

# 4

## HEREDITY & EVOLUTION

### 4.1 Introduction

### 4.2 Accumulation of variation during reproduction

### 4.3 Heredity

### 4.4 Evolution

### 4.5 Speciation

### 4.6 Evolution and Classification

### 4.7 Evolution should not be equated with 'Progress'

### 4.8 Human Evolution

## 4.1 INTRODUCTION

Heredity is the process of transmission of characters from parents to offspring. Variation is degree by which progeny differs from parents.

The branch of biology that deals with the heredity and variation is called Genetics.

The physical basis of heredity is gene and the chemical basis is DNA.

Variation may be formed because of errors in DNA copying and as a result of sexual reproduction. Variation causes evolution in long run.

### Question based on basic knowledge required to understand this chapter

- The transmission of characters from parents to offspring is called—  
(A) Heredity (B) Variation  
(C) Evolution (D) None of these
- The physical basis of heredity is —  
(A) Gene (B) RNA (C) DNA (D) Protein
- The branch of biology that deals with heredity and variation is called—  
(A) Genetics (B) Molecular biology  
(C) Biology (D) Chemistry
- Father of Genetics is —  
(A) Darwin (B) Hugo de veries  
(C) Von Tschemark (D) None of the above
- Oval, rod or thread like DNA complexes that are vehicles of heredity, Posses Genes are —  
(A) chromosome (B) DNA (C) Protein (D) RNA
- The chromosome which are responsible for sex-determination in an individual are  
(A) Autosomes (B) Sex chromosome  
(C) RNA (D) Protein
- Chemical that perform all the reactions in an organism & gives a particular phenotypes are —  
(A) DNA (B) RNA (C) Enzyme (D) Gene

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8. The study of fossils is called –  
 (A) Geography (B) Chemistry  
 (C) Palaeontology (D) Histology
9. Human evolution can be studied by –  
 (A) excavating (B) time dating  
 (C) determining DNA sequences (D) All the above
10. All humans are originated in –  
 (A) America (B) India (C) Australia (D) Africa

## 4.2 ACCUMULATION OF VARIATION DURING REPRODUCTION

- Heredity : – Transmission of characteristic from parents to off spring.
- Variation : – Transmission of dissimilar characteristic.
- In asexual reproduction only very minor differences between progeny are seen, due to small inaccuracies in DNA copying.
- Number of successful variations are maximised by the process of sexual reproduction.
- In sexual reproduction, greater diversity is generated because it involves two parents.
- Variation affect's survival.

### *Illustration 1*

*When first generation with inherited traits from previous generation reproduces, the second generation will have –*

- (A) *Traits Inherited from the first generation only*  
 (B) *Newly created differences only*  
 (C) *Both (A) & (B)* (D) *None of the above*

### *Solution*

∴ (C)

### *Illustration 2*

*If one bacterium divides and the resultant two bacterium divides again, then the four individual bacteria generated –*

- (A) *would be identical* (B) *would be quite different*  
 (C) *similar but may have minor differences* (D) *none of the above*

### *Solution*

∴ (C)

### *Illustration 3*

*Bacteria that can withstand heat will survive better in –*

- (A) *cold only* (B) *heat only* (C) *In any condition* (D) *none of these*

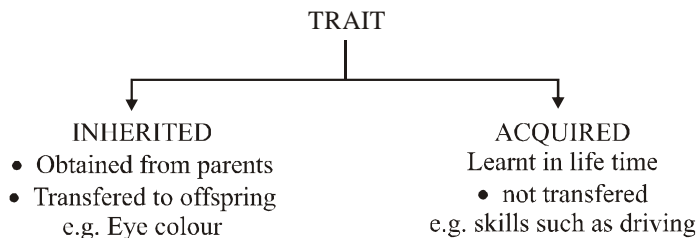
### *Solution*

∴ (B)

## 4.3 HEREDITY

### 4.3.1 Traits

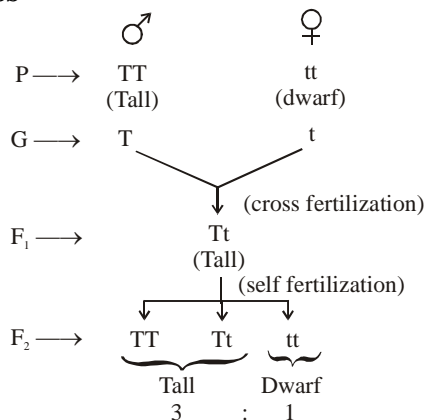
Traits Refers to particular form or feature. Traits may be of following types



### 4.3.1 Rules of Heredity

- Mendel is known as father of genetics. He worked on *Pisum sativum* (Garden Pea) and give following laws.
  - Law of segregation
  - Law of dominance
  - Law of independent assortment

### 4.3.2 A monohybrid cross



Phenotype	3:1
Genotype	1:2:1

### 4.3.3 Terms related with Heredity & Genetics

- \* Genetics : – It is branch of biology that deals with heredity and variations.
- \* Heredity : – It is the transmission of characters from parents to offspring.
- \* Offspring : – Product of sexual Reproduction.
- \* Clone : – Product of Asexual Reproduction.
- \* Physical basis of Heredity : – Genes.
- \* Chemical basis of Heredity : – DNA.
- \* Father of Genetics : – MENDEL [Mendel works on garden pea having 7 pair of contrasting characters]
- \* Rediscovery of Mendel work by : – Hugo de Vries ; Carl Correns ; Von Tschermak

\* Monohybrid : –  $\begin{array}{c} A \\ \bullet \\ \square \\ \bullet \\ a \end{array}$  (Cross between single characters)

\* Dihybrid : –  $\begin{array}{cc} A & a \\ \bullet & \bullet \\ \square & \square \\ \bullet & \bullet \\ B & b \end{array}$  (Cross involving two characters)

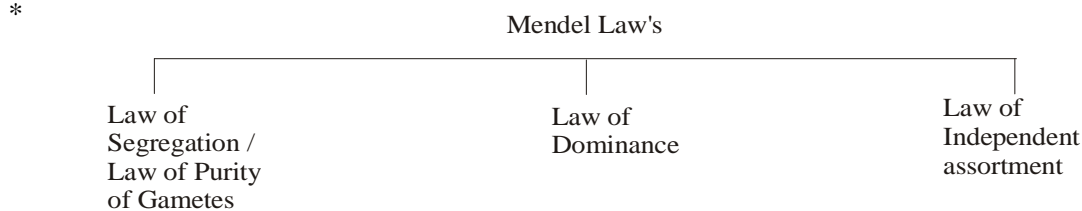
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