

**Important Questions from the Previous Years' Board Papers**  
**Unit: Genetics and Evolution**  
**2010 Set 3**  
**(Delhi Region)**

**One mark Questions:**

**Q.4.** Mention two functions of the codon AUG.

**Answer:** Two functions of codon AUG are:

- It is the start-codon. It marks the beginning of translation.
- It codes for the amino acid methionine.

**(Chapter 6, Pg.no. 112)**

**Q.6.** Name the scientist who disproved spontaneous generation theory.

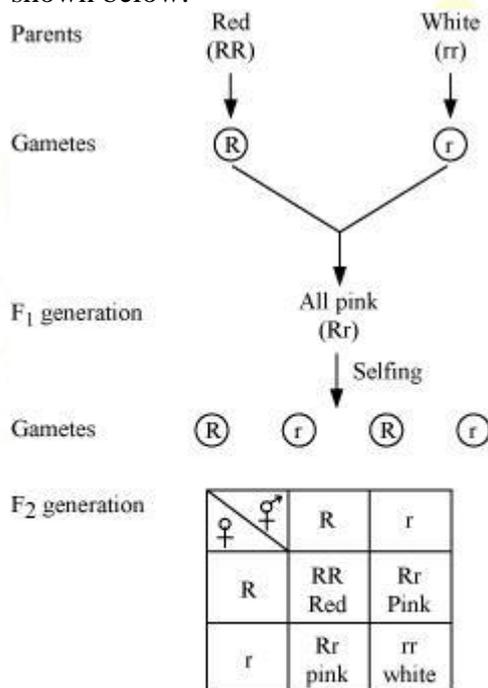
**Answer:** Louis Pasteur disproved the spontaneous generation theory.

**(Chapter 7, Pg.no. 127)**

**Two mark Questions:**

**Q.17.** Why are F<sub>2</sub> phenotypic and genotypic ratios same in a cross between red-flowered snapdragon and white-flowered snapdragon plants. Explain with the help of a cross.

**Answer:** A cross between red-flowered *Snapdragon* and white-flowered *Snapdragon* plants is shown below:



Phenotypic ratio — Red : Pink : White  
 1 : 2 : 1

Genotypic ratio — RR : Rr : rr  
 1 : 2 : 1

In a normal Mendelian cross, Rr would have corresponded to the red coloured flower

only, because in the Mendelian inheritance pattern, only dominant allele is expressed in the phenotype. However, *Snapdragon* shows incomplete dominance in which Rr, instead of expressing dominant phenotype, in fact expresses a mixture of dominant (red) and recessive (white) traits that leads to the pink colour for Rr. Hence, the phenotypic ratio modifies to 1:2:1. Thus, both phenotypic and genotypic ratios are same for a *Snapdragon* flower. (Chapter 5, Pg.no.76)

### Three mark Questions:

**Q.19.** During his studies on genes in *Drosophila* that were sex-linked T.H. Morgan found F<sub>2</sub> – population phenotypic ratios deviated from expected 9:3:3:1. Explain the conclusion he arrived at.

**Answer:** The phenotypic ratios deviated from expected Mendelian ratio in case of *Drosophila* because the two genes representing a single character did not segregate independently. Morgan explained that the deviation from Mendelian ratio was because of linkage. Linkage is defined as the coexistence of two or more genes in the same chromosome that inherited together. If the genes are situated on the same chromosome and lie close to each other, then they are inherited together and are said to be linked genes. He also observed that some genes were more tightly linked than the others. He concluded that the occurrence of recombinants was further restricted in the case of the more tightly linked genes. (Chapter 5, Pg.no. 84)

