

General Bacteriology

Questions

117. **Who discovered the process of phagocytosis and explained the inflammatory process on its basis? (MH PGM CET 2005)**
- a. Robert Koch
 - b. Metchnikoff
 - c. Jenner
 - d. Ehrlich
118. **Which of the following cannot be used for biological warfare? (SGPGI 2003)**
- a. Yersenia
 - b. Plague
 - c. Anthrax
 - d. T. Pallidum
119. **Pasteur developed the vaccine for: (MAHE 2005)**
- a. Anthrax
 - b. Rabies
 - c. Cholera
 - d. All
120. **Prokaryotes are: (Kerala 96)**
- a. Have nucleus
 - b. Contain DNA and RNA
 - c. Does not contain cell wall
 - d. Unicellular
 - e. None
121. **Dark ground microscopy is used to see: (AI 95)**
- a. Refractive organs
 - b. Flagella
 - c. Capsule
 - d. Fimbriae
122. **Dark ground microscopy is used for detection of: (AI 89)**
- a. Spirochete
 - b. Myco-Tuberculosis
 - c. Myco-Leprae
 - d. Mycoplasma

- 123. Mesophilic organisms are those that grow best at temperature of: (Kerala 2000)**
- 20°C to -7°C
 - 7°C to 20°C
 - 25°C to 40°C
 - 55°C to 80°C
- 124. The discovery of gene transformation came from study of one of the following bacteria: (Manipal 97)**
- Bacillus subtilis
 - Streptococcus pyogenes
 - Streptococcus pneumoniae
 - E. coli
- 125. Virus mediated transfer of host DNA from one cell to another is known as: (MH PGM CET 2000 Dec and 2005 Jan)**
- Transduction
 - Transformation
 - Transcription
 - Integration
- 126. Transfer of a portion of DNA from one bacterium to another by the Bacteriophage is known as (MHPGMCET-2003, Manipal 2001)**
- Transformation
 - Transduction
 - Transcription
 - Lysogenic conversion
- 127. Transfer of a portion of DNA from one bacterium to another by the Bacteriophages is known as (MH PGM CET-2003, Manipal 2001)**
- Transformation
 - Transduction
 - Transcription
 - Lysogenic conversion
- 128. The mechanism by which specific information encoded in a nucleic acid chain in a virus transferred to mRNA is known as: (JIPMER 2005)**
- Transcription
 - Translation
 - Transformation
 - Transduction

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129. Conjugation does not involve: (AMU 98)

- a. Bacteriophages
- b. HFr
- c. Fr
- d. Plasmids

130. Extra chromosomal genetic material are called: (Kar 93)

- a. Plasmids
- b. Mesosomes
- c. Ribosomes
- d. Lysosomes

131. The membrane attack complex consists of: (J and K 2005)

- a. Colicins
- b. C3b, 2a
- c. C5b,6,7,8,9
- d. Properdin

132. Most of the drug resistance occurs due to: (UP 96)

- a. Transduction
- b. Translation
- c. Mutation
- d. Conjugation

133. The mechanism of genetic transfer where a phage serves as a vehicle is: (CUPGEE 98)

- a. Transduction
- b. Translation
- c. Lysogeny
- d. Conjugation

134. The most primitive mode of gene transfer occurs by:

- a. Transduction
- b. Translation
- c. Cell fusion
- d. Conjugation

135. Fimbriae are demonstrated by? (Kar 93)

- a. Culture
- b. Gram stain
- c. Biochemical reaction
- d. Haemagglutination test

- 136. Fibroblast in tissue culture form interferon of which type? (AMC 88)**
- Alpha
 - Beta
 - Gamma
 - All the above
- 137. Which of the following are features of the bacterial cell wall: (PGI 2005)**
- Peptidoglycan
 - Flagellin
 - Lipopolysaccharide
 - Pilus protein
 - Teichoic acid
- 138. C-reactive protein (CRP) is: (AIIMS 97)**
- Produced by Pneumococcus
 - Marker of septicemia
 - Raised in acute inflammation
 - Low in rheumatoid arthritis
- 139. Following is true about C-reactive protein: (MP 2004)**
- Detected by precipitation with carbohydrate
 - Raised in acute pneumococcal infection.
 - It is an antibody
 - Detected by agglutination test
- 140. Obligate anaerobes cannot withstand oxygen because of absence of: (AP 2005)**
- Superoxide dismutase
 - Catalase
 - Peroxidase
 - Cytochrome oxidase
- 141. True about Lymphokines: (Kerala 2005)**
- Alpha-interferon activates macrophages
 - Interleukin 2 (IL-2) is a T-cell growth factor
 - The action of lymphokines is not antigen specific
 - All CD4+ T-cells do not produce the same Lymphokines
 - Colony stimulating factors (CSF) stimulate bacterial growth

