PETIT SEMINAIRE HIGHER SECONDARY SCHOOL, PUDUCHERRY

20. BREEDING AND BIO-TECHNOLOGY

X std SELF – EVALUATION BIOLOGY

I. Choose the best answer :

1. Which method of crop improvement can be practiced by a farmer if he is inexperienced? **Mass selection.**
   a) Clonal selection c) pureline selection
   b) Mass selection d) Hybridisation

2. Pusa Komal is a disease resistant variety of **cow pea.**
   a) Sugarcane c) cow pea
   b) rice d) maize

3. Himgiri developed by hybridization and selection for disease resistance against rust pathogens is a variety of **wheat.**
   a) Chilli c) sugarcane
   b) Maize d) wheat

4. The miracle rice which saved millions of lives and celebrated its 50th birthday is **IR8.**
   a) IR8 b) IR24 c) Atomita d) Ponni

5. Which of the following is used to produce products useful to humans by biotechnology techniques? **Both (a) and (b).**
   a) Enzyme from organism c) vitamins
   b) Live organism d) both (a) and (b)

6. We can cut the DNA with the help of **restriction endonucleases.**
   a) Scissors b) restriction endonucleases c) knife d) RNAase

7. rDNA is a **recombinant of vector DNA and desired DNA.**
   a) Vector DNA c) recombinant of vector DNA and desired DNA
   b) circular DNA d) satellite DNA

8. DNA fingerprinting is based on the principle of identifying **repetitive** sequences of DNA.
   a) Single stranded b) mutated c) polymorphic d) repetitive

9. Organisms with modified endogenous gene or a foreign gene are also known as **Both (a) and (b).**
   a) Transgenic organisms b) genetically modified c) mutated d) Both (a) and (b)

10. In a hexaploid wheat (2n = 6x = 42) the haploid (n) and the basic (x) number of chromosomes respectively are : **n = 21 and x = 7.**
    a) n = 7 and x = 21 b) n = 21 and x = 21 c) n = 7 and x = 7 d) n = 21 and x = 7

II. Fill in the blanks :

1. Economically important crop plants with superior quality are raised by **plant breeding.**
2. A protein rich wheat variety is **Atlas 66.**
3. **Colchicine** is the chemical used for doubling the chromosomes.
4. The scientific process which produces crop plants enriched with desirable nutrients is called **fortification.**
5. Rice normally grows well in alluvial soil, but **atomita 2** is a rice variety produced by mutation breeding that grows well in saline soil.
6. **Gene therapy** technique made it possible to genetically engineer living organism.
7. Restriction endonucleases cut the DNA molecule at specific positions known as **restriction site.**
8. Similar DNA fingerprinting is obtained for **identical twins.**
9. **Callus** cells are undifferentiated mass of cells.
10. In gene cloning the DNA of interest is integrated in a **vector.**

III. State whether True or False. If False, write the Correct statement :

01. *Raphano brassica* is a man-made tetraploid produced by colchicine treatment. **TRUE**

02. The process of producing an organism with more than two sets of chromosome is called mutation. **FALSE**

Correct Statement : The process of producing an organism with more than two sets of chromosome is called **Polyploidy.**

03. A group of plants produced from a single plant through vegetative or asexual reproduction are called a Pureline. **FALSE**

Correct Statement : A group of plants produced from a single plant through vegetative or asexual reproduction are called a **clone.**

04. Iron fortified rice variety determines the protein quality of the cultivated plant. **FALSE**

Correct Statement : **Amino acid** fortified rice variety **containing more amino acids** determines the protein quality of the cultivated plant.

05. Golden rice is a hybrid. **FALSE**

Correct Statement : Golden rice is a **genetically modified plant.**

06. Bt gene from bacteria can kill insects. **FALSE**

Correct Statement : Bt gene from bacteria **produces a toxin that** can kill insects

07. In vitro fertilization means the fertilization done inside the body. **FALSE**

Correct Statement : In vitro fertilization means the fertilization **taking place outside** the body **by artificial means.**

08. DNA fingerprinting technique was developed by Alec Jeffrey. **TRUE**

09. Molecular scissors refers to DNA ligases. **FALSE**

Correct Statement : Molecular scissors refers to **restriction endonucleases.**

IV. Match the following :

Column A		Column B
01. Sonalika	----------	**semi-dwarf wheat**
02. IR8	----------	**semi-dwarf rice**
03. Saccharum	----------	**sugarcane**
04. Mung No. 1	----------	***Phaseolus mungo***
05. TMV – 2	----------	**groundnut**
06. Insulin	----------	**first hormone produced using rDNA technique**
07. Bt toxin	----------	***Bacillus thuringiensis***
08. Golden rice	----------	**beta carotene**

