1.Name the disease that was first to get the gene therapy treatment. Write the cause of the disease and the effect it has on the patient

Gene therapy is a corrective therapy or technique of genetic engineering that is used to replace a faulty or non-functional gene with a normal healthy functional gene.

The first clinical gene therapy was given to a 4 year old girl with ADA (Adenosine Deaminase) deficiency in 1990. It is caused due to the deletion of the gene coding for ADA, which adversely . affects the functioning of immune system.

2.Why does Bt toxin not kill the bacterium that produces it, but kills the insect that ingests it? (Delhi 2014)

Or

Why do the toxic insecticidal proteins secreted by Bacillus thuringiensis kill the insect and not the bacteria itself? (Foreign 2010)

Answer:

Bt toxin does not kill bacteria because in bacteria it exists in inactive state.

When Bt toxin is ingested by an insect, it gets converted into its active form due to the alkaline pH of the gut.

The activated toxin binds to the surface of the epithelial cells of the midgut and creates pores. Water enters through these pores and causes swelling and lysis of cells in insect body.

3.What do ‘cry genes’ in Bacillus thuringiensis code for? State its importance for cotton crop. (All India 2014C)  
Or  
Name the soil bacterium that produces a protein/chemical that is toxic to insect pests. Show with example that these are encoded by different forms of the genes. (All India 2012)  
Answer:  
‘cry genes’ in Bacillus thuringiensis code for toxic insecticidal proteins called Cry proteins which are encoded by different forms of a gene called cry gene, e.g. cry IAc and cry II Ab control the cotton bollworm whereas cry IAb controls corn borer.

Cry proteins when expressed in cotton crops through genetic engineering confer pest resistance against cotton bollworms and prevent damage. As the larva of these insects when feed upon cotton plant parts, the toxin gets activated in their gut, lysing their cells and leads to death thus, making them pest resistant.

4.Human insulin when synthesised in the body needs to be processed before it can act. Explain giving reasons. (Delhi 2014C)

Or

Why is proinsulin so called? How is proinsulin different from functional insulin in humans? (All India 2013, 2012C)

Answer:

Human insulin when initially synthesised in human body consists of three peptide chains-A, B and C. The C-peptide is an extra stretch of amino acids joining the A and B-chains. This is called proinsulin or prohormone. It undergoes processing or splicing to release the functional mature insulin that can carry out its normal functions.

During processing, the C-peptide is removed. Only A and B-chains contribute to form the functional insulin.

5.How has the use of Agrobacterium as vectors helped in controlling Meloidogyne incognita infestation in tobacco plants? Explain in correct sequence. (2018)  
Answer:  
Several nematodes infect a wide variety of plants and animals including human beings.  
A nematode Meloidogyne incognita infects the roots of tobacco plants which reduces the production of tobacco.  
The strategy adopted to prevent this infection is based on the process of RNA interference (RNAi). RNA; mechanism takes place in all eukaryotic organisms as a method of cellular defence.

This method involves the following steps

* Silencing of a specific mRNA due to the complementary dsRNA molecule that binds to and prevents translation of the mRNA.
* Agrobacterium vectors are used to introduce nematode specific genes into the host plant. It produces both sense and antisense RNA in the host cells.
* These two RNAs are complementary to each other and form a double-stranded RNA (dsRNA) that initiates RNAi and hence, silence the specific mRNA of the nematode.
* The parasite cannot survive in a transgenic host, therefore the transgenic plant gets itself protected from the parasite.

6.Why do lepidopterans die when they feed on Bt cotton plant? Explain how does it happen. (Delhi 2017)  
Or  
Explain the application of rDNA technology to produce insulin. (Delhi 2015C)  
Answer:  
Bt cotton plants are the transgenic plants that express a Bacillus thuringiensis gene called cry gene. This gene, encodes for protein crystals having insecticidal properties against insects of group Lepidoptera, Diptera and Coleoptera. Inside the bacterium, these proteins remain inactive and do not harm the bacteria. However, these inactive crystals can get activated in the alkaline pH of the gut of insects upon ingestion.

After activation, these crystals can bind to the receptors present on the membranes of gut epithelial cells. Due to this binding, the membrane swells and pores are created on them. These pores lead to bursting of cell and soon the lepidopteran dies due to starvation.

7.How have transgenic animals proved to be beneficial in

(i) production of biological products?

(ii) chemical safety testing? (Delhi 2014, 2013)

Answer:

(i) The transgenic animals have been proved beneficial in the production of biological products like human protein a-1 antitrypsin (by coding genes for that protein only), for the treatment of emphysema and production of human protein (a-lactalbumin) enriched milk by transgenic cow, i.e. Rosie. This milk was more nutritionally balanced for. human babies than natural cow’s milk.

(ii) Transgenic animals are studied for testing toxicity of drugs and other chemicals, as they carry genes that make them more sensitive to toxic substances.

8.Biopiracy should be prevented. State why and how. (All India 2011)  
Answer:  
Biopiracy should be prevented because

* The countries and people concerned are not given adequate compensatory payment.
* The countries/people also lose their right to grow and use breeding experiments to improve the other varieties of the same species.  
  It may be prevented by implementing specific laws that take into consideration all the biopatents and biopiracy related issues

9.Human insulin when synthesised in the body needs to be processed before it can act. Explain giving reasons. (Delhi 2014C)

Or

Why is proinsulin so called? How is proinsulin different from functional insulin in humans? (All India 2013, 2012C)

Answer:

Human insulin when initially synthesised in human body consists of three peptide chains-A, B and C. The C-peptide is an extra stretch of amino acids joining the A and B-chains. This is called proinsulin or prohormone. It undergoes processing or splicing to release the functional mature insulin that can carry out its normal functions.

During processing, the C-peptide is removed. Only A and B-chains contribute to form the functional insulin.

10.Mention the chemical change that proinsulin undergoes, to be able to act as mature insulin. (2018)

Answer:

The C-peptide present in proinsulin is removed during its maturation.