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GENETICS OF MICROORGANISMS

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Annotation. The article analyzes micro-organisms as an object of research in solving fundamental problems in the genetics of microorganisms, parts named Real-core organisms, prokaryotic organisms, genotype and phenotype, phenotypic variability, genotypic variability, transformation in bacteria, transduction and conjugation, biotechnology of microorganisms.
Keywords: eukaryotic, prokaryotic, mutations, genotype, phenotype, phenotypic variability, genotypic variability, transformation, transduction.

1. Microorganisms as an object of research in solving fundamental problems. Microorganisms have a number of advantages as a genetic object. Their chromosome set is haploid, and the mutation under study occurs as early as the first generation. Microorganisms reproduce easily in laboratory conditions and give a huge number of offspring in a short period of time. They clarified the nature of parasexual processes in fungi, such as transformation[1], transduction[2], sex in bacteria (conjugation[3] or conjunction), unknown to science due to the study of their genetics. Among microorganisms, fungi, algae, bacteria and viruses are widely used as genetic objects. The nuclei of fungi and algae are formed, which are separated from the cytoplasm as if they were in higher organisms. Such organisms are called eukaryotes, that is, organisms with a real core. Although bacteria and blue-green algae have chromosomes, they are not separated from the cytoplasm by a separate border. Such organisms are referred to as prokaryotic organisms. Bacterial chromosomes are not visible in light microscopes. With an electron microscope, however, it can be seen that one small chromosome is connected to the cell membrane.

Viruses parasitize plant, animal and bacterial cells[4]. Viruses lack cells. They contain only protein from the outside, DNA as the material basis of heredity in the viral head, and in some cases, PHK.

At present, various antibiotics and chemicals are used in various areas of the national economy. Such substances can be easily determined with the help of microorganisms, whether they have mutagenic properties. When the mutagenicity of a newly obtained antibiotic is determined, it is not used in production.

It will take years to determine the mutagenic properties of chemicals used in various areas of the national economy in high organisms. So microorganisms are also the most favorable object in determining the mutagenicity of chemicals. The reason why microorganisms are a favorable genetic object is that they are rich in various mutations.

Such mutations include: (a) morphological mutants; (B) pigmented mutants; (v) auxotrophic mutants; (g) prototrophic mutants; (d) tiny colonial mutants; (e) various substance-resistant

mutation, etc.

Such mutants can be easily produced under laboratory conditions.

2. Genotype and phenotype. In microorganisms, as in other animals, signs specific to a particular species are passed down from generation to generation. Under the influence of the external environment, morphological, physiological properties inherent in one species can change. In 1881, For example, Louis Pasteur artificially produced irreversible changes in the causative agent of anthrax and developed vaccines to prevent these diseases [5]. N.F.Gamaleya observed changes in the morphology of the plague vibrion when he added lithium chloride to the food environment[6]. These examples show that microorganisms can change their properties depending on the living conditions.

With heredity, variability is two closely related processes, forming a fundamental property inherent in vitality. Currently, the hereditary properties and variability of microorganisms are better studied than that of other organisms.

G.A.Nadson and G.S.Filippov (1925) who succeeded in obtaining New Mutants by exposing X-rays to yeast fungi[7]. They were followed by M.N.Meisel (in 1928-1932) obtained New Mutants by exposing the yeast to chloroform and weak tsian salts.

Microorganisms are important in the study of genetic laws. Because the rapid division of bacteria and the fact that the breed is extremely abundant, small and takes up little space makes them an extremely comfortable object. For example, the intestinal wand (E.soli) split every 15 minutes under favorable conditions, with the number of one cell lineage reaching 24 billion at 1 mm3 after 18-24 hours.

Phenotypic (inbreeding) and genotypic (inbreeding) variability are distinguished in microorganisms. These are due to two main characteristics of the cell: genotype and phenotype. The genotype is a common set (sum) of genes in a cell[8]. It defines a whole group of properties of an organism, different manifestations in different conditions of the external environment. However, the genotype retains its relative constancy under any conditions, a condition that allows the species of microorganisms to be distinguished and distinguished from each other.

Phenotype is a general complex of morphological and physiological properties inherent in each individual[9]. The phenotype is, as it were, the appearance - expression of the genotype character in a certain specific living situation.

While the genotype is a general property of a cell that can project to the surface, the phenotype is a visible representation of these properties.