**Q.20.** Describe the termination process of transcription in bacteria.

**Answer:** Termination of transcription starts when the termination region is recognised. It is a particular sequence of nucleotide where the translation stops. In bacteria, as soon as the polymerase enzyme encounters the terminator region, the nascent RNA so formed falls off. The polymerase enzyme associates transiently with termination factor ( $\rho$ ) to terminate the transcription. Actually, the association with termination factor alters the specificity of RNA polymerase. In bacteria, the mRNA does not require any post transcriptional processing. Also, transcription and translation take place simultaneously in the same region of the cell (i.e., translation begins before the mRNA is fully synthesised) in them. (Chapter 6, Pg.no. 110)

**Q.24.** Explain convergent and divergent evolution with the help of one example of each.

**Answer: Convergent evolution -**

When more than one adaptive radiation occurs in an isolated geographical area, the phenomenon is called convergent evolution. The best example for convergent evolution is the case of Australian marsupials. A number of marsupial animals evolved from a single stock but they were restricted to the Australian continent.

**Divergent evolution -**

The process of evolution starting from a single point and radiating in different directions is called adaptive radiation or divergent evolution. The best example for divergent evolution is Darwin's finches. During his exploration of the Galapagos Islands, he observed many varieties of finches in the same island. They varied from normal seed-eating varieties to those that ate insects. They all diverged from one original species of finch. (Chapter 7, Pg.no. 131)

**Five mark Questions:**

**Q.30.** Write the symptoms of haemophilia and sickle-cell anaemia in humans. Explain how the inheritance pattern of the two diseases differ from each other.

**Answer:** Haemophilia is a sex-linked recessive disease that shows its transmission from unaffected carrier female to some of male progeny. The symptom of a haemophiliac patient includes non-stop bleeding even on a simple cut.

Sickle-cell anaemia is an autosome-linked recessive trait exhibiting change in shape of the red blood cells from biconcave disk to sickle shape under low oxygen tension.

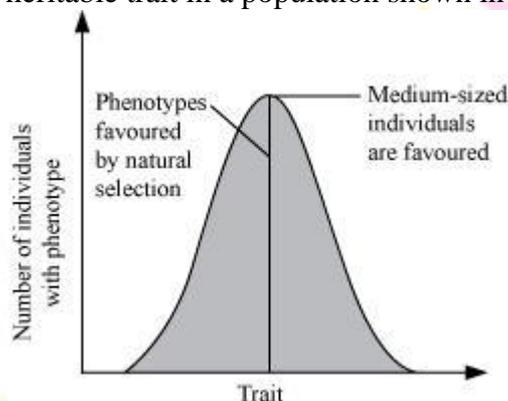
It is characterised by low haemoglobin count and other symptoms of anaemia such as fatigue and irritability, etc.

The pattern of inheritance of haemophilia involves the passing on of haemophilia from the heterozygous female (carrier) to her sons. However in sickle-cell anaemia, the disease is controlled by a single pair of allele,  $Hb^A$  and  $Hb^S$ . Only homozygous individuals for haemophilia ( $Hb^S Hb^S$ ) show the diseased phenotype. However, heterozygous ( $Hb^A Hb^S$ ) individuals appear apparently unaffected; they are the carriers of the disease.

