Department of Biotechnology
Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)
M.Sc. Biotechnology III Semester Examination, 2014-15
(LBTM: 303 Plant Biotechnology)

Model Answer

Q1. Multiple choice question answer

i. (a) ii.(d) iii.(a) iv.(a) v.(b) vi.(d) vii.(b) viii.(c) ix.(b) x.(c)

Descriptive type question answers

Q2. Answer: The method of culturing a single cell isolated from the tissue is known as single cell culture. Single cell cultures are excellent systems to study the properties and potentialities of plant cells.

Isolation of single cells

1. Mechanical method 2. Enzymatic method

Techniques of single cell culture

Several techniques were used for single cell culture which are as follows

1. Bergman's plating technique 2. filter paper raft nurse tissue technique
3. microchamber technique 4. microdrop method,

Culture in Bioreactors

Now for large scale single cell culture different bioreactors were used like Spaged carboy, Bubble column, Stirred –tank, Air-lift and Rotating -drum

Cell Viability Test

Cell viability can be determined by anyone of the following approaches:

1. phase contrast microscopy 2. staining with 2, 3, 5-triphenyltetrazolium chloride (TTC)
3. fluorescein diacetate (FDA) 4. Evan's blue.

Factors affecting the culture

1. Composition of the medium 2. Explant source and genotype 3. Physical parameters like temperature, pH, humidity etc also affect the culture

Applications

1. Mutant selection, 2. Industrial use for production of use full compounds through plant cell culture, 3. Induction of polyploidy, 4. Transgenic plant development, 5. Synthetic seed production

Q2. Answer: Protoplast fusion is an additional technique for inducing variation in plant crops. By fusing protoplasts from different strains of species, it is possible to transfer genes from one strain to another.

Strategies used for Protoplast Fusion (explain each strategies with its significance and its limitation

1. Physical method
   i. Electroporation ii. Microinjection iii. Macroinjection iv. Silicon carbide medieted v. Liposome mediated
2. Chemical method
   i. NaNO3 mediated ii. Ca2+ at high pH iii. PEG

Q4 (i). Answer: A genetically engineered plants is generated in a laboratory by altering its genetic makeup. Bt brinjal is a suite of transgenic brinjals (also known as an eggplant or aubergine) created by inserting a crystal protein gene (*Cry1Ac*) from the soil bacterium *Bacillus thuringiensis* into the genome of various brinjal cultivars. The insertion of the gene, along with other genetic elements like promoters, terminators and an antibiotic resistance marker gene into the brinjal plant is accomplished using *Agrobacterium* mediated genetic transformation. The Bt brinjal has been developed to give resistance against lepidopteron insects, in particular the Brinjal Fruit and Shoot Borer (*Leucinodes orbonalis*)(FSB). Mahyco, an Indian Seed Company based in Jalna, Maharashtra has developed the Bt brinjal. Explain Bt brinjal in the following head

- Development (Diagrammatically)
- Effective against pest
- Attempted commercialization in India
- Controversy

Q4 (ii). Answer: In recent years 'hairy root culture' gained importance as production system for secondary metabolites due to their tremendous potential exhibiting greater biomass production as well as metabolite contents. *Agrobacterium rhizogenes*, a gram- negative soil bacterium is the causative agent of 'hairy root disease', proliferating the root-like structures upon infecting the plant. These roots have received

considerable attention from plant biologists, for the production of secondary metabolites. A major characteristic of hairy roots is the concomitant production of secondary metabolites with growth.
Explain the following points

i. Methods of development ii. Factors iii. Applications iv. Limitations

Q5. Answer: Transgenic plants are genetically engineered varieties containing one or more artificially inserted genes. There are various methods used to transfer the gene basically it is of two types i.e direct and indirect mode of gene transfer. Indirect gene transfer is through vector and direct gene transfer of DNA direct to the targeted host it is of following types

i. Electroporation
ii. Macro- and micro-injection of foreign DNA
iii. particle bombardment

(explain each types along with their significance and limitations)

Compare advantages of direct and indirect method of gene transfer

Q6. Answer: The Second Set of reactions in photosynthesis involves a biochemical pathway known as the **Calvin cycle.** This pathway produces Organic Compounds, using the energy stored in ATP and NADPH during the Light Reactions. The Calvin Cycle is named after Melvin Calvin.

- draw the sketch of C3 cycle only along with the name of the enzymes

Regulation: Light-Dependent Enzyme Activation Regulates the Calvin Cycle
Five light-regulated enzymes operate in the Calvin cycle:
1. Rubisco
2. NADP:glyceraldehyde-3-phosphate dehydrogenase
3. Fructose-1,6-bisphosphatase
4. Sedoheptulose-1,7-bisphosphatase
5. Ribulose-5-phosphate kinase

Explain ferredoxin–thioredoxin system and Rubisco regulation

Q7. Answer: Photosynthesis is the process in which the light energy is converted in to the chemical energy i.e. synthesis of carbohydrate. This photosynthesis mainly take place in two steps i.e. Light dependent step where the reducing power NADP(H) and ATP were synthesized with the help of sunlight using the photosynthetic apparatus (explain the structure of photosynthetic apparatus including the photosystems).
In Light dependent reaction of photosynthesis after photolysis of water the e- released from the H_2O molecules are drained to Yz complex which successively transfer to the PS-II subsequently the electron move through a number electron accepter and PS-I finally the electron is being used to reduce the $NADP^+$ to NADP (H) which is the final electron accepter. As the electron released from water never return back to the source of origin the movement of electron is known as noncyclic electron transport. Also here the electron moves in a Zig Zag manner so the path/ scheme of this type of electron movement is known as Z-Scheme. The details of the electron flow is as below (Explain the movement of electron in details along with steps where the ATPs were generated as the diagram given below)

Q8(i). Answer: Plastics derived from renewable raw resources (biomass) is known as Bioplastic. It is of different types based on the substrate from which it was produced
(explain on following points)

- Examples of biodegradable plastics:

While aromatic polyesters are almost totally resistant to microbial attack, most aliphatic polyesters are biodegradable due to their potentially hydrolysable ester bonds: Naturally Produced: Polyhydroxyalkanoates (PHAs) like the poly-3-hydroxybutyrate (PHB), polyhydroxyvalerate (PHV) and polyhydroxyhexanoate (PHH); Renewable Resource: Polylactic acid (PLA); Synthetic: Polybutylene succinate (PBS), polycaprolactone (PCL)...
Polyanhydrides, Polyvinyl alcohol, Most of the starch derivatives, Cellulose esters like cellulose acetate and nitrocellulose and their derivatives (celluloid).

- Advantages and disadvantages:
- Environmental concerns and benefits:
- Energy costs for production:

Q8(ii). Answer: Vaccine that one can eat, called edible vaccines, are among the most unusual approaches for administering new vaccine. (write on the following points)

-Methods of development
-Mechanism of action
-Advantages
-Limitations

11.12.14
(Dr. S. K. Senapati)