V. Understand the assertion statement, justify the reason given and choose the correct choice :

a. Assertion is correct and reason is wrong
b. Reason is correct and the assertion is wrong
c. Both assertion and reason is correct
d. Both assertion and reason is wrong

01. **Assertion :** Hybrid is superior than either of its parents.
Reason : Hybrid vigour is lost upon inbreeding.
(a) Assertion is correct and reason is wrong

02. **Assertion :** Colchicine reduces the chromosome number.
Reason : It promotes the movement of sister chromatids to the opposite poles.
(d) Both assertion and reason is wrong

03. **Assertion :** rDNA is superior over hybridization techniques.
Reason : Desired genes are inserted without introducing the undesirable genes in target organisms.
(c) Both assertion and reason is correct

VI. Answer in a sentence :

01. Give the name of wheat variety having higher dietary fibre and protein.
The wheat variety having higher dietary fibre and protein is **Triticale (6n)**

02. Semi-dwarf varieties were introduced in rice. This was made possible by the presence of dwarfing gene in rice. Name this dwarfing gene.
The dwarfing gene was got from a dwarf variety of rice from China, named Dee-geo-woo-gen (DGWG).

03. Define genetic engineering.
Genetic engineering is the manipulation and transfer of genes from one organism to another organisms to create a new DNA called as recombinant DNA (rDNA). Genetic engineering is also called as Recombinant DNA technology.

04. Name the types of stem cells.
Based on the source of extraction, Stem cells are of two types namely,
i) Embryonic stem cells (derived from the inner cell mass of Blastocyst) and
ii) Adult or Somatic stem cells (derived from amniotic fluid, umbilical cord and bone marrow).

05. What are transgenic organisms?
Plants or Animals expressing a modified endogenous gene or a foreign gene are known as TRANSGENIC ORGANISMS; also known as GENETICALLY MODIFIED ORGANISMS (GMOs). This foreign gene (of desired characteristics) is obtained by alteration or manipulation of genes in that organisms using rDNA techniques. The foreign gene or DNA fragment that is inserted is called TRANSGENE.

06. State the importance of biofertilizer.

Significance of Bio-fertilizer :

i) They are eco-friendly.
ii) They are Bio-degradable; hence non-pollutant.
iii) They conserve bio-diversity as well as nature.
iv) They are cheaper and economical.

VII. Short answer questions :

01. Discuss the method of breeding for disease resistance.

Plant diseases are caused by pathogens like Viruses, Bacteria and Fungi. This affects crop yield. Hence, it is important to develop disease resistant varieties of crops, that would increase the yield and reduce the use of Pesticides.

Disease resistant varieties can be produced by the following methods :

a) *Selection* :

Selection is one of the oldest methods of plant breeding in which individual plants or group of plants are sorted out from a mixed population based on the morphological characters. There are three methods of selection, namely : Mass selection, Pureline selection and Clonal selection.

b) *Polyploidy breeding* :

Somatic cells are diploid (2n) in nature; whereas gametes are haploid (n) in nature. An organism having more than two sets of chromosomes is called Polyploid. Such condition is called Polyploidy, which can be induced by physical agents (heat or cold treatment, X-rays, etc.,) and chemical agents (Colchicine).

c) *Mutation breeding* :

Mutation is defined as the sudden heritable change in the nucleotide sequence of DNA in organism. The organism which undergoes mutation is called Mutant. The factors which induce mutation are known as Mutagens or Mutagenic agents.

d) *Hybridization* :

Hybridization is defined as the process of crossing two or more types of plants for bringing their desired characters together into one progeny (Hybrid).

CROP	VARIETY	RESISTANCE TO DISEASES
Wheat	*Himgiri*	Leaf and Stipe rust, Hill bunt
Cauliflower	*Pusa Shubhra, Pusa Snowball K-1*	Black rot
Cowpea	*Pusa komal*	Bacterial blight

02. Name three improved characteristics of wheat that helped India to achieve high productivity.

The following are the improved wheat varieties that helped India to achieve high productivity.

i) Sonalika, Kalyan Sona are high yielding semi-dwarf varieties of wheat.
ii) Himgiri is a wheat variety resistant to Leaf rust, stipe rust and Hill bunt diseases.
iii) Triticale is a hybrid of wheat and rye, having higher dietary fibre and protein.

