

CHAPTER : 12 BIO TECHNOLOGY & ITS APPLICATION
(KEY POINTS)

S.N	Term	Explanation
1	Green Revolution	The increased production of food production by use of improved varieties of crops,better agricultural practices and use of Agrochemicals
2	GMO	Genetically Modified Organisms-organisms in which the genes are manipulated or foreign gene introduced into
3	Bt	Bacillus thuringiensis,a bacteria producing an insecticidal protein.
4	Bt Cotton	Cotton plant with Bt gene thereby made resistant to Bollworm insects
5	Insecticidal protein	Protein toxin that kills insect pests
6	cry gene	Gene coding for insecticidal toxin
7	RNA interference	Process which interferes with the translation of mRNA of the parasite in the host plant/cell
8	ds RNA	Double stranded RNA formed to prevent the translation of the mRNA of the parasite DNA in the host cell
9	C peptide	The peptide which is part of the Pro-insulin and removed before maturation of Insulin
10	Transgenic animals	Animals with manipulated genes or a foreign gene that can be expressed are called astransgenic animals
11	GEAC	Genetic Engineering Approval Committee –checks the validity and safety of GM reearchand GM organisms
12	Biopiracy	Unauthorised use of Bioresources of one Nation by another without proper compensation being given
13	Gene therapy	The procedure by which a genetic disorder is treated by introduction of a functional gene in the body through cultured cells carrying the functional gene in children or embyo.
14	ADA	Adenosine Deaminase –an enzyme required for the functioning of the immune system.

15	c DNA	DNA which is made complementary to the mRNA
16	α 1-antitrypsin	Human protein (made from transgenic animals)used in the treatment of Emphysema
17	ELISA	Enzyme Linked Immuno Sorbent Assay-a test based on detection of antibody produced against the pathogen using specific antigen– antibody reaction used It is used for diagnosis of diseases like AIDS.
18	Agrobactetrium vectors	The bacteria Agrabacterium tumifaciens (used in transferring rDNA to plant cells)has the natural ability to transfer genes to plant cells.
19	Indian Patents Bill	A Bill passed by the Indian Parliament which takes issues such as terms for patent ,research and development initiatives etc.
20	Meloidegyne incognitia	The nematode that affects roots of tobacco plants and reduce their yield,RNA interference is used against the nematode to protect tobacco plants
21	cryIAb	Gene coding for protein that controls corn borer.
22	cryIAc and cry IIAb	Genes coding for protein that controls Bollworm insects

CHAPTER : 12 BIO TECHNOLOGY & ITS APPLICATION (FLOW CHART)

AGRICULTURE

MEDICINE

TRANSGENIC ANIMALS

1 AGRICULTURE :APPLICATIONS

CREATE GM CROPS RESISTANT TO PEST (Bt COTTON,BRINJAL ,SOYA)

GM CROPS TO REDUCE POST HARVEST LOSS(FLAVRSAVR TOMATO)

GM CROPS TOLERANT TO COLD,SALINITY,WATER SCARCITY

GM CROPS CAPABLE OF USING MINERALS EFFICIENTLY

GM CROPS ENRICHED WITH NUTRIENTS(BIOFORTIFIED)

2 METHODS TO PRODUCE PEST RESISTANT PLANTS:

CROPS WITH Bt GENE INSERTED IN ITS CELLS

RNA INTERFERENCE (TOBACCO
RESISTANT TO NEMATODE)

3 Bt COTTON:

The gene for the insecticidal toxin is transferred to cells of the crops in culture

The crop plant is cultured from these cells and therefore expresses this gene

The toxin protein is produced in the crop which is ingested by the pest that feeds on

The toxin is activated in the gut of the pest larva due to the alkaline pH in the gut of the insect pest

4 APPLICATIONS IN MEDICINE: FORMATION OF INSULIN BY r DNA TECHNOLOGY

Gene for A peptide introduced into E Coli plasmid to produce A peptide

Gene for B peptide introduced into another batch of E Coli plasmid to produce B peptide

The two peptide chains are joined by creating disulphide bonds to form mature Insulin

