of a young vegetative cell; dipicolic acid and calcium are released into the external environment. The outer shell of the spore ruptures, through the ruptures a "sprout" of a new cell comes out, from which a vegetative bacterial cell is then formed.

Food spoilage is caused only by vegetative cells. Knowledge of the factors contributing to the formation of spores in bacteria and the factors that cause them to germinate into vegetative cells is important in choosing the method of processing products in order to prevent their microbial spoilage.

The above information characterizes mainly the so-called true bacteria. There are others that are more or less different from them, which include the following.

Filamentous (filamentous bacteria). These are multicellular organisms in the form of filaments of various lengths, with a diameter from 1 to 7 microns, movable or attached to a substrate. Mostly filaments with a slimy cover. They may contain magnesium oxide or iron oxides. They live in reservoirs and are found in the soil.

Myxobacteria. These are rod-shaped bacteria that move by sliding. They form fruit bodies — clusters of cells enclosed in mucus. The cells in the fruit bodies go into a resting state — myxospores. These bacteria live in the soil, on various plant residues.

Budding and stem bacteria multiply by budding, form stems, or both. There are species with prosthetic outgrowths. They live in soil and reservoirs.

Literature

1. Sh, O. F., Ikhtiyarova, G. A., Xudoyqulova, F. S., & Abdieva, N. U. (2023). EFFECTIVE AND EXPRESS METHOD FOR DIAGNOSING THE CERVICAL AND VAGINA DISEASES IN REPRODUCTIVE AGE WOMEN.
2. Abdieva, N. (2024). CONDITION OF BREAST TISSUEAND THE RISK OF DEVELOPING BREAST CANCER IN PATHOLOGICAL SECERATION SYNDROME. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(4), 161-170

3. Abdieva, N. (2024). THE ROLE OF GENETIC PREDICTORS OF METABOLIC DISORDERS IN WOMEN WITH POLYCYSTIC OVARY SYNDROME CONCOMITANT WITH CERVICAL NEOPLASIA. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(3), 50-54.
4. Abdiyeva Nigina Ulugbekovna. (2024). ENDOSCOPIC-MORPHOLOGICAL CHARACTERISTICS OF BACKGROUND DISEASES OF THE CERVIX. Лучшие интеллектуальные исследования, 14(4), 120–129.
5. Abdiyeva Nigina Ulugbekovna. (2024). ENDOSCOPIC-MORPHOLOGICAL CHARACTERISTICS OF BACKGROUND DISEASES OF THE CERVIX. Лучшие интеллектуальные исследования, 14(4), 120–129. Retrieved from http://web-journal.ru/index.php/journal/article/view/3052.
6. Abdieva, N. U. (2024). THE ROLE OF CYTOKINES IN THE DEVELOPMENT OF CERVICAL ECTOPIA AND ITS PREVENTION. Valeology: International Journal of Medical Anthropology and Bioethics (2995-4924), 2(9), 112-119.
7. Farida Farkhodovna, K. ., Umida Rakhmatulloevna, N. ., & Mokhigul Abdurasulovna, B. (2022). ETIOLOGY OF CHRONIC RHINOSINUSITIS AND EFFECTIVENESS OF ETIOTROPIC TREATMENT METHODS (LITERATURE REVIEW). Новости образования: исследование в XXI веке, 1(4), 377–381. извлечено от https://nauchniyimpuls.ru/index.php/noiv/article/view/1367
8. Numonova, A., & Narzulayeva, U. (2023). EPIDEMIOLOGY AND ETIOPATHOGENESIS OF CHF. Наука и инновация, 1(15), 115-119.
9. Орипова Озода Олимовна, Самиева Гулноза Уткуровна, Хамидова Фарида Муиновна, & Нарзулаева Умида Рахматуллаевна (2020). Состояние плотности распределения лимфоидных клеток слизистой оболочки гортани и проявления местного иммунитета при хроническом ларингите (анализ секционного материала). Academy, (4 (55)), 83-86.
10. Umida Rakhmatulloevna Narzulaeva, & Xamrayeva Muxlisa Farmon qizi. (2023). ETIOPATHOGENESIS OF HEMOLYTIC ANEMIA. Web of Medicine: Journal of Medicine, Practice and Nursing, 1(1), 1–4. Retrieved from https://webofjournals.com/index.php/5/article/view/26
11. Нарзулаева, У., Самиева, Г., & Насирова, Ш. (2023). Гемореологические нарушения на ранних стадиях гипертензии в жарком климате. Журнал биомедицины и практики, 1(1), 221–225. https://doi.org/10.26739/2181 -9300-2021-1-31
12. Umida Rakhmatulloevna Narzulaeva. (2023). Important Aspects of Etiology and Pathogenesis of Hemolytic Anemias. American Journal of Pediatric Medicine and Health Sciences (2993-2149), 1(7), 179–182. Retrieved from https://grnjournal.us/index.php/AJPMHS/article/view/817
13. Нарзулаева, У. Р. Самиева, Г. У. & Насирова, Ш. Ш. (2021). ИССИҚ ИҚЛИМДА КЕЧУВЧИ ГИПЕРТОНИЯ КАСАЛЛИГИНИНГ БОШЛАНҒИЧ БОСҚИЧЛАРИДА ГЕМОРЕОЛОГИК БУЗИЛИШЛАР. ЖУРНАЛ БИОМЕДИЦИНЫ И ПРАКТИКИ, 6(1).
14. Нарзулаева, У. Самиева, Г. Лапасова, З. & Таирова, С. (2023). Значение диеты в лечении артериальной гипертензии. Журнал биомедицины и практики, 1(3/2), 111–116. https://doi.org/10.26739/2181-9300-2021-3-98
15. Xalimova, Y. S. (2024). Morphology of the Testes in the Detection of Infertility. Journal of Science in Medicine and Life, 2(6), 83-88.
16. Халимова, Ю. С. (2024). Морфологические Особенности Поражения Печени У Пациентов С Синдромом Мэллори-Вейса. Journal of Science in Medicine and Life, 2(6), 166-172.