General Bacteriology

Answers

117. Ans. b (Metchnikoff)

(Ref. Robbin's pathology 7th ed. 49)

In 1880s, Russian biologist Elie Metchnikoff and Paul Ehrlich (who developed humoral theory of immunity) shared Nobel Prize in 1908.

118. Ans. d (T. Pallidum)

T. Pallidum is a spirochete causing STD and cannot be used for biological warfare.

119. Ans. d (All)

(Ref. Textbook of Microbiology by Ananthanarayan 6th ed. 2)

Contributions of Louis Pasteur:

Microbial theory of fermentation

Anthrax, cholera, Rabies vaccine

Principle of sterilization

Streptococci

Father of modern microbiology

While at Lille University, Pasteur received a query from an industrialist on the production of alcohol from beet sugar. Apparently the beer was going sour after fermentation. Thus began the biological investigations, for which he is best known.

Pasteur began his studies of fermentation where once again he encountered, in liquid form, his right and left compounds. He examined the problem of lactic fermentation and showed yeast to be an organism capable of reproducing itself without free oxygen. This became known as the Pasteur effect. He showed that fermentation involved microorganisms, and for the process to be alcohol-producing, rather than lactic-acid producing, the correct type of yeast need to be used. To prevent souring of the wine during the ageing process, Pasteur realised that the wine had formed it must be gently heated to 50°C/122°F. This heating process is today called Pasteurization.

He was elected to the Academy of Sciences in 1862, and the following year a chair at the École des Beaux-Arts was established for him for a new and original program of instruction in geology, physics, and chemistry applied to the fine arts. However, his interest, and engagement in research, caused him to give up the post in 1867.

With the support of Napoleon 3 the same institution created for him a laboratory of physiological chemistry.

Spontaneous Generation

He now turned his attention to a controversy of the time, namely spontaneous generation. Pasteur recognised the fact that both lactic and alcohol fermentations were hastened by exposure to air. This led him to wonder whether his invisible organisms were always present in the atmosphere or whether they were spontaneously generated. Pasteur was able to show that air contained spores of living organisms. When they were placed into nutrient broth the organisms reproduced. When he now boiled the broth in a special 'swan necked' container, that allowed air in but kept dust out, the broth remained free of living organisms. This simple experiment helped disproved the theory of spontaneous generation.

Silkworm Breeding

In 1865 the silk industry in France was threatened by disease that was killing the silkworm. The government commissioned Pasteur to find the cause. He moved to the south of France, the centre of silkworm breeding, to carry out his investigations. After three years he was able to announce that he had found the parasite that was infecting the worms. One of his recommendations was the isolation and destruction of all infected silkworms. By following his advice the industry eliminated the disease.

This work stimulated further the interest of Pasteur in infectious disease. Ideas were now beginning to formulate in his mind, they were to eventually lead to the most important single medical discovery of all time, the '*germ theory*' of disease.

Pasteur was partially paralyzed in 1868 and applied for retirement from the university. He did, however, continue his researches. He was elected to the Academy of Medicine in 1873 and in 1874 the French Parliament provided him with an award to ensure his material security. It also allowed him to continue with his work.

120. Ans. d (Unicellular)

(Ref. *Textbook of Microbiology by Ananthanarayan 6th ed. 281*)

Prokaryotes are unicellular organism. Bacteria and blue green algae are prokaryotes.