3. Phenotypic variability. Modifications are caused by the action of various factors of the external environment and are usually observed when the germ grows and multiplies in different food environments[10]. The composition and quality of the food environment, the pH of the environment, changes in temperature, chemicals (colchicine, ethylamine), etc.can cause the origin of modifications. Such changes are non-hereditary (non-hereditary) and disappear with the cessation of the influence of the factor that caused them.

Cells stretch if penicillin is added to the environment, sometimes very altered. The formation of spores in bacteria will also depend on the nature of the environment (dark or liquid), its composition, the temperature of cultivation.

When 0.1% pepton is added to the environment, 100% spore is formed after 48 hours, while only vegetative forms are recorded when 2% pepton is added. Many bacteria and fungi, when grown in different food environments and at different temperatures, change the rate of pigment

formation. The Chunonchi, the" wonderful stick " (wonderful stick) produces a purplish pigment in the food environment when grown at home temperature (27°C). At 37°C, however, no such pigment is produced. When bacteria are grown in a dark food environment, the type of colonies they form can also vary.

Some colonies are smooth, rounded in shape, with a flat edge, shiny, monoecious, small, these are S-forms. Others are vulgar, dull, often not clear, the edge is uneven, in the wrong shape, dry, these are K-forms. There will also be intermediate forms of colonies, namely slugs (M-form), dwarfs (C-form). The formation of colonies of different shapes by a species of bacteria is called dissociation (separation).

Genotypic variability. The hereditary information of the cell is located in the genes on the chromosome that pass from the mother cell to the daughter cell. In asexual division, during mitosis, genes are evenly distributed between two cells. Daughter cells receive the complete set of genes (naborini) of the initial (pre-existing) cell.

Genotypic variability can occur as a result of mutations and genotypic recombinations (transformation, transduction, conjugation) [11].

Mutations. The change in the DNA molecule under the influence of various factors also leads to a change in the information contained in it[12]. Such changes result in mutations. Mutations can be spontaneous and induced. The reasons for the origin of spontaneous mutations cannot be determined[13]. In induced mutations, however, their causes can be known[14]. The causes that cause mutations are caused by chemical modds (colchicine, ethylamine, iprit, etc.k.), sex hormones, growth accelerators, and more can be cited as examples. Under the influence of these, nucleotides are accidentally regrouped and a mutant with a new property is formed. If the resulting mutation is beneficial for the body, the mutants will multiply and, conversely, if the resulting change is not beneficial, the mutants will die.

In microorganisms, one mutation per million cells can occur. Examples include antibiotic resistance, tryptophan synthesis specificity, phage resistance, colony shape changes, pigment formation changes, or capsule formation becoming encapsulated, changes in hivchin formation, etc. Examples of mutations are the taking of new strains of yeast used in bakery, The Taking of strains synthesizing large amounts of antibiotics, the taking of vitamin B12, strains synthesizing oils and lipids, the taking of lactic acid-forming strains, or the taking of active preventive (preventive) forms against dysentery, paratyphoid and typhoid, among others.

4. Transformation, transduction and conjugation in bacteria. The transition of a hereditary trait from a donor chromosome to a recipient cell is called transformation. The transformation goes through a small plot (recon) of DNA. The Recon contains a pair of nucleotides, which can be exchanged with other elements during recombination.

Frederick Griffith (1928) conducted an experiment such that mice were infected with a small number of non-capsular type II pneumococci with no pathogenicity[15]. The same culture has a pathogenicity, with capsular Type III pneumococcal culture (which was killed by heat exposure before the culture) added. As a result, tap II was known to have the pathogenicity of pneumococci and was encapsulated in a capsule. Hence, the characteristic features of Type III pneumococci passed through transformation to type II pneumococci. Mycobacteria forming a white colony, mycobacteria forming a yellow colony, have been found to have the property of forming a yellow colony under the influence of DNA si.

In 1944, O.Everi and K.Mac Leoid, M.Mac Cartis have also found that bacterial properties pass through DNA[16]. It was later revealed that DNA also affects other properties. For example, hay Bacillus, meningococci, pneumococci, streptococci and others can be modified through a transformation agent-DNA. The transforming activity of DNA is extremely high, usually after 10-15 minutes a change occurs in it and stops after 2 hours.

A transformation cell occurs in a certain physiological state (i.e., during the time the cell is ready) without always occurring. Under the influence of high temperatures, ultraviolet rays, chemical mutagens, the transforming nature of DNA decreases. For example, if tansformative DNA is affected by HNO3, it loses its activity. Activity decreases as the temperature rises to 80-100°C. The most favorable temperature is 29-32°C. Hence, transformation activity is influenced by the composition of the environment, temperature, physiological state of the recipient, and polymerization of the transforming DNA.