5 TREATMENT : FOR ADA DEFICIENCY

Enzyme Replacement
–temporary cure

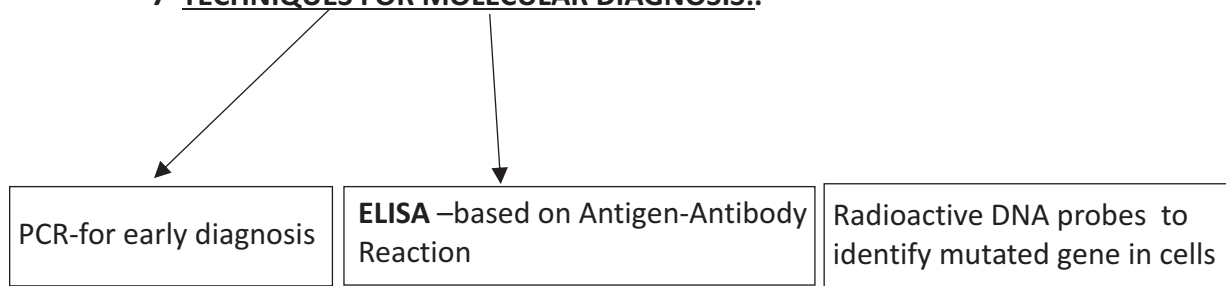
Bone Marrow Transplant –
temporary cure

Gene Therapy

6 GENE THERAPY:

- (c) Lymphocytes cultured outside the body
- (d) The gene for ADA introduced into the lymphocytes using retrovirus
- (e) The lymphocytes with the functional gene is returned to the patients body .
- (f) The lymphocytes produce ADA enzyme as long as they last in the body .
- (g) If the gene is introduced into cells in the embryonic stages ,the cure could be permanent.

7 TECHNIQUES FOR MOLECULAR DIAGNOSIS:



8 USES IN ANIMALS:-

To study normal functions of the body .When an altered gene is introduced the altered effects can be studied.

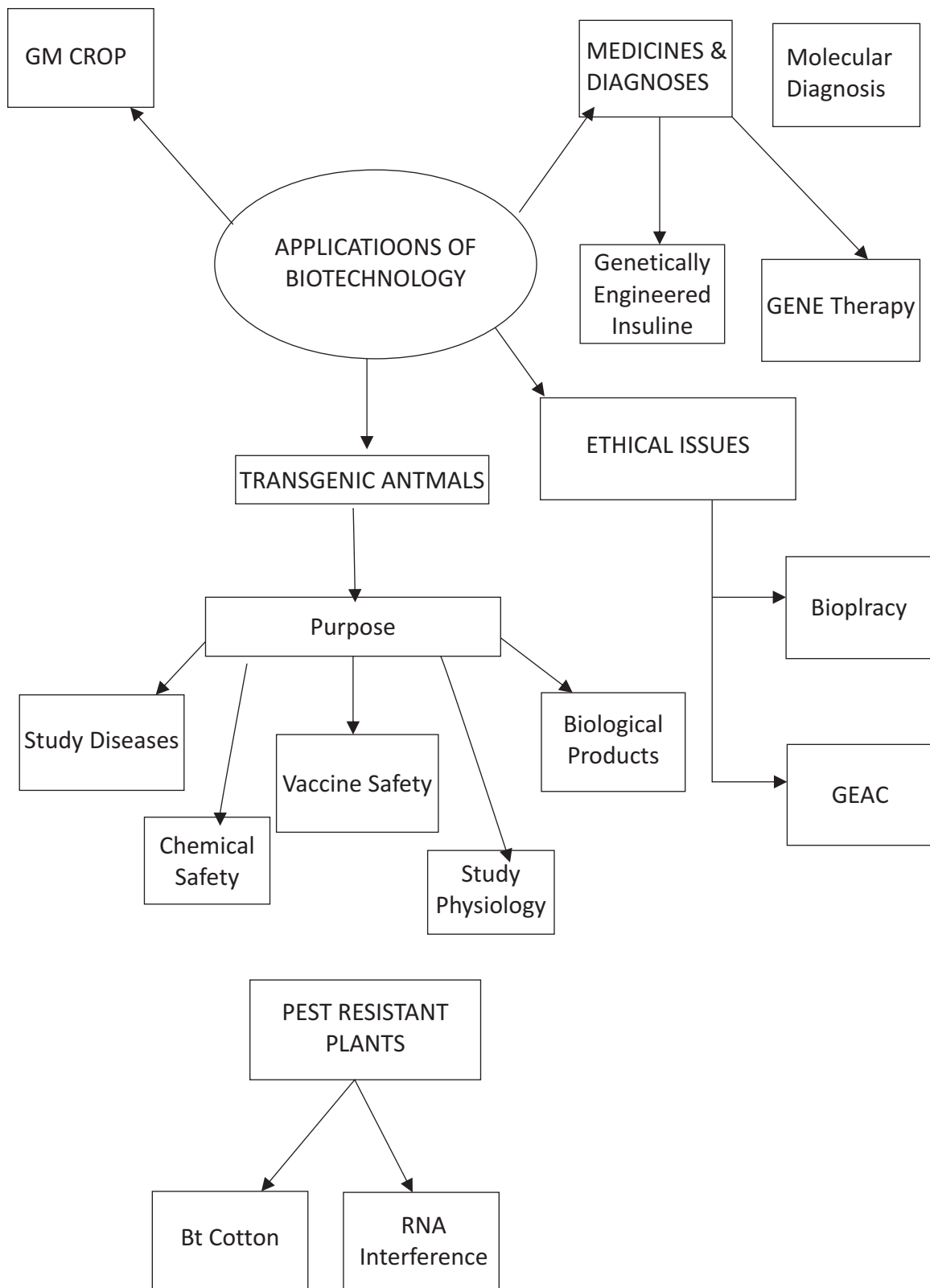
Animals are made as models of human diseases to study their effects.

To produce Medicines, proteins required for treatment of disease,human milk- protein etc

Animals modified to test safety of vaccines like Polio.

