

# Solved Paper 2013

## BIOLOGY

Time : 3 Hours

Class-XII

Max. Marks : 70

### General Instructions :

- (i) All questions are compulsory.
- (ii) This question paper consists of **four** Sections A, B, C and D. Section A contains **8** questions of **one** mark each, Section B is of **10** questions of **two** marks each, Section C is of **9** questions of **three** marks each and Section D is of **3** questions of good **five** marks each.
- (iii) There is no overall choice. However, an internal choice has been provided in **one** question of **2** marks, **one** question of **3** marks and **two** questions of **5** marks weightage. A student has to attempt only one of the alternatives in such questions.
- (iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

Delhi Set

Code No. 57/1/1

### SECTION - A

- 1. An anther with malfunctioning tapetum often fails to produce viable male gametophytes. Give any one reason.** 1  
**Ans.** The tapetum is the innermost layer of a microsporangium, which is found in a cluster of two in each lobe of an anther. The tapetum is in charge of nurturing the pollen grains. As a result, if it fails, the pollen grains will be malnourished and unable to mature into healthy male gametes.
- 2. Why sharing of injection needles between two individuals is not recommended?**  
**Ans.** Sharing an injection needle between two people can result in the transmission of numerous diseases, such as HIV from an infected person to a healthy person.
- 3. Name the enzyme and state its property that is responsible for continuous and discontinuous replication of the two strands of a DNA molecule.** 1  
**Ans.** The enzyme is known as DNA polymerase. The enzyme catalyses the polymerization of nucleotides in the 5' to 3' direction, which is responsible for continuous and discontinuous replication of the two strands of a DNA molecule.
- 4. Identify the examples of convergent evolution from the following:**  
(i) Flippers of penguins and dolphins  
(ii) Eyes of octopus and mammals  
(iii) Vertebrate brains 1  
**Ans.** Convergent evolution can be seen in the flippers of penguins and dolphins, as well as the eyes of octopuses and mammals.
- 5. Write the importance of MOET.** 1  
**Ans.** MOET (multiple ovulation and embryo transfer) is a procedure used to boost the success rate of hybrid development in a short period of time.
- 6. Why is the enzyme cellulase needed for isolating genetic material from plant cells and not from the animal cells ?** 1

**Ans.** Plant cells have a cell wall composed of cellulose, while animal cells do not have a cell wall and lack cellulose. As a result, the enzyme cellulase is only required for extracting genetic material from plant cells.

**7. Name the type of biodiversity represented by the following:**

- (a) 50,000 different strains of rice in India
- (b) Estuaries and alpine meadows in India. 1

**Ans.** (a) Genetic diversity

(b) Ecological diversity

**8. Write the equation that helps in deriving the net primary productivity of an ecosystem.** 1

**Ans.** Net primary productivity (NPP) in an ecosystem can be derived using the following equation:

$$\text{NPP} = \text{GPP} (\text{Gross primary productivity}) - \text{R} (\text{Respiratory losses}).$$

### SECTION - B

- 9. Geitonogamous flowering plants are genetically autogamous but functionally cross-pollinated. Justify.** 2  
**Ans.** Geitonogamy is a form of pollination where pollen is transferred from the anther of one flower to the stigma of another flower on the same plant. Although these geitonogamous flowering plants are genetically self-pollinating as the gametes come from the same parent plant, the transfer of pollen to a different flower requires a pollination agent, making it functionally a type of cross-pollination.
- 10. When and where do chorionic villi appear in humans? State their function.** 2  
**Ans.** Chorionic villi are finger-like growths that emerge from the trophoblast layer formed in the zygote after implantation. Their purpose is to:
  - Interdigitates with projections from the uterine tissue to create the placenta, which acts as the connection between the mother and fetus.
  - Ensure the adequate supply of oxygen and nutrients to the developing embryo.

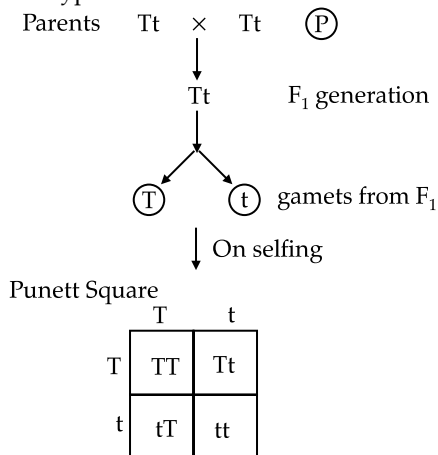
11. In a cross between two tall pea plants some of the offsprings produced were dwarf. Show with the help of Punnett square how this is possible. 2

Ans. Some of the progeny of a hybrid between two phenotypically tall plants may be phenotypically dwarf. This indicates that both parents are heterozygous (Tt). This cross is demonstrated below by a Punnett Square.