For example, let a strain of streptomycin-insensitive pneumococci obtained as donors have mannitine cleavage properties, whereas a recipient does not. From these, it is possible to obtain such intermediate forms in which both of the above properties can occur. In a transformation, one property is replaced by a second one. For example, strains that are extremely sensitive or insensitive to antibiotics can also be obtained. Hence, the formation of the transformation consists of two periods, namely adsorption of DNA into the microbial cell and transfer to the cell.

Transduction. The transfer of the Donor bacterial property through the bacteriophage to the recipient bacterium is called transduction. For example, bacteriophages can be passed on to the recipient bacterium by hiccups, feeding control genes, enzyme systems, antibiotics, and genes that determine acid tolerance, virulence, capsule formation, and other properties.

In 1952, Martha Chase and Alfred Hershey determined in an experiment whether phages reproduce within a bacterial cell depends on the protein molecule in it or the DNA molecule[17]. To do this, the phage protein is stamped with the radioactive isotope of sulfur, S35, since the amino acids methionine and cysteine, which are part of the protein, contain sulfur. The DNA molecule, on the other hand, is stamped with the radioactive isotope of phosphorus, P32. 99% of the phosphorus in the phage is in the U DNA molecule. In order to stamp phages with the above radioactive isotopes, phages feed the bacteria that must enter with such a nutrient that radioactive isotopes are added. After that, the stamped phages were infected with bacteria that were not S35 and P32 in their cell. In the new phage generations formed, only the radioactive isotope P32 of DNA-tagging phosphorus is conserved, while S35 is not found. So it turns out that the increase in phages depends on phacate DNA. In 1969, for this discovery, Alfred Hershey won the Nobel Prize[18].

The first to introduce a transduction cell was N. in 1902.Zinder and Dj.Ledeberg determined[19]. The transfer of genes from one bacterial cell to another through phages is called transduction. Genes that have passed through phages to a second bacterial cell attach to the chromosome of the same bacterium and alter its heredity. Traduction can be observed in the following experiment. A filter is installed on the underside of a special U-shaped glass tube that does not pass bacteria. On one side of the same tube is placed the type 22A of the typhoid-causing bacterium in mice and the type 2a on the other side. These bacteria do not mix with each other because there is a filter in the middle of the container. The type 22A of the bacterium is a mutant and the gene that controls the synthesis of the amino acid tryptophan is mutated,

meaning it cannot synthesize tryptophon. Thanks to this, it is necessary to definitely add the amino acid tryptophan to their food when these bacteria are artificially grown. The second type of bacterium (2A) is also a mutant, in which the gene that controls the synthesis of the amino acid histidine is mutated. Therefore, when artificially growing these bacteria, histidine should be added to their feed. Both of these species are mentioned above, in a container with a filter between known time when artificially grown they were transferred to containers separately, and it was observed that some of them survived even when tryptophan was not added to the bacterial feed of species 22A. This means that some bacterial cells have the ability to synthesize tryptophan, which cells have begun to produce bacteria similar to themselves. The ability of bacteria to synthesize tryptophan occurs as a result of the transfer of a gene that performs the synthesis of this amino acid through phage from type 2a bacteria to 22A bacteria. So, when phage kills the bacterium in which it lives, its DNA is broken into small pieces by attaching one of these fragments, that is, a fragment with a gene that performs tryptophan synthesis, to its DNA and attaching it to that bacterial DNA when it enters the second bacterial cell. As a result, this bacterial property becomes able to synthesize altered tryptophan, meaning that a transduction event occurs.

This work is usually done by moderate bacteriophages.

3 types of transduction are known:

1. In the case of nospecific transduction, different fragments of DNA are observed to pass through the motile bacteriophages to the recipient cell. In this case, the DNA fragment carried by the bacteriophage can be attached to the homologous plot of the recipient cell DNA si.
2. In specific transduction, a bacteriophage donor cell carries a specific gene in DNA into a recipient cell. In this, transducting bacteriophage DNA si binds to certain genes of bacterial cell DNA si (donor). Each bacteriophage particle carries one or more closely located genes.
3. In abortive transduction, the DNA fragment (fragment) of the donor cell carried by the bacteriophage does not fuse into the recipient cell DNA Si and localizes autonomously in the cytoplasm of the recipient cell, thus fulfilling its function. When the cell divides, this fragment (DNA) passes to one of the daughter cells and the other cell is freed from it.

