PHARMACEUTICAL BIOTECHNOLOGY

MOST IMPORTANT QUESTIONS

2 MARKS SOLUTIONS --

(1)

→ Biotechnology → It is the branch of science that use living organism (biological source) as a raw material to produce new product.

application →

It is mainly used for the production of antibiotics, vaccines, hormones, vitamins etc --

Also includes standardization of chemotherapeutic agents, enzyme immobilization, monoclonal antibodies etc -

(2)

→ Enzyme biotechnology → It involves modification of enzyme structure or its function by using biotech. (eg.) Enzyme immobilization.

Enzyme immobilization → It is defined as a process of confining (restriction/prevention) the enzyme molecules, in which enzyme's movement has been restricted completely or in small region.

- used to produce more effective enzyme, enhance stability ...

③

→ Methods → ACECE

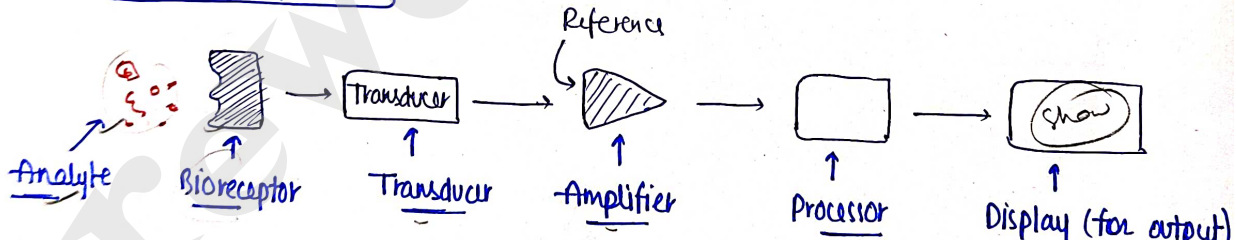
- chemical methods
  - i) Adsorption method
  - ii) Covalent binding
  - iii) Entrapment
  - iv) Cross linking
  - v) Encapsulation method
- Physical methods

④

→ Biosensors →

These are those analytical (measure) devices which are used to change biological response into a electrical signals..

- used to measure the body's response
- main components →



⑤ Define protein engineering →

It can be defined as the modification of protein structure with recombinant DNA technology or other chemical treatment to get a desirable function of proteins for better use in medicines, industry and agriculture

⑥

→ Use of microbes →

Microbes are used in many large-scale industrial processes..

- Bacteria are used in paper, textile and baking industries. (bread, curd..)
- they are used to synthesis of various valuable products to humans such as Antibiotics etc..

eg. fungi used to produce penicillin.

⑦

→ Genetic Engineering → (Genetic modification)

It is the process of changing an organism's genetic material to produce a new and useful results.

- It is a laboratory-based technology to alter the DNA makeup of a organism.
- It includes recombinant DNA technology, biogenetics...

⑧ Define →

(i) Amylase → It is an enzyme that catalyses the hydrolysis of starch into sugar. It is present in the saliva of human and helps to digest starch and glycogen in the mouth, stomach and intestine.

- Production of Amylase → α- amylase can be isolated from plants, animals, microbes, etc..

(ii) Catalase →

It is an enzyme found in food as potato and liver.

- It is one of the fastest enzyme in the cell that used for decomposition of hydrogen peroxide into water and oxygen.
- It protect cell from from oxidative enzyme

(iii) Penicillinase →

It is an enzyme (β-lactamase) produced by curtain bacteria which open β-lactam ring and inactivates penicillins and some closely related (congeners) — Similar structure.

(iv) Peroxidase →

It is a common enzyme that decomposing the peroxide compounds such as hydrogen peroxide, organic hydroperoxides etc..

- Conversion of peroxidase (toxic substances) into non-toxic substances.
- Used to decompose of (pollutants), paper industries, dye colorization, (sewage) treatment etc..

(v) Lipase →

It is the digestive enzyme that need to digest fat. It is the primary, digestants used to split fats into fatty acid and glycerol.

- Lipase is produced in pancreas, seeds and Euphorbiaceae.

(vi) Protease → (Proteolytic enzymes)

It is an enzyme which breakdown proteins into small peptide / amino acids.

- these enzymes are made by animals, plants, fungi and bacteria.
- It break down proteins in the body or on the skin..

uses → breakdown milk protein into amino acid, diminishing risk of babies developing milk allergies....

Q-9

→ Vectors → A vector is a small DNA molecules capable of self replication and it is used as a carrier of DNA fragment inserted into it for cloning the vectors..

- Also called as cloning vehicle

- types :— cloning (multiple copies)
  expression (r-RNA → protein)

- ideal properties :
  - should be easily introduced into host cells.
  - should affords easy transformation of host cells.
  - Supposed to have one origin of replication for DNA replication.

Cloning Vectors →

Vector that is used only for the propogation or cloning of DNA insert inside a suitable host cell.

eg. Plasmid vectors, cosmids, Bacteriophage vectors etc..

(10)

→ Restriction Endonucleacus → (RE)

These are a family of enzyme that each cut DNA at a specific sequence within the DNA.

