QB365 Question Paper Software
12th Standard - Biology
Biotechnology and its Applications Case Study Questions

Exam Time: 00:30 Hrs | Date: 2025-10-14
Total Marks: 8

Questions:

Case Study Questions

1. **Read the following and answer any four questions from (i) to (v) given below:**
Transgenic animals can serve as factories that in some cases, may produce large amount of proteins more efficiently. Transgenic mice have been engineered to express human antibodies by introducing large segment of human DNA encoding human immunoglobulin genes. In transgenic large animals such as cow or sheep proteins of pharmaceutical value can be produced in large quantities in milk which is later purified. Transgenesis can be used to alter many phenotypic properties including growth rate, fat composition, milk production, hair texture, etc.
(i) The production of transgenic animals includes
(a) identification and separation of desired gene
(b) combining the desired gene with appropriate vector
(c) introduction of vector in cells, tissues or embryos
(d) all of these.
(ii) In transgenic animals, i.e., cow and sheep proteins of pharmaceutical value are produced in large quantities in the
(a) blood (b) accumulated fat (c) mammary glands (d) none of these.
(iii) Mouse is mostly preferred animal for studies on gene transfer because
A. short oestrous cycle
B.long gestation period
C.Short generation time
D.Production of one or two offspring per pregnancy
(a) both (A) and (C) (b) both (A) and (B) (C) Only D (d) both (C) and (D).
(iv) Transgenic genes alter many phenotypic properties including
(a) growth rate (b) fat composition (c) milk production (d) all of these
(v) **Assertion :** Transgenic mice have been engineered to express human antibodies.
Reason : Large segment of human DNA encoding human immunoglobulin have been transferred to mice.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false

2. **Read the following and answer any four questions from (i) to (v) given below:**
Stem cells hold the potential for manifold applications in biotechnology based next generation therapeutics. Scientists are trying to formulate better and more personalised treatment modalities against some seemingly irremediable diseases, by harnessing

body's own stem cells and stem cell niche. Stem cells of different origin and level of potency are being investigated for tissue regeneration, treatment of bone defect, drug testing, gene therapy and cell based therapy for muscle damage, spinal cord injury, cancer therapy, etc. The properties of embryonic and adult stem cells to either self-renew or differentiate into multiple cell lineages make them an attractive source for cell therapies, tissue engineering and as model system for drug screening.

(i) Stem cells are widely used in medical research. Which property of stem cells makes them particularly useful in this research?

(a) They can be fused together to form a zygote.

(b) They can divide and eventually give rise to a whole organism.

(c) They can divide and be made to differentiate into various types of cell.

(d) They will continue to divide indefinitely.

(ii) Stem cells can be divided into four main types. Which of the four types of stem cell can differentiate into a limited range of tissues?

(a) Adult stem cells **(b) Embryonic stem cells** **(c) Fetal stem cells** **(d) Zygotic stem cells**

(iii) Which feature of stem cells obtained from blood in the umbilical cord enables their use in the treatment of a variety of blood cancers?

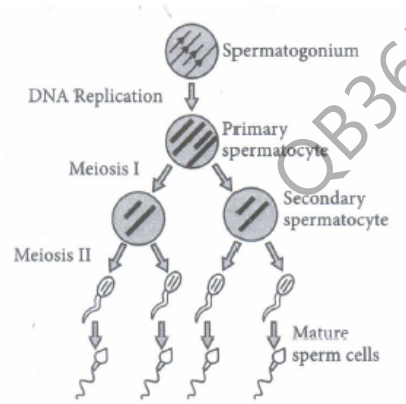
(a) They can differentiate into bone marrow cells.

(b) They can differentiate into any cellular component of blood.

(c) They can replace blood stem cells affected by cancer

(d) They are totipotent.

(iv) The search for pluripotent stem cells is intense. The spermatogonium is the diploid precursor of haploid sperm in the development pathway of mouse gametes as shown below.



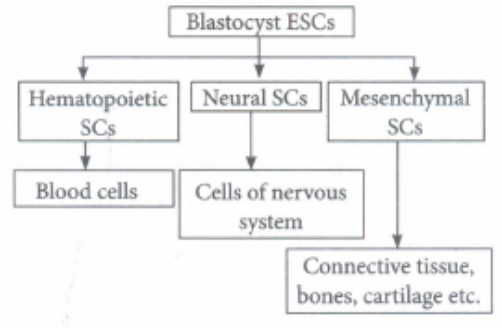
Scientists were interested to find out which stages of sperm development have stem cell capacity. Two experiments were carried out using sterile host males with testes that lacked germ cells. The results are shown in the table.

	Type of cells used	**Result**
Experiment 1	**Secondary spermatocytes were injected**	**Fertility was not restored**
Experiment 2	**Spermatogonia were injected**	**Fertility was restored for the rest of the mouse's life**

What property of a stem cell ISmIssmg m the secondary spermatocytes?

(a) Specialisation **(b) Self-renewal** **(c) Commitment** **(d) A proper stem-cell niche**

(v) Which feature of embryonic stem cells (ESCs) is illustrated below?



(a) ESCs are capable of dividing **(b) ESCs are multipotent** **(c) ESCs are pluripotent** **(d) ESCs show plasticity**

Answers Key:

Case Study Questions

1. **(i) (d)**
   (ii) (c)
   (iii) (a) : Mouse has short gestation period and it produces several number of offspring per pregnancy.
   (iv) (d)
   (v) (a)
2. **(i) (c) :** Stem cells are capable of dividing indefinitely and producing copies of themselves. In addition, stem cells can undergo differentiation giving rise to specialized cell types.
   (ii) (a) : Adult stem cells are tissue specific and can enter normal differentiation pathways to form only the specialized cell types of the tissue which they reside in.
   (iii) (b) : Umbilical cord blood stem cells are multipotent in that they have the ability to differentiate into limited cell types to give rise to a range of specialized cells that have a specific function. Umbilical cord stem cells found in blood only can differentiate into any cellular component of blood, e.g., white blood cells (such as B lymphocytes, T lymphocytes, natural killer cells, macrophages and platelets etc.) vital for fighting infections and safeguarding the body, red blood cells - important for transporting oxygen to cells.
   (iv) (d) : Stem cell niche is used to describe the microenvironment in which stem cells are found. Since fertility was restored after the injection of spermatogonia, it suggests that spermatogonium displays the general properties of stem cells such as being capable of dividing indefinitely and producing copies of themselves (self-renewal), can undergo differentiation giving rise to specialised cell types (haploid sperm). As fertility was not restored upon injection of secondary spermatocytes, it suggest that the secondary spermatocytes do not have a stem cell niche and do not display the properties of stem cell.
   (v) (c) : Embryonic stem cells are pluripotent cells. That is, they have the ability to develop into almost any kind of cell in the body (as seen from diagram, hematopoietic SCs, neural SCs and mesenchymal SCs) except extra-embryonic membrane (but not the trophoblast).