Transduction has been found in bacterial representatives such as batsillus, Pseudomonas, salmonella, intestinal wand.

Again, the transduction is of two types[20]:

1. Total transduction
2. Special transduction

Total transduction. In this type, bacteriophage first infects donor cells and initiates the lithic cycle. Then the virus develops its components using the host cell apparatus. Master cell DNA is hydrolyzed into small fragments by viral enzymes.

Small fragments of bacterial DNA are now integrated into the viral genome. When the Virus infects other bacteria, DNA is transferred to it.

Special transduction. In doing so, only a few restricted bacteria pass from the donor to the receiving bacteria. This is done by a mottled bacteriophage that undergoes a lysogenic cycle.

The Virus enters bacteria and unites its genome within the host cell DNA. It remains motionless and is passed down from generation to generation. When the lysogenic cell is affected by some kind of external triggers, the lithic cycle begins.

The viral genome is induced in the host cell genome. Because of this, the phage genome

sometimes carries the bacterial genome with it and integrates it into the recipient cell genome. Only a limited genome here has access to receiving cells.

Conjugation. Microbiologists discovered the phenomenon of cone-gation in bacteria at the end of the 19th century, which they called "conjunctions" to distinguish it from conjugation in other organisms. Genetic analysis of conjugation was carried out by Lederberg and Tatums in 1946[21]. They observed this phenomenon in an electron microscope, and it was found that one of the cells to be conjugated is oblong, the other is Oval. The oblong cell is the male cell and is defined as F+ (donor), while the Oval cell is the female and is defined as F- (recipient). At the time of conjugation, these converge, forming a cytoplasmic bridging between them. Through the resulting bridgehead, genetic factors flow from the donor cell to the recipient cell in a certain order. Conjugation was studied much more deeply in salmonella, intestinal wand, and Pseudomonas, with F+ and F - cells defined as follows. Which of the two cells is the donor depends on whether the cell has f factorniig. The cell it has is called" F+ - cells". Factor F is defined as an "F - Cell" if it is a colon.

The F+ Factor belongs to the conjugative plasmids, which is known as Halic DNA (64 x 106 a. m.e.) state. F ensures that the plasma has 1-2 sexual fimbriums above the cell, merging with the donor cell. F-plasmid localizes autonomously in the cytoplasm, but it has the property of attaching with a bacterial chromosome.

As a result of the integration, the F-plasmid combines with a bacterial chromasome to make the HFR strain specific. Usually when "F" bacteria are transmitted with the HFR strain, the F Factor is not given (genes in the bacterial chromasome are transferred at a very high frequency). At the beginning of conjugation, F+ or Hfr-containing donor cells, fuse with the recipient cell. A conjugate bridge is then formed between the cell and a genetic source is given from the donor cell to the recipient cell, with either an F-plasmid or a chromasome.

At the time of conjugation, double-stranded DNA is broken into separate strands and usually only one strand of DNA is given, while the second strand is converted into a double-stranded plasmid using DNA-polymerase in a recipient cell, with the transition starting from one side of the chromasome and then moving to other parts as well. It is possible to stop the passage of a genetic source by shaking pairs of contaminated bacteria. Sometimes such a feature of the male cell can be transferred to the female cell and be seen in the next generation. In the absence of halacitation, the passage of the genetic source at the end of the commutation stops. The conjugate bridge between is broken because it is less robust. The violation of the bridge does not affect the life activity of the cell.

As a result of spontaneous cessation of conjugation in an F+ recipient cell, only F + passes to a certain genetic information of the cell. Thus as a result of conjugation, the recipient cell F becomes merozygote (meaning"partial zygote"), the recipient-the full genome of the cell, and the donor the partial genome of the cell).

As a result of the crossover (alternating maturation of chromasomes), genes are replaced and a combination of a genetic source is formed[22]. In the next generation, various recombinates are now formed.

The study of the genetics of microorganisms is important. Because in order to get antibiotics, vitamins, hormones, enzymes, lysine and glutamine and other substances from amino acids, New-new strains with high activity are needed.

Bacteria, species and actinomycetes are affected by radioactive rays and chemical mutagens,

changing the structure of DNA in their cells so that their activity can be directed to the side of the synthesis of substances useful for humans. Currently, with a good knowledge of the physiological nature of bacteria, their modification and, in this way, their large-scale use in technological processes in agriculture, medicine, food industry are important issues facing microbiologists.