Genotype of Parents = Tt.

Genotypic ratios of progeny after F<sub>1</sub> cross = TT, Tt, Tt, tt.

Phenotypic ratios = 1 TT + 2 Tt : 1 tt or 3 Tall : 1 dwarf



Progeny phenotype ratio – 3 : 1

Progeny genotype ratio – 1 : 2 : 1  
(TT : Tt : tt)

12. A student on a school trip started sneezing and wheezing soon after reaching the hill station for no explained reasons. But, on return to the plains, the symptoms disappeared. What is such a response called? How does the body produce it? 2

Ans. An allergy refers to an exaggerated response to a substance, such as sneezing and wheezing, without a clear cause. The substances that trigger such a response are called allergens, and the immune system produces IgE antibodies against them. Common examples of allergens include pollen and dust.

13. Name two commonly used bioreactors. State the importance of using a bioreactor. 2

Ans. The two most widely employed bioreactors are the simple stirred-tank bioreactor and the sparged stirred-tank bioreactor. The significance of utilizing bioreactors is:

- They provide a large capacity for cultures, leading to high production of products.
- They offer ideal conditions such as temperature and pH for the growth of the desired product.

14. Write the function of adenosine deaminase enzyme. State the cause of ADA deficiency in humans. Mention a possible permanent cure for a ADA deficiency patient. 2

Ans. Adenosine deaminase (ADA) enzyme is crucial for the smooth functioning of the immune system. ADA deficiency in humans is caused by the deletion of the gene responsible for producing ADA. The permanent cure for this deficiency is gene therapy,

which involves inserting a functional ADA gene into cells at an early embryonic stage.

15. Expand the following and mention one application of each: 2

(i) PCR (ii) ELISA

OR

(a) Mention the difference in the mode of action of exonuclease and endonuclease.

(b) How does restriction endonuclease function? 2

Ans. (i) Polymerase chain reaction (PCR) is a technique used in molecular biology to multiply a gene or a piece of DNA. Each PCR cycle has three steps:

- Denaturation
- Primer annealing
- Extension of primers

**Application:** It is widely used in the gene manipulation process.

(ii) The ELISA (Enzyme linked Immunosorbent Assay) is a method in molecular biology that detects infectious diseases by identifying antigens or measuring the production of antibodies against the infection.

**Application:** This method is widely used to detect AIDS.

OR

(a) Exonuclease removes nucleotides from the ends of the DNA chain, whereas endonuclease cuts the DNA at specific positions within the DNA strand.

(b) Each restriction endonuclease targets specific palindromic nucleotide sequences within DNA, and cuts the DNA at those sites by binding to them and slicing both strands at defined points along the sugar-phosphate backbone.

16. Name any two sources of e-Wastes and write two different ways for their disposal. 2

Ans. Electronic waste (e-waste) can come from two sources, such as irreparable computers and other electronic devices like mobile phones and TVs. Currently, two main methods for disposing of e-waste are placing it in landfills or burning it. However, both of these methods are harmful to the environment as they release toxic substances. Recycling e-waste in an environmentally safe manner is the best solution for its disposal.

17. Why the pyramid of energy is always upright? Explain. 2

Ans. The energy pyramid represents the amount of energy consumed by each level in a food chain. The pyramid is always upright because the amount of energy available at higher levels is less than at lower levels, due to the 10% energy transfer law, which states that only 10% of the energy is transferred from one level to the next.

18. Explain why very small animals are rarely found in polar region. 2

Ans. The amount of body heat loss is proportional to the surface area. Because small animals have a larger surface area compared to their volume, they tend to lose heat rapidly in cold areas, which could be a threat to their survival. This is why small animals are rarely seen in Polar Regions.