03. Name two maize hybrids rich in amino acid lysine.

Protina, Shakti and Ratna are the two maize hybrids rich in amino acid, lysine.

04. Distinguish between

a)

Sl. No.	SOMATIC GENE THERAPY	GERM LINE GENE THERAPY
01.	It is the replacement of defective gene in somatic cells.	It is the replacement of defective gene in germ cells (egg and sperm).
02.	It is not inheritable	It is inheritable

b)

Sl. No.	UNDIFFERENTIATED CELLS	DIFFERENTIATED CELLS
01.	They are unspecialized mass of cells that can divide to form more cells or give rise to differentiated cells.	They are specialized cells that cannot form into any other types of cell. They are formed from undifferentiated cells.
02.	Eg : Embryonic and Adult or somatic stem cells	Eg : Muscles, Neurons, Epithelial, and Skeletal tissues

05. State the applications of DNA fingerprinting technique.

Applications of DNA fingerprinting :

i) DNA fingerprinting technique is widely used in forensic applications like crime investigation such an identifying the culprit.
ii) It is also used for paternity testing in case of disputes.
iii) It also helps in the study of genetic diversity of population, evolution and speciation.

06. How are stem cells useful in regenerative process?

Sometimes cells, tissues and organs in the body may be permanently damaged or lost due to genetic condition or disease or injury. In such situations, stem cells are used for the treatment of diseases which is called Stem-cell therapy.

In treating Neurodegenerative disorders like Parkinson's disease and Alzheimer's disease, neuronal stem cells can be used to replace the damaged or lost neurons.

07. Differentiate between outbreeding and inbreeding.

Sl. No.	OUTBREEDING	INBREEDING
01.	It is the breeding of unrelated animals.	It refers to the mating of closely related animals within the same breed.
02.	The hybrids are stronger and vigorous than their parents.	It helps in the accumulation of superior genes and elimination of genes which are undesirable
03.	Eg : *Hissardale* was produced by crossing *Bikaneri* (Magra) ewes and Australian Marino rams.	Eg : Karan Swiss cow produced by crossing Brown swiss and Sahiwal.

VIII. Long answer questions :

01. What are the effects of hybrid vigour in animals ?

Effects of hybrid vigour in animals :

i) Increased production of milk by cattle.
ii) Increased production of egg by poultry.
iii) High quality of meat is produced.
iv) Increased growth rate in domesticated animals.

02. Describe mutation breeding with an example.

Mutation is defined as the sudden heritable change in the nucleotide sequence of DNA in an organism. It is a process by which genetic variations are created which in turn brings about changes in the organism. The utlilisation of induced mutation in crop improvement is called Mutation Breeding. The organism which undergoes mutation is called a mutant.

The factors which induce mutations are known as mutagens or mutagenic agents. Mutagens are of two types namely Physical mutagens and Chemical mutagens.

i) Physical mutagens :
Radiations like X-rays, α, β, and γ-rays, UV rays, temperature, etc.,

ii) Chemical mutagens :
Mustard gas and nitrous acid.

Achievements of Mutation Breeding :

a) Sharbati Sonora wheat produced from Sonora-64 by using gamma rays.
b) Atomita 2 rice with saline tolerance and pest resistance.
c) Groundnuts with thick shells.

03. Biofortification may help in removing hidden hunger. How?

Biofortification is the scientific process of developing crop plants enriched with high levels of desirable nutrients like vitamins, proteins and minerals.

Some examples of crop varieties developed as a result of biofortification are :

i) Protina, Shakti and Rathna are lysine rich maize hybrids,
ii) Atlas 66 is a protein rich wheat variety,
iii) Iron rich fortifies rice variety, and
iv) Vitamin A enriched carrots, pumpkin and spinach.

Thus, these enriched crops produced by Biofortification help in removing hidden hunger in the society.