These specific sequence are called Restriction sites.

• Diff. b/w Exonuclease and Endonuclease.

→

Endonuclease	Exonuclease
• It refers to an enzyme that cleaves the poly-nucleotide chain separating nucleotides other than the two end ones.	• It refers to an enzyme that cleaves polynucleotide chain from the end of the chain by removing the nucleotides one by one.
• Cleave nucleic acid at the middle of the nucleic acid	• Cleave nucleic acid at the end.

basic structural unit of DNA

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(11)

→ DNA ligase →

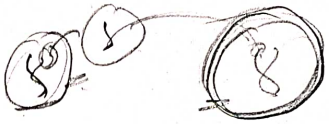
It is a specific type of enzyme that facilitates the joining of DNA strands together by catalyzing the formation of a phosphodiester bond, during DNA replication..

(12) Plasmid →

A plasmid is a small circular DNA molecules found in bacteria and some other microorganism.

- Plasmid are physically separate from chromosomal DNA and replicate independently.

(13) rDNA technology →



Recombinant DNA technology,

It is a technique used for producing artificial DNA through the combination of diff genetic materials (DNA) from diff. source

- the process involves the introduction of a foreign piece of DNA structure into the genome (our gene)

(14) Interferons →

These are signalling proteins belonging to class of (small proteins) Cytokinis that helps in communication b/w one or more cells and are released by host cell as an immunological response

(15) PCR →

Polymerase Chain Reactions

It is an method of producing millions of identical DNA in an quick and short succession of time, mainly used in genetic analysis & analysis of HIV, TB viruses ..

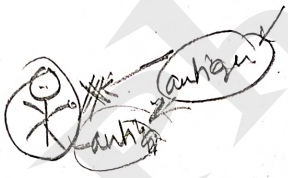
(16) MHC

→ Major Histocompatability Complex

These are the group of proteins present on surface of T-lymphocytes and are responsible for

- Antigen recognition
- Autoimmune disorder recognition
- Leukocyte interaction

(17)

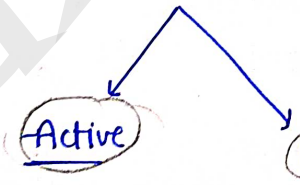


- Immunity →

It is a defensive mechanism produced by body against foreign substances or invader microorganisms

It protect our body and work as a bodyguard.

- Inate immunity → immunity present from birth
- Acquired immunity → immunity produced by body during life span.



Active

- also known as adaptive immunity
- developed throughout our lives.

Passive

- also known as temporary immunity
- taken from an artificial sources.

- Humoral Immunity →

immunity mediated by Ag-Ab interaction

- Cellular immunity →

immunological responses mediated by T-lymphocytes and phagocytes

(18) Immunoglobulins →

Also called as antibodies, these are immunological substances produced by immune system to protect body from invader toxins & allergens

eg/types → Ig-G, IgA, IgM, IgE, IgD (GAMED)

(19) Hypersensitivity reactions →

These are the immune responses that are exaggerated against an antigen-antibody rxns--

exaggerated = excessively/overstated (inappropriated)

It is mediated by immunoglobins (antibodies) or T-lymphocytes

types → type I, II, III, IV

eg. Allergic Asthma, food allergy, drug induce allergy -

(20)

→ Immune stimulation (↑ activity of immune system)

- Immunostimulators, those substances that stimulate the immune system by inducing activation of any of its components..

Immune Suppression (↓ activity of immune system)

- that reduces the activation or efficacy of immune system and suppress them.

(21)

→ Toxins →

Naturally occuring poisons (substances) produced by metabolic activities of living cells

eg. Hemotoxins, phototoxins etc..

Toxoids →

These are harmless toxin produced via denaturation of toxins

- Used in vaccine production.

eg. Toxoids for diptheria, tetanus (tetanospasim)..

(22)

→ Hybridoma technology →

(form hybrid cells..)

It is a technique in which

Monoclonal antibodies are produced from isolation of immune cells from an sample's body artificially in the laboratory

(23) → hybridoma / M Abs → used in diagnosis & detection of cancer

→ Monoclonal Antibodies →

these are the synthetic antibodies produced through hybridoma technology which are identical to antibodies.

Drugs made from monoclonal antibodies act by inhibiting or inducing immune system mechanism.

eg. Alemtuzumab (Campath)

(24)

→ i) Bacterial vaccines →

Those vaccines that are isolated from some species of bacteria and are used against different microbial species for production of antibodies

eg. BCG → Bacillus Calmette Guarin vaccine for tuberculosis

ii) Anti-toxins →

Also called as (toxoids).

These are those agents that are used against an specific toxins..

eg. Tetanus, Diptheria..

(25)

→ (i) Blood Products →

These are the therapeutic substances derived from whole blood ~~blood~~ & play crucial role in health care.

eg. RBC's, WBC's, plasma, platelets..

(ii) Plasma Substitutes →

These are the colloidal liquids usually a serum solution used to substitute human plasma

eg. Human serum albumin (HSA)..

(26)

→ Stability tests for (vaccines) →

these tests are used to retain the chemical, physical and biological properties of an vaccine.. eg. Humidity tests, temperature etc..