Episomes. Episomes are a set of tiny genes that are free of chromasomes. They are found free in the cytoplasm or added to the bacterial chromasome[23].

Episomes are involved in the interbreeding of bacterial factors such as pinkness (f), drug tolerance (R), bacteriocinogenicity, cholinocinogenicity, and others. The antibiotic resistance factor (K-factor) of episomas was first identified by Japanese scientists.

Bacteriocinogenicity is understood as the property of synthesizing substances against antibiotics in a bacterial cell[24], these substances are called bacteriocins. For example: intestinal wand E. soli-colicin, so on. Cerlusa-erotsin, Bac. Megaterium-megacine, E. Restis - testicine, Staphylococcus aureus-staphylacococcus synthesizes. They adsorb into the bacterial cell and cause bacterial destruction. Bacteriocins act only on bacteria that stay close to the prodrug.

5. Biotechnology of microorganisms. Microbial diversity, improvement, and application for food processing, health, environmental safety, and agriculture[25] the 1970s saw the emergence of Biotechnology, a production method based on advances in Molecular Genetics, Cell Biology, and chemistry. But the process of production in a biological way is known to us from ancient times. For example, bread, wine, dairy products, cheese production, bijection, the production of medicines used in medicine, etc.are biotechnological processes that do not require much energy and raw materials than other methods of production. Another convenience of Biotechnology is that the waste generated by this process is scarce and they are certainly used for another purpose. Biotechnology is further developing in subsequent years, relying on the achievements of genetic engineering. Networks that produce the DNA molecule began to be created. Such networks first appeared in America in 1976, and later, in Europe and Japan. From biotechnology processes, it is widely used in the microbiology industry, the enzyme production industry in plant and animal selection, the food industry, medical drug production and other industries. Currently, many (about 4,500) antibiotics are being taken on the basis of Biotechnology methods.

Biotechnology science arose on the basis of the development of Molecular Genetics, Microbiology and biochemistry. Using the knowledge of vital processes taking place in living beings (viruses, bacteria, fungi in plant and animal cells), a complex of technologies that produce products on an industrial scale with the participation of living beings or their cells is called biotechnology.

In ancient times, humanity unconsciously used the technology of making yogurt from milk, porridge and yeast from wheat, wine or vinegar from fruit juices based on life processes. But those who did not know that these products are formed in the presence of microbes or bacteria. The creation of the pasteurization method by the great French scientist Louis Pasteur (the so-called pasteurization of milk or fruit juice by heating them to 100oc) laid the foundation for the conscious use of microorganisms in biotechnology[26].

Obtaining bacterial clones and strains. A colony of a generation of bacteria formed by multiple consistent cleavage of one bacterial cell is called a bacterial clone. Each cell in the clone is

similar to the mother cell in terms of all its hereditary properties. When each cell isolated from the clone is divided, the offspring is transferred to the cell without changing hereditary characters[27].

The cloning of bacteria is carried out as follows: the bacterium growing in artificial liquid feed is transferred to the level of solid artificial feed mixed with agar-agar substance under sterile conditions. Each bacterial cell that has fallen to the solid agar-agar level begins to be sequenced. As a result, a colony of a generation of bacteria formed from one mother cell is formed, and this colony is called a clone.

In biotechnology processes, only bacterial clones with purposeful properties are selectively grown, propagated and used.

Humanity until the middle of the XIX century believed that bacteria are plastic changeable, that is, hereditary. Louis Pasteur first demonstrated the diversity of bacteria, the presence of their heredity and the full dependence of their properties on heredity, with the discovery of a method for cloning bacteria. Existing microorganisms in nature are not always suitable for the purpose.

Strain. Researchers increase the diversity of bacterial strains (strain hereditary altered clone) with certain hereditary properties through the use of mutagenic substances, select by cloning, and are used in the biotechnological process[28]. In recent years, Biotechnology has been developed to replace any nucleotide of the desired gene by the gene engineering method. The technique is currently being perfected. This method is called directed mutation[29].

The biotechnology of microorganisms is widely used in the industries of milk processing (cottage cheese, sour cream, cottage cheese, kefir, quince, cheese and other products), vinegar production, amino acid and protein production, antibiotic production, yeast (droji) production, alcohol production, wine and beer production. At the same time, the production of biofuels using microorganisms is now also being established on an industrial basis.

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