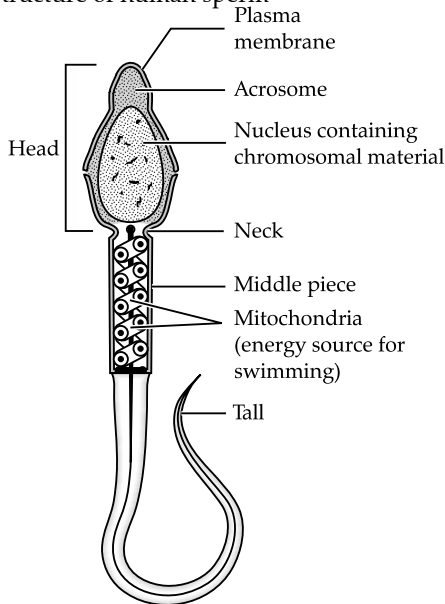
**SECTION - C**

19. Draw a diagram of the microscopic structure of human sperm. Label the following parts in it and write their functions.

- (a) Acrosome
- (b) Nucleus
- (c) Middle piece

3

Ans. Structure of human sperm



- **Acrosome:** The role of the Acrosome is to discharge chemicals such as hyaluronidase and acrosin to aid the sperm in merging with the egg cell.
- **Nucleus:** It stores the genetic information and has 23 chromosomes, including one sex chromosome (X or Y) which determines the sex of the individual.
- **Middle piece:** It holds several mitochondria, produces energy to support the movement of the sperm.

20. With the help of any two suitable examples explain the effect of anthropogenic actions on organic evolution.

3

Ans. Anthropogenic activities have accelerated the rate of organic evolution.

As an example:

- (i) Overreliance on herbicides and pesticides in agriculture to control pests and insects has led to the rapid selection and evolution of resistant varieties.
- (ii) The widespread use of antibiotics has resulted in the evolution of drug-resistant microbes, as the susceptible ones perished while the resistant variants survived and became more dangerous.

21. (a) Why is human ABO blood group gene considered a good example of multiple alleles ?

(b) Work out a cross up to F<sub>1</sub> generation only, between a mother with blood group A (Homozygous) and the father with blood group B (Homozygous). Explain the pattern of inheritance exhibited.

3

Ans. (a) Two alleles represent one gene. In humans, however, there are three alleles that govern the same blood group, namely I<sup>A</sup>, I<sup>B</sup>, and i. As a result, it is an example of multiple allele.

Allele from Parent 1	Allele from Parent 2	Genotype of offspring	Blood type of offspring
I <sup>A</sup>	I <sup>A</sup>	I <sup>A</sup> I <sup>A</sup>	A
I <sup>A</sup>	I <sup>B</sup>	I <sup>A</sup> I <sup>B</sup>	AB
I <sup>A</sup>	i	I <sup>A</sup> i	A
I <sup>B</sup>	I <sup>A</sup>	I <sup>A</sup> I <sup>B</sup>	AB
I <sup>B</sup>	I <sup>B</sup>	I <sup>B</sup> I <sup>B</sup>	B
I <sup>B</sup>	i	I <sup>B</sup> i	B
i	i	ii	O

(b)

Mother (I <sub>A</sub> I <sub>A</sub> )	X	Father (I <sub>B</sub> I <sub>B</sub> )
	↓	
Child(I <sup>A</sup> I <sup>B</sup> )		

As a result, the child will be of blood group AB.

The pattern of inheritance is known as co-dominance.

22. Describe the structure of a RNA polynucleotide chain having four different types of nucleotides. 3

Ans. A nitrogenous base, a ribose sugar, and a phosphate group are the three primary components of an RNA nucleotide.

- The ribose sugar and phosphates form the backbone of a polynucleotide chain, with nitrogenous bases linked to the sugar moiety and projecting from the backbone.
- Purines (Adenine and Guanine) and Pyrimidines are the two types of nitrogenous bases present (Cytosine and Uracil).
- A nucleoside is formed when a nitrogenous base is linked to a ribose sugar via N-glycosidic linkages (like adenosine, guanosine or cytidine and uridine).
- To form a corresponding nucleotide, a phosphate group is linked to the 5'-OH of a nucleoside via phosphoester linkage.
- Every nucleotide residue has an additional OH group at the 2' -position in the ribose.
- The polynucleotide chain is made up of many nucleotides linked together by 3'-5' phosphodiester linkages.
- The 5'-end of a polynucleotide chain refers to the end that has a free phosphate group attached to the 5'-position of the ribose sugar, while the 3'-end refers to the opposite end that has a free 3'-OH group at the ribose sugar.

23. Differentiate between inbreeding and outbreeding in cattle. State one advantage and one disadvantage for each one of them. 3

Ans.