17. Salokhiddinovna, X. Y. (2023). Anemia of Chronic Diseases. Research Journal of Trauma and Disability Studies, 2(12), 364-372.
18. Salokhiddinovna, X. Y. (2023). MALLORY WEISS SYNDROME IN DIFFUSE LIVER LESIONS. Journal of Science in Medicine and Life, 1(4), 11-15.
19. Salohiddinovna, X. Y. (2023). SURUNKALI KASALLIKLARDA UCHRAYDIGAN ANEMIYALAR MORFO-FUNKSIONAL XUSUSIYATLARI. Ta'lim innovatsiyasi va integratsiyasi, 10(3), 180-188.
20. Халимова, Ю. С. (2024). КЛИНИКО-МОРФОЛОГИЧЕСКИЕ ОСОБЕННОСТИ ВИТАМИНА D В ФОРМИРОВАНИЕ ПРОТИВОИНФЕКЦИОННОГО ИММУНИТА. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 36(3), 86-94.
21. Saloxiddinovna, X. Y. (2024). CLINICAL FEATURES OF VITAMIN D EFFECTS ON BONE METABOLISM. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 36(5), 90-99.
22. Saloxiddinovna, X. Y. (2024). CLINICAL AND MORPHOLOGICAL ASPECTS OF AUTOIMMUNE THYROIDITIS. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 36(5), 100-108.
23. Saloxiddinovna, X. Y. (2024). MORPHOFUNCTIONAL FEATURES BLOOD MORPHOLOGY IN AGE-RELATED CHANGES. Лучшие интеллектуальные исследования, 14(4), 146-158.
24. Saloxiddinovna, X. Y. (2024). CLINICAL MORPHOLOGICAL CRITERIA OF LEUKOCYTES. Лучшие интеллектуальные исследования, 14(4), 159-167.
25. Saloxiddinovna, X. Y. (2024). Current Views of Vitamin D Metabolism in the Body. Best Journal of Innovation in Science, Research and Development, 3(3), 235-243.
26. Saloxiddinovna, X. Y. (2024). MORPHOFUNCTIONAL FEATURES OF THE STRUCTURE AND DEVELOPMENT OF THE OVARIES. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(4), 220-227.
27. Saloxiddinovna, X. Y. (2024). Modern Views on the Effects of the Use of Cholecalciferol on the General Condition of the Bod. JOURNAL OF HEALTHCARE AND LIFE-SCIENCE RESEARCH, 3(5), 79-85.
28. Abdurashitovich, Z. F. (2024). APPLICATION OF MYOCARDIAL CYTOPROTECTORS IN ISCHEMIC HEART DISEASES. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 39(5), 152-159.
29. Abdurashitovich, Z. F. (2024). ASTRAGAL O'SIMLIGINING TIBBIYOTDAGI MUHIM AHAMIYATLARI VA SOG'LOM TURMUSH TARZIGA TA'SIRI. Лучшие интеллектуальные исследования, 14(4), 111-119.
30. Abdurashitovich, Z. F. (2024). MORPHO-FUNCTIONAL ASPECTS OF THE DEEP VEINS OF THE HUMAN BRAIN. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 36(6), 203-206.
31. Abdurashitovich, Z. F. (2024). THE RELATIONSHIP OF STRESS FACTORS AND THYMUS. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 36(6), 188-196.
32. Abdurashitovich, Z. F. (2024). MIOKARD INFARKTI UCHUN XAVF OMILLARINING AHAMIYATINI ANIQLASH. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 36(5), 83-89.