(27)

→ Mutation →

It is defined as the change produced in a particular part of DNA sequence is called as mutation.

The product produced after mutation in an organism called mutants.

(28)

→ Immunoblotting →

It is a highly sensitive method for identification of proteins, including antigen of viruses and other plant pathogens.. → HIV TB HIV

(i) ELISA → Enzyme linked Immunosorbent Assay.

It uses virus antigen to detect antibody.

- It is commonly used analytical method for detecting antibody
- based on the principle of antigen-antibody interaction.
- used in diagnosis of HIV infection & cytokines measurement.

• A positive ELISA indicates the presence of antibody to a virus in our patient.

ii) Western blotting →

It is an biochemical analytical method for the determination & identification of specific proteins on the basis of their molecular weight.

iii) Southern blotting →

It is a technique used for identification and determination of specific DNA sequences.

mostly used in determination of mutation.

(29)

→

Prokaryotic	Eukaryotic
• No nucleus present	• Nucleus is present
• cell diameter 0.2 - 2 µm	• 10 - 100 µm
• Unicellular	• Multicellular
• Single or circular DNA	• Multiple stranded DNA
• Cell division by binary fission	• Cell division through mitosis.

(30)

→ Microbial biotransformation →

- Organic compounds are transformed from one form to another to reduce the toxicity of the chemical compounds by using micro-organism such as bacteria, fungi and enzymes..

types → Reduction, Oxidation, Hydrolytic rxns, condensations..

(31)

→ fermentation →

It is a metabolic process in which microorganism (bacteria, yeast etc.) generate energy (ATP & grow himself) from carbohydrates (organic compounds)

- they does not require oxygen..

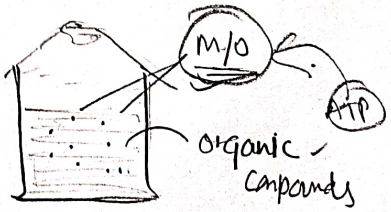
eg. yeasts perform fermentation to obtain energy by converting sugar into alcohol.

fermenter →

It is the vessels or containers in which the process of fermentation takes places..

eg/types -

i) Stirred tank fermentor
ii) fluidized tank fermentor
iii) Packed bed fermentor



(32)

→ Aerator →

It is a device in fermentor which brings water and air close in contact to remove dissolved gases, volatile material from the process..

types – ??

(33)

→ Methods to control foam in fermentation process are :–

i) Using anti-foam agents (defoamers)
eg. Cetostearyl alcohol, sterates etc..

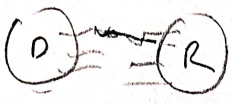
ii) Use of concentrated acid or alkali..

iii) Use of foam control system.

(34)

→ Conjugation methods → mainly called as bacterial conjugation method of gene transfer.

In this process recepient bacterium receives DNA from a donor bacterium by cell to cell interaction via pilli..



(35)

→ Polymerase →

DNA polymerase enzymes.

these are those enzymes that are essential in DNA replication and synthesize DNA molecules.

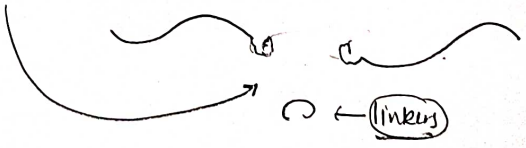
- they usually work in pair to create two identical DNA strands from a single original original DNA molecules.

(36)

→ Linkers →

they are chemically synthesized double stranded DNA oligonucleotide containing on it one or more restriction sites for cleavage by restriction enzyme

- Linkers are ligated to blunt end DNA by using DNA ligase



Adaptors →

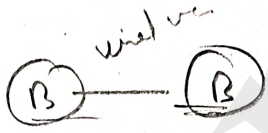
they are also short double stranded oligonucleotide that carry an internal RE sites and single

strands tails at one or both ends.

- After ligation, the DNA can be cleaved with appropriate RE to create new protruding terminus.

(37)

→ Transduction method →



The transfer of genetic material (DNA) from one cell to another cell by a bacteriophage

bacterial virus

virus

viral vector

- from one bacterium to another
- It is a common tool used by molecular biologist to stably introduce a foreign gene into a host cell's genome

(38)

→ Human fibrinogen →

It refers to a soluble protein found in the blood plasma from which the fibrin is produced during the blood coagulation.

helps in coagulation.

(39)

→ six kinds of enzymes :- Oxidoreductase, transferase, hydrolase, lyase, Isomerase, ligase

6 Categories for Enzyme Classification		
Type	**Function**	**Examples**
Oxidoreductase	• Transfer of electrons • Results in a change in oxidation state	• Dehydrogenase
Transferase	• Transfer of functional group from one molecule to another	• Phosphorylase • Kinase
Hydrolase	• Breakdown of a covalent bond using water	• Protease • Phosphatase
Lyase	• Breakdown of a covalent bond without water or oxidation	• Decarboxylase
Isomerase	• Rearrangement of bonds within a molecule	• Mutase
Ligase	• Formation of a covalent bond between two large molecules	*(unimportant)*