Inbreeding	Outbreeding
Mating of closely related individuals within the same breed over a period of four to six generations.	Unrelated animals of the same or different breed that do not share a common ancestor are bred.
It is not subdivided into any other types.	Outcrossing, cross-breeding, and interspecific hybridization are all examples of it.

**Advantages:**

Inbreeding results in an increase in homozygosity and is employed for creating pure lines, where animals or plants exhibit consistent traits across

generations. Outbreeding, on the other hand, generates hybrids that possess desirable qualities.

**Disadvantages:**

- Inbreeding in small populations raises the risk of extinction, particularly for species that do not normally inbreed.
- Continuous inbreeding within closely related species reduces fertility and productivity, which is known as inbreeding depression.
- Outbreeding between populations with incompatible chromosomes or those adapted to different environmental conditions can also increase the risk of extinction.
- Outbreeding depression occurs when mating between two genetically distinct groups or populations reduces productivity and fitness.

24. (a) Why are the fruit juices bought from market clearer as compared to those made at home?

(b) Name the bioactive molecules produced by *Trichoderma polysporum* and *Monascus purpureus*.

3

Ans. (a) Fruit juices on the market (bottled) are clarified by treating them with enzymes called pectinases and proteases. As a result, they are clearer than those created at home.

(b) *Trichoderma polysporum* is used to manufacture the immunosuppressive agent cyclosporine A. *Monascus purpureus* is used to manufacture the blood-cholesterol-lowering agent Statins.

25. (a) Why are transgenic animals so called?

(b) Explain the role of transgenic animals in (i) Vaccine safety and (ii) Biological products with the help of an example each.

3

Ans. (a) Transgenic animals are named as such because they have intentional modifications in their genome, which are achieved through the use of recombinant DNA technology.

(b) **Role of transgenic animal in vaccine safety:** Transgenic mice are being generated for evaluating the safety of vaccines before they are administered to humans. For instance, transgenic mice are being utilized to test the safety of the polio vaccine. If the results are favourable and dependable, it could lead to a replacement for using monkeys to examine the safety of vaccine batches.

**Role of transgenic animal in production of biological products:** The transgenic cow, Rosie, is utilized to produce milk that is enriched with human proteins and contains  $\alpha$ -actalbumin, making it more nutritionally appropriate for infants.

26. How have human activities caused desertification? Explain.

3

OR

How does algal bloom destroy the quality of a fresh water body? Explain.

3

Ans. Following human activities contribute to desertification:

- (i) **Deforestation:** Humans cut down trees for personal gain, such as road and house construction, which is the primary cause of desertification.
- (ii) **Improper farming practices:** If the same crop is grown repeatedly, the soil becomes deficient in nutrients, resulting in soil fertility loss.
- (iii) Excessive ploughing of field.
- (iv) **Soil erosion:** Soil erosion caused by various human activities such as deforestation from house

construction and industrialization.

(v) Mining and mineral leaching degrade soil quality even further, rendering it completely infertile.

OR

An algal bloom is characterized by an excessive proliferation of planktonic organisms in a water body rich in nutrients. As the plankton multiply on the surface, they form a layer that covers the entire water body, hindering sunlight from reaching underwater plants that are crucial for providing nutrients to other aquatic life and maintaining water quality. The build-up of excretory substances from the plankton causes water pollution. Some algal species even produce toxins that are harmful to other aquatic life. The large amount of biomass on the surface also leads to a rise in the biological oxygen demand (BOD) of the water, causing death to many aquatic species. The resulting dead bodies further worsen the water quality.

27. Explain mutualism with the help of any two examples. How is it different from commensalism?

3

Ans. Mutualism is a type of population interaction in which both participating species benefit from the presence of the other. Examples of mutualism are given below:

- Mycorrhizae are associations between fungi and plants. The plant benefits from soil nutrients that the fungus absorbs and transfers to the plant via its roots. The fungus, in turn, benefits from the plant's energy-producing carbohydrates.
- **Pollination:** Plant flowers provide sweet, mucilaginous nectar to birds or insects in exchange for assistance in spreading pollen grains to other flowers. To protect against the use of nectar by other non-useful organisms, the plant-pollinator pair frequently co-evolves.

Mutualism differs from commensalism in that the latter benefits only one of the participating species, which is referred to as a commensal.