**(Chapter 5, Pg.no. 89)**

**Q.30 (OR)**

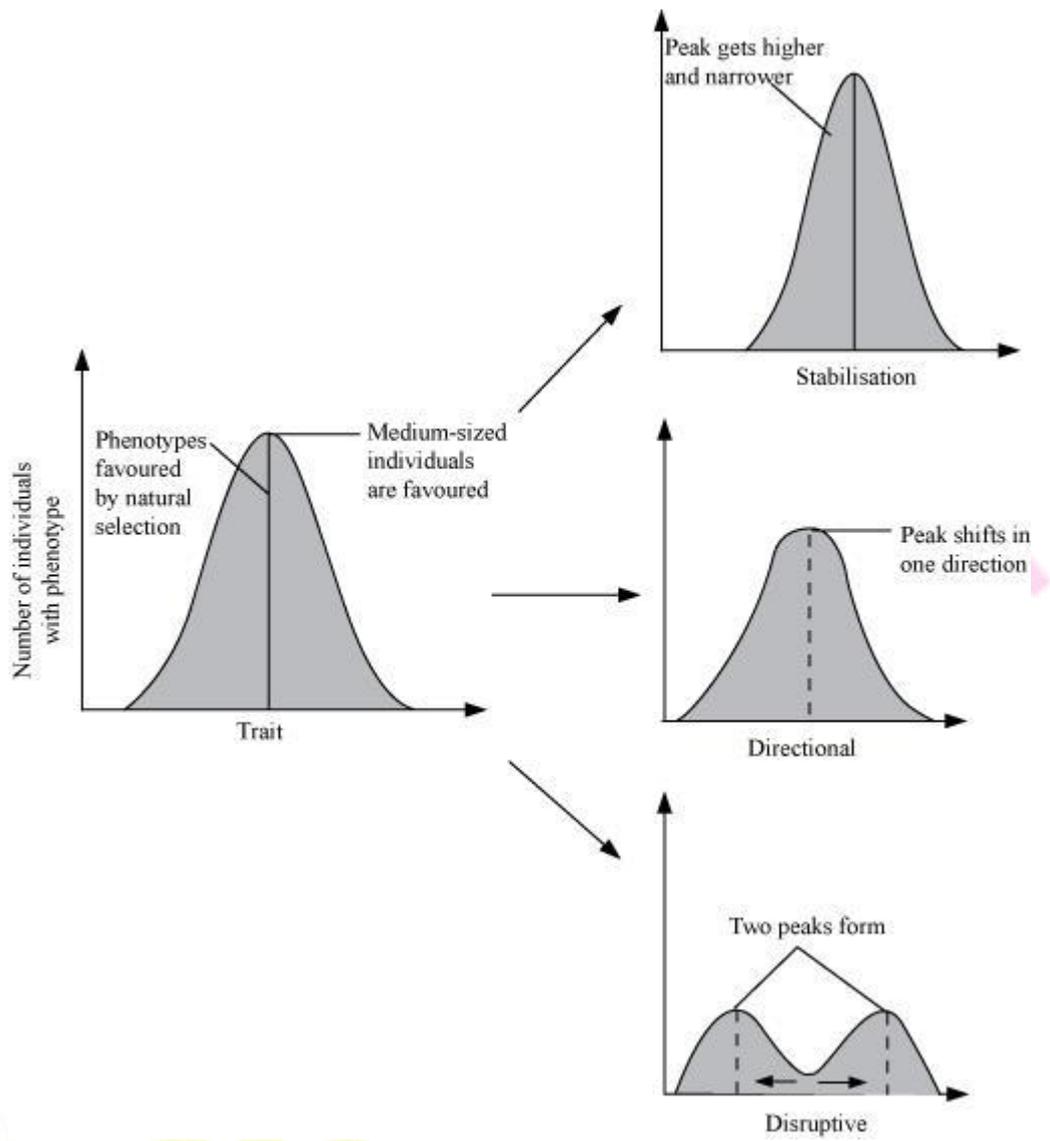
- Write Hardy-Weinberg principle.
- Explain the three different ways the natural selection can affect the frequency of a heritable trait in a population shown in the graph given below.



**Answer:** (a) Hardy-Weinberg principle states that the frequency of occurrence of alleles of a gene in a population remains constant through generations unless disturbances such as mutations, non-random mating, natural selection, etc. are introduced.

- Natural selection can affect the frequency of a heritable trait in a population in the following ways:
  - It can lead to stabilization (in which more individual acquire mean character value i.e. medium-sized individuals)
  - It may result in directional change (more individuals acquire value other than the mean character value)
  - It may result in disruption (more individuals acquire peripheral character value at both ends of the distribution curve)

The effect of natural selection on the frequency of a heritable trait in a population can be represented schematically as follows:



(Chapter 7, Pg.no. 136)