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Features		Prokaryotes	Eukaryotes
Nucleus	Nuclear membrane	Absent	Present
	Nucleolus	Absent	Present
	DNA	Absent	Present
	Chromosome	One (circular)	More than one (linear)
	Mitotic division	Absent	More than one (linear)
Cytoplasm	Mitochondria	Absent	Present
	Golgi apparatus	Absent	Present
	E. reticulum	Absent	Present
	Lysosomes	Absent	Present
Chemical composition	Sterols	Absent	Present
	Muramic acid	Present	Absent
		E.g.: Bacteria Blue green algae	E.g.: Fungi Other algae Slime moulds protozoa

121. **Ans. b (Flagella)** (Ref. *Textbook of Microbiology by Ananthanarayan 6th ed. 15*)

Flagella

They are organs of locomotion.

They are made up of a protein flagellin.

Flagellar antigen induces specific antibodies in high titers. These antibodies are not protective but are useful in serodiagnosis.

Types:

1. Peritrichous → all around cell, e.g. Typhoid bacillus.
2. Polar → at one or both ends:
 - a. Single → monotrichous, e. g. Cholera
 - b. Tufts → lophotrichous, e.g. Spirilla
 - c. Both poles → amphitrichous

Flagella may be seen under dark ground illumination.

They can be visualized by special staining techniques or by electron microscopy. Their presence can be observed on the semisolid agar medium by noting spreading type of growth due to motility.

122. Ans.a (Spirochete)

(Ref. Harrison Principle of Medicine 15th ed.-1044; Textbook of Microbiology by Ananthanarayan 6th ed. 351 and above Q for explanation)

Dark ground microscopic examination is useful but negative results do not exclude diagnosis of syphilis.

Diagnosis by microscopy is applicable in primary and secondary stages and congenital syphilis.

Wet film prepared with exudates is seen under dark ground microscope.

T.pallidum show slow movement with slender spiral structure.

However, serology remains the best diagnostic test for syphilis.

In blood transfusion and in congenital syphilis, no chancre occurs.

123. Ans. c (25°C to 40°C)

(Ref. Textbook of Microbiology by Ananthanarayan 6th ed. 21)

Bacteria that grow best at temp 25°C to 40°C are called mesophilic organisms.

Psychrophilic bacteria grow best at temperature below 20°C.

Thermophiles grow best at temp 55°C-80°C.

124. Ans. c (Streptococcus pneumoniae)

(Ref. Textbook of Microbiology by Ananthanarayan 6th ed. 51)

Griffith (1928) found that mice died when injected with a mixture of live noncapsulated (R) Streptococcus pneumoniae and heat killed capsulated (S) Pneumococci, neither of which separately proved fatal. After this it was concluded that transfer of information for capsule synthesis to live rough strain occurred. Nature of such transformation was found to be DNA by Avery, Macleod and McCarty in 1944.

Transformation has been studied also in Bacillus species, and the Haemophilus influenzae mainly.

Any information may be transferred by transformation.

125. Ans: a (Transduction)

(Ref. Textbook of Microbiology by Ananthanarayan-6th Edⁿ-53)

• The transfer of DNA from one cell/bacterium to another by a virus (Bacteriophage) is transduction.

• The transfer of genetic information through the agency of free DNA is transformation.

126. Ans. b (Transduction)

(Ref. Ananthanarayan Microbiology 6th ed.- 53)

Transmission of genetic material in bacteria is by:

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a. Transformation

A phenomenon in which transfer of genetic information occurs through the agency of free DNA.

Certain cell lines, such as cancer cells, are also able to grow indefinitely in culture by this mechanism.

b. Transduction

Transfer of a portion of DNA from one bacteria to another by bacteriophage. It is not confined to transfer of chromosomal DNA, it transduces episomes and plasmids also.

Bacteriophages are viruses that parasitise bacteria and consist of nucleic acid core and a protein coat.

It is excellent tool for genetic mapping of bacteria.

c. Lysogenic conversion

Phage DNA becomes integrated with bacterial chromosome as prophage, which multiplies synchronously with host DNA and is transferred to daughter cells, this is lysogeny and bacteria harboring prophages are lysogenic bacteria.

In transduction phage acts only as vehicle carrying bacterial genes from one cell to another but in lysogenic conversion phage DNA itself is new genetic element.

d. Conjugation

The process whereby 'male' or 'donor' bacteria mates or makes physical contact with female or recipient bacteria and transfer genetic element into it.

e. Sexduction

Process of transfer of host genes through f factor, resembles transduction

f. Transfection

Transfer of a gene into a cell, enabling the transfected cell to form a new gene product.