3

**SECTION - D**

28. (a) Draw a diagrammatic sectional view of a mature anatropous ovule and label the following parts in it:

- (i) that develops into seed coat.
- (ii) that develops into an embryo after fertilisation.
- (iii) that develops into an endosperm in an albuminous seed.
- (iv) through which the pollen tube gains entry into the embryo sac.
- (v) that attaches the ovule to the placenta.

(b) Describe the characteristic features of wind pollinated flowers.

5

OR

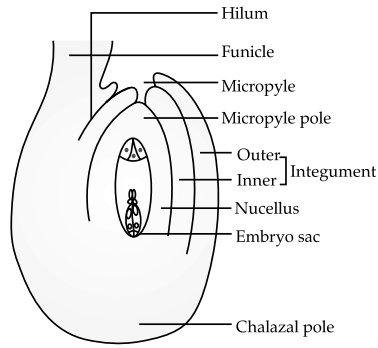
(a) Draw a diagrammatic sectional view of the female reproductive system of human and label the parts

- (i) where the secondary oocytes develop
- (ii) which helps in collection of ovum after ovulation
- (iii) where fertilization occurs
- (iv) where implantation of embryo occurs.

(b) Explain the role of pituitary and the ovarian hormones in menstrual cycle in human females.

5

Ans. (a)



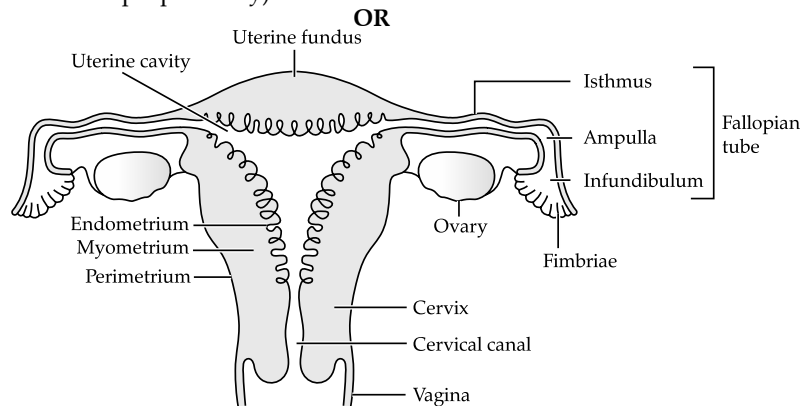
A diagrammatic view of a typical anatropous ovule

(a) (Note: Image is for reference purpose only)

- (i) The part that develops into seed coat – Integument
- (ii) The part that develops into an embryo after fertilisation – Embryo sac
- (iii) The part that develops into an endosperm in an albuminous seed – Nucellus
- (iv) The part through which the pollen tube gains entry into the embryo sac – Micropyle
- (v) The part that attaches the ovule to the placenta – Funicle

**(b) Characteristics of wind pollinated flowers**

- It shows compact inflorescence.
- It has well exposed stamens.
- The plants produce large quantity of pollens.
- The pollens are dry and unwettable.



Female Reproductive system

(Note: Image is for reference purpose only)

- (i) The part where secondary oocytes develop – Ovary
- (ii) The part which helps in collection of ovum after ovulation – Fimbriae
- (iii) The part where fertilization occurs – Fallopian tubes
- (iv) The part where implantation of embryo occurs – Uterus

(b) The menstrual cycle begins with menstrual bleeding (lasting 3 to 5 days), caused by the shedding of the uterus' endometrium. This is followed by the follicular phase, during which the primary follicles mature into Graffian follicles, leading to the regrowth of the endometrium.

These changes are brought about by ovarian and pituitary hormones.

- The release of gonadotropins (LH and FSH) increases during this phase. This causes follicular growth, and the follicles that grow produce oestrogen.
- The LH and FSH levels are highest in the middle of the cycle (14th day), causing the Graffian follicles to rupture and release the ovum. This is known as the ovulatory phase.
- The Graffian follicle remnants are converted into the corpus luteum, which secretes progesterone to maintain the endometrium.

29. Describe the asexual and sexual phases of life cycle of Plasmodium that causes malaria in humans. 5

OR

(a) What is plant breeding? List the two steps the classical plant breeding involves.