04. With a neat labelled diagram explain the technique involved in gene cloning.

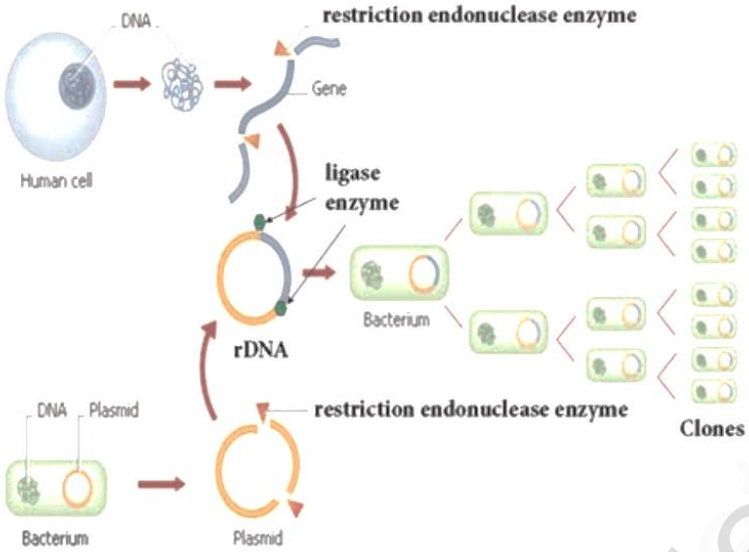
Making a genetically exact copy of an organism is called Gene cloning. The carbon copy of an individual, thus produced is called a Clone.

In gene cloning, a gene or a piece of DNA fragment is inserted into a bacterial cell where DNA will be multiplied (copied) as the cell divides.

A brief outline of the basic steps involved in gene cloning are :

i) Isolation of desired DNA fragment by using restriction enzymes.
ii) Insertion of the DNA fragment into a suitable vector (Plasmid) to make rDNA.
iii) Transfer of rDNA into bacterial host cell (Transformation).
iv) Selection and multiplication of recombinant host cell to get a clone.
v) Expression of cloned gene in host cell.

Using this strategy, several enzymes, hormones and vaccines can be produced.



< also can refer book page no. : 292 Figure 20.7 Diagram >

05. Discuss the importance of biotechnology in the field of medicine.

Using genetic engineering techniques medicinally important valuable proteins or polypeptides that form the potential pharmaceutical products for treatment of various diseases have been developed on a commercial scale.

Pharmaceutical products developed by rDNA technique are :

a) Insulin used in the treatment of diabetes.
b) Human growth hormone used for treating children with growth deficiencies.
c) Blood clotting factors are developed to treat Haemophilia.
d) Tissue plasminogen activator is used to dissolve blood clots and prevent heart attack.
e) Development of vaccines against various diseases like Hepatitis B and Rabies.

IX. Higher Order Thinking Skills :

01. A breeder wishes to incorporate desirable characters into the crop plants. Prepare a list of characters he will incorporate.

Desirable characters to be incorporated are :

i) Higher yield and better quality,
ii) Disease resistance,
iii) Insects / Pests resistance,
iv) Short duration, and
v) Tolerance to extreme environmental conditions

02. Organic farming is better than Green Revolution. Give reasons.

Green revolution :

Green revolution is the process of increasing food production through high yielding crop varieties and modern agricultural techniques.

Demerits of Green revolution :

i) Green revolution promotes monoculture of certain desired plant varieties.
ii) Use of fertilizers / pesticides in excess, alters the chemical composition of the soil.
iii) All farmers cannot afford the cost.
iv) Certain traditional crop varieties would be neglected.

Organic farming :

i) In contrast to Green revolutionary methods, Organic farming avoids utilization of synthetic fertilizers, chemical pesticides and mutated species and makes use of Green manures, Bio/Vermi-Composts and Bio-pest control measures that do not harm the environment.

ii) Mixed cropping will lead to efficient use of the space as well as fewer outbreak of diseases.

iii) Usage of Bio-fertilizers leads to efficient use of nutrients as well as fixing excess of nutrients in the soil.

iv) Organic farming also increases bio-diversity (beneficial organisms).

Thus, organic farming is stable, sustainable, beneficial, cost-effective, and eco-friendly to all generations.

03. Polyploids are characterized by gigantism. Justify your answer.

Polyploids are organisms having more than two sets of chromosomes (Greek ; Polys = many; aploos = one fold; eidos = form).

Depending on the degree of ploidy, the number of genes get multiplied. Therefore, size of fruits and vegetables are oversized (gigantism). These fruits and vegetables also have high vitamin and mineral content.

04. 'P' is a gene required for the synthesis of vitamin A. it is integrated with genome of 'Q' to produce genetically modified plant 'R'.

i) What is P, Q and R?

'P' - beta carotene gene
'Q' - genome of rice plant
'R' - Golden rice

ii) State the importance of 'R' in India.

'Golden rice' is a genetically modified rice which can produce beta carotene, that prevent Vitamin A deficiency disorders like Nyctalopia and Xerophthalmia.