Animals with genes sensitive to the chemical, is exposed to the chemical to test the safety of the chemical

CHAPTER : 12 BIO TECHNOLOGY & ITS APPLICATION
(CONCEPT MAP)



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(QUESTION BANK)

1. PCR is a powerful diagnostic technique .Justify. (1)
2. Name the diagnostic test for AIDS when the concentration of HIV is (a) low (b) high. (1)
3. State the principle used in ELISA? (1)
4. What is GEAC .State its function? (2)
5. How are transgenic animals made useful in chemical safety testing and studying diseases? (2)
6. How is use of r DNA better than using traditional methods of agriculture? (2)
7. Name four application of biotechnology (2)
8. Mention two applications of biotechnology in medicine with examples (2)
9. What problem was faced in production of insulin by rDNA technology and how was it resolved (2)
10. What merits do the products made using Biotechnology have ?Give an example of one such product used in treatment.? (3)
11. What are the three critical research areas of Biotechnology (3)
12. How is Biotechnology used to produce bt cotton? Explain (3)
13. How has the bt toxin been effective against insects? (3)
14. How can biotechnology help in increasing the yield of tobacco (3)
15. Name a natural genetic engineer and state how it has been used to create pest resistant tobacco? (3).
16. Insulin produced earlier had problems This has been overcome with rDNA technology. Explain.Why is Insulin not administered orally?. (3)
17. Gene therapy is a better alternative to the other measures taken for ADA deficiency. Why is it a better alternative . What are the other methods used earlier? How can it be done? (3)
18. GMO's have been useful to mankind. List about five useful GMO's created so far. and how they have been useful (5)
19. "Most of the industrialized nations are rich financially but poor in biodiversity and traditional knowledge." Justify this statement with an example.How can you as a Biology student help a tribe who is exploited for their traditional knowledge (4)
20. How would you have used Biotechnology if you had the complete technology in your hands? (4)

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(ANSWER KEY)

Q.No	Hints	Marks
1	Diagnosis at the time when symptoms are not shown(early stage)of AIDS /Cancer	$\frac{1}{2}+\frac{1}{2}$
2	PCR,ELISA	1
3	Antigen-antibody interaction	1
4	Genetic Engineering Approval Committee,ensure safety and validity of experiments	1+1
6	Made sensitive to chemicals,making them disease models for studying	1+1
6	Use of fertilizers ,pesticides minimized,only desirable traits can be selected for breeding,create tailor made plants for industries	$\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$
7	(I) therapy,(ii) Diagnostics,(iii) Genetically modified crop in agriculture,(iv)Biofortified food,(transgenic animals)	$\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$
8	Insulin production ,treatment of genetic disorders with gene therapy as in ADA deficiency	1+1
9	To assemble mature insulin from Proinsulin,separate production of A and B in E Coli peptide and combined	1+1
10	No allergic reactions(Could cause allergy if made using other animals), α -1 antitrypsin in treatment of emphysema	1+1
11	Providing the best catalyst in the form of a microbe/enzyme,creating optimal conditions for their action,downstream processing technologies Toxins of Bacillus introduced into cotton using r DNA,the toxin was activated	1+1+1
12	Toxins of Bacillus introduced into cotton using r DNA,the toxin was activated therefore became resistant to Bollworms	1+1+1
13	The larva ingests the leaves of Bt cotton containing the toxin,the toxin is activated in the gut of the insect by enzymes,which solubilize the toxin, the toxin binds to the lining of epithelial cells create pores cause swelling and death of the insect (i)cause for tobacco reduction due to infection by parasitise, nematode <i>Meloidogyne incognita</i> , in roots.	1+1+1
14	RNA interference,Agrobacterium as vectors,formation of complementary RNA double strand specific to nematode DNA,silencing of mRNA of nematode,makes tobacco pest resistant	1+1+1
15	Agrobacterium tumefaciens,By RNA interference,and stopping of nematode protein production,agrobacterium as vectors to introduce genes into tobacco plants which result in ,formation of complementary RNA double strand specific to nematode DNA, silencing of mRNA of nematode, makes tobacco pest resistant	1+1+1

16	Obtained from animals caused allergic reactions,Insulin produced using rDNA did not cause allergic reactions as animal proteins were not used here , Insulin being a protein gets digested if taken orally	1+1+1
17	Peramament cure ,Bone marrow transplantation and enzyme replacement therapy,introducing cDNA of a functional ADA using retrovirus into the stem cells/early embryonic stages	1+1+1
18	Crops tolerant to abiotic stress,reduced reliance on chemicals,reduced post harvest loss,enhanced nutritional value,physiologicsl models,huam lactalbuminproducing cow(any 5)	1+1+1+1+1
19	(i)ethical issues (iii)e.g basmati an Indian variety, patent obtained by US (iv)awareness of Biopiracy and need for Biopatent of thr traditional resurces and wisdom	1+1+2
20	Any five applications of the students choice-values of societal needs problem awareness, selflessness reflected in the answers	1+1+1+1+1