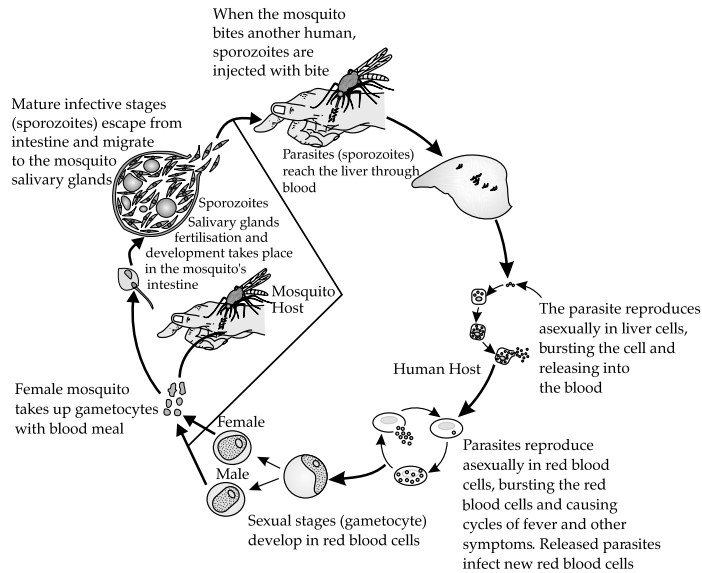
(b) How has the mutation breeding helped in

improving crop varieties? Give one example where this technique has helped.

(c) How has the breeding programme helped in improving the public nutritional health? State two examples in support of your answer. 5

Ans. Life Cycle of Plasmodium:

- Plasmodium must have two hosts in order to complete its life cycle.
- When a female Anopheles mosquito bites a healthy human, it releases Plasmodium, which lives in its body as sporozoite (infectious form).
- The parasites multiply (asexual reproduction) in the liver cells until they burst. Sporozoites are released into the bloodstream.
- Parasites enter RBCs, multiply (asexual reproduction), and eventually burst RBCs.
- The rupture of RBCs is accompanied by the release of a toxic substance known as haemozoin (associated with fever and chills).
- Only sporozoites in RBCs develop into gametocytes (sexual stage). Gametocytes multiply.
- Gametocytes are introduced into the mosquito when a diseased person is bitten by a female Anopheles mosquito.
- Gametocytes fertilise and develop inside the mosquito's intestine to form sporozoites.
- Sporozoites are stored in the salivary glands of mosquitos and are released into the healthy person who is bitten by this mosquito.



(Note: Image is for reference purpose only)

OR

- (a) Plant breeding involves cross-fertilizing two plants to create offspring with specific genetic traits that are passed down to future generations. The goal is to develop desired plant varieties that are better suited for cultivation, more productive, and resistant to disease.

Two steps involved in Classical plant breeding are:

- Crossing of superior pure lines and
- Selection of plants with desired characteristics.

- (b) Mutational breeding refers to the generation of genetic variations leading to traits not present in the parent plant. This method has been instrumental in creating plants that are resistant to bacterial, fungal, and viral diseases.

- (c) The breeding programme aided in improving public nutritional health by breeding nutrient-dense crops. This method is known as crop bio-fortification. The goals of bio-fortification are to improve:

- Protein content and quality
- Oil content and quality
- Vitamin content
- Micronutrient and mineral content

Examples:

- Maize hybrids developed after the year 2000 contain twice as much lysine and tryptophan as other maize hybrids.
- Atlas 66 (a wheat variety having higher protein content).

30. A child suffering from Thalassaemia is born to a normal couple. But the mother is being blamed by the family for delivering a sick baby.

- (a) What is Thalassaemia?

- (b) How would you counsel the family not to blame the mother for delivering a child suffering from this disease? Explain.

- (c) List the values your counselling can propagate in the families. 5

Ans. (a) Thalassaemia is a collection of hereditary blood disorders causing severe anaemia, due to the production of abnormal haemoglobin chains. The mutations in the genes responsible for coding alpha, beta, or delta haemoglobin chains result in the formation of improperly shaped haemoglobin that is not able to effectively transport oxygen.


- (b) Thalassaemia is a genetic disease that is inherited through one of the autosomes and can be carried by either parent. The chance of the disease being passed on is the same from the mother or the father, so it is unfair to solely blame the mother for a child's condition.

- (c) The following values can be instilled in families through counselling:


- Give the child a diet plan that is healthy.
- Accepting their child with all of his or her flaws
- Neither parent is responsible for the birth of a sick child.
- The defect is caused by a random change in the child's genes.
- Encourage the child to stick to his or her treatment plan and live a happy and normal life.
- Support the child emotionally by discussing his or her fears, anxiety, depression, or stress.

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