127. Ans. b (Transduction)

(Ref. Ananthanarayan Microbiology 6th ed. 53)

Transduction

It is defined as the transfer of a portion of DNA from one bacteria to another by bacteriophage.

It is not confined to transfer of chromosomal DNA; it transduces episomes and plasmids also.

Bacteriophages are viruses that parasitise bacteria and consist of nucleic acid core and a protein coat.

It is excellent tool for genetic mapping of bacteria.

128. Ans. d (Transduction)

(Ref. Ananthanarayan Microbiology 6th ed. 53)

Transduction

It is defined as the transfer of a portion of DNA from one bacterium to another by bacteriophage.

It is not confined to transfer of chromosomal DNA; it transduces episomes and plasmids also.

Thus it is the mechanism by which specific information encoded in a nucleic acid chain in a virus transferred to mRNA.

Bacteriophages are viruses that parasitize bacteria and consist of nucleic acid core and a protein coat.

It is excellent tool for genetic mapping of bacteria.

129. Ans. a (Bacteriophages)

(Ref. Ananthanarayan Microbiology 6th ed. 53)

The F factor in Hfr cells, Colicinogenic factor, and the plasmids (with Resistance transfer factor and resistance determinant) are required for conjugation.

130. Ans. a (Plasmids)

(Ref. Textbook of Microbiology by Ananthanarayan 6th ed. 51)

Transformation: - transfer of genetic information through agency of free DNA. Found by Griffith in Pneumococci

Transduction: - transfer of a portion of DNA from one bacterium to another by bacteriophages is known as Transduction.

Bacteriophages are viruses that parasitise bacteria.

Lysogenic conversion: - Bacteriophages exhibit two types of life cycle. In the virulent or lytic cycle, large numbers of progeny phages are built up inside the host bacterium, which ruptures to release them. In temperate or nonlytic cycle, host bacterium is unharmed, phage DNA becomes integrated with bacterial chromosome as prophage, which multiplies synchronously with host DNA and is transferred to the daughter cells. This is called Lysogeny. Prophage behaves as an additional segment of bacterial chromosome coding for new characteristics. This process is called Lysogenic / phage conversion.

E.g. Diphtheria bacilli acquire toxigenicity by lysogenisation with phage beta.

Conjugation: - Described by Lederberg and Tatum in strain of E. coli called K12. 'Male' or 'Donor' bacterium mates with 'Female' or 'Recipient' bacterium and transfers genetic material into it. Equivalent of sexual mating of higher organism responsible for most of drug resistance. The maleness or donor status is determined by the presence in it of a Plasmid, which codes for specialized fimbria sex pilus. The plasmid responsible was termed as sex factor or fertility (F) factor.

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Resistance transfer factor: - This plasmid is responsible for the spread of multiple drug resistance among bacteria.

Extra chromosomal genetic element: - In addition to chromosomal DNA most bacteria possess extra chromosomal genetic element which may confer on it properties such as drug resistance and toxigenicity. They are called Plasmids. (Circular DNA molecules present in cytoplasm of bacteria).

131. Ans. c (C5b,6,7,8,9)

Membrane attack complex consists of terminal components (C5b,6,7,8,9) form a complex which inserts into the membrane to form a transmembrane ion channel which leads to lysis of the cell.

132. Ans. d (Conjugation)

(Refer above Q for explanation)

Bacteria may acquire drug resistance by mutation or by one of the methods of genetic transfer. The biochemical mechanisms of resistance may be several, including decreased permeability to the drug, development of alternative metabolic pathways, and production of enzymes inactivating the drugs.

Mutational resistance is mainly of two types:

1. Stepwise mutation
2. One-step mutation

In clinical practice, mutational resistance is of great importance in tuberculosis.

Acquisition of resistance by transduction is common in staphylococci.

Transferable drug resistance mediated by the R factor is the most important method of drug resistance.

Resistance may be transferred between bacteria of different taxonomic groups.

Although in laboratory, R factors may sometimes be eliminated by treating bacteria with acridine dyes or ethidium bromide. But in community, the only way to prevent widespread dissemination of multiple resistances is to restrict the use of antibiotics to essential minimum.