33. Rakhmatova, D. B., & Zikrillaev, F. A. (2022). DETERMINE THE VALUE OF RISK FACTORS FOR MYOCARDIAL INFARCTION. FAN, TA'LIM, MADANIYAT VA INNOVATSIYA JURNALI| JOURNAL OF SCIENCE, EDUCATION, CULTURE AND INNOVATION, 1(4), 23-28.
34. Toxirovna, E. G. (2024). QANDLI DIABET 2-TIP VA KOMORBID KASALLIKLARI BO'LGAN BEMORLARDA GLIKEMIK NAZORAT. TADQIQOTLAR. UZ, 40(3), 48-54.
35. Toxirovna, E. G. (2024). XOMILADORLIKDA QANDLI DIABET KELTIRIB CHIQARUVCHI XAVF OMILLARINI ERTA ANIQLASH USULLARI. TADQIQOTLAR. UZ, 40(3), 63-70.
36. Toxirovna, E. G. (2024). DETERMINATION AND STUDY OF GLYCEMIA IN PATIENTS WITH TYPE 2 DIABETES MELLITUS WITH COMORBID DISEASES. TADQIQOTLAR. UZ, 40(3), 71-77.
37. Tokhirovna, E. G. (2024). COEXISTENCE OF CARDIOVASCULAR DISEASES IN PATIENTS WITH TYPE 2 DIABETES. TADQIQOTLAR. UZ, 40(3), 55-62.
38. Toxirovna, E. G. (2024). GIPERPROLAKTINEMIYA KLINIK BELGILARI VA BEPUSHTLIKKA SABAB BO'LUVCHI OMILLAR. Лучшие интеллектуальные исследования, 14(4), 168-175.
39. Tokhirovna, E. G. (2024). MECHANISM OF ACTION OF METFORMIN (BIGUANIDE) IN TYPE 2 DIABETES. JOURNAL OF HEALTHCARE AND LIFE-SCIENCE RESEARCH, 3(5), 210-216.
40. Tokhirovna, E. G. (2024). THE ROLE OF METFORMIN (GLIFORMIN) IN THE TREATMENT OF PATIENTS WITH TYPE 2 DIABETES MELLITUS. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(4), 171-177.
41. Qilichovna, A. M., & Nematilloyevna, X. M. (2024). METABOLIK SINDROMI VA QON BOSIMI BOR BEMORLARDA O'ZGARISH XUSUSIYATLARI BAHOLASH: Yangi O'zbekiston taraqqiyotida tadqiqotlarni o'rni va rivojlanish omillari. Yangi O'zbekiston taraqqiyotida tadqiqotlarni o'rni va rivojlanish omillari, 6(4), 187-196.
42. Qilichovna, A. M., & Nematilloyevna, X. M. (2024). TIBBIYOT TILI HISOBLANMISH LOTIN TILINI SAMARALI O'RGANISH OMILLARI: Yangi O'zbekiston taraqqiyotida tadqiqotlarni o'rni va rivojlanish omillari. Yangi O'zbekiston taraqqiyotida tadqiqotlarni o'rni va rivojlanish omillari, 6(4), 197-206.
43. Tog'aydullayeva, D. D. (2024). Embrional Davrda Gemopoez Va Unda Jigar Va Taloqning Roli. Journal of Science in Medicine and Life, 2(6), 132-134.
44. Tog'aydullayeva, D. D. (2024). Occurrence of Combination Diseases in Ischemic Heart Disease and Metabolic Syndrome and their Diagnosis. Journal of Science in Medicine and Life, 2(6), 126-131.
45. Tog'aydullayeva, D. D. (2024). Occurrence of Combination Diseases in Ischemic Heart Disease and Metabolic Syndrome and their Diagnosis. Journal of Science in Medicine and Life, 2(6), 126-131.