133. Ans. c (Lysogeny)

(Refer above Q for explanation)

Lysogeny: Bacteriophages exhibit two types of life cycle. In the virulent or lytic cycle, large numbers of progeny phages are built up inside the host bacterium, which ruptures to release them. In temperate or nonlytic cycle, host bacterium is unharmed, phage DNA becomes integrated with bacterial chromosome as prophage, which multiplies synchronously with host DNA and is transferred to

the daughter cells. This is called Lysogeny. Prophage behaves as an additional segment of bacterial chromosome coding for new characteristics. This process is called Lysogenic / phage conversion.

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Conjugation: First described by Lederberg and Tatum in strain of *E. coli* called K12. 'Male' or 'Donor' bacterium mates with 'Female' or 'Recipient' bacterium and transfers genetic material into it. Equivalent of sexual mating of higher organism responsible for most of drug resistance. The maleness or donor status is determined by the presence in it of a Plasmid, which codes for specialized fimbria sex pilus. The plasmid responsible was termed as sex factor or fertility (F) factor.

135. Ans. d (Haemagglutination test)

(Ref. *Textbook of Microbiology by Ananthanarayan 6th ed. 16*)

Fimbriae

- o Fimbriae are fine, hair like appendages originating in the cell membrane seen only under electron microscope.
- o They Function as organs of adhesion.
- o Fimbriae are antigenic found on few gram-negative bacteria. Haemagglutination is simple method for demonstrating fimbriae. Haemagglutination is specifically inhibited by D-mannose
- o Special types of fimbriae are sex pill, which are longer and fewer found on male bacteria. These help in conjugation.

136. Ans. b (Beta)

(Ref. *Textbook of Microbiology by Ananthanarayan 6th ed. 420*)

There are 3 classes of interferon, alpha produced by leucocytes, beta produced by fibroblast and gamma produced by T cells activated by antigens, mitogens or exposure to IL-2.

137. Ans. A, C, E

Peptidoglycan, lipopolysaccharide, and teichoic acid all occur in the structure of the bacterial cell wall itself. Flagellin is the structural protein for extracellular appendages known as *flagella* (in the singular, one flagellum) which are the means of motility in bacteria Pilus protein is the structural protein for extracellular appendages known as *pili* (hair-like projections) in Gram negative bacteria, or *fimbriae* (from fringe) which are important in adherence of bacteria to other bacteria, to cells or to various surfaces.

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138. Ans. c (Raised in acute inflammation)

(Ref. Textbook of Microbiology by Ananthanarayan 6th ed. 70)

139. Ans. b (Raised in acute pneumococcal infection)

Infection or injury leads to sudden increase in plasma concentration of certain proteins. This includes c-reactive protein, mannose binding protein, alpha-1-acid glycoprotein, and serum amyloid p component. This is called acute phase protein. CRP and some others activate alternative pathway of complement. They enhance host resistance, prevent tissue injury and promote repair of inflammatory lesions.

140. Ans. d (Cytochrome oxidase)

(Ref. Microbiology by Ananthanarayan 6th ed. 39)

Anaerobic bacteria differ in their requirement of and sensitivity to oxygen. Some, such as *Cl. Histolyticum*, are aerotolerant and may produce some growth on the surface of aerobic plates, while others like *Cl. Tetani* and *pseudomonas*, are strict anaerobes and form surface growth only if the oxygen tension is less than 2 mmHg.

141. Ans. e (Colony stimulating factors (CSF) stimulate bacterial growth)

Lymphokines

- a) Alpha interferon makes macrophages more effective cells.
- b) IL-2 is necessary for T-cell growth and activation
- c) Lymphokines are produced by stimulation of T-cells by a specific antigen through binding to T-cell receptor. The molecules produced, lymphokines, act on various cells in an antigen non-specific fashion.
- d) CD4+ T-cells can be divided into at least two types TH1 and TH2. Each type produces a different set of lymphokines.
- e) TH1 cells are stimulated by IL-1, they produce IL-2 and gamma interferon and enhance CMI and Delayed hypersensitivity primarily.
- f) TH2 cells are stimulated by IL-4, they produce IL-4, IL-5, IL-6 and IL-10 and primarily enhance antibody production.
- g) Colony stimulating factors signal to bone marrow to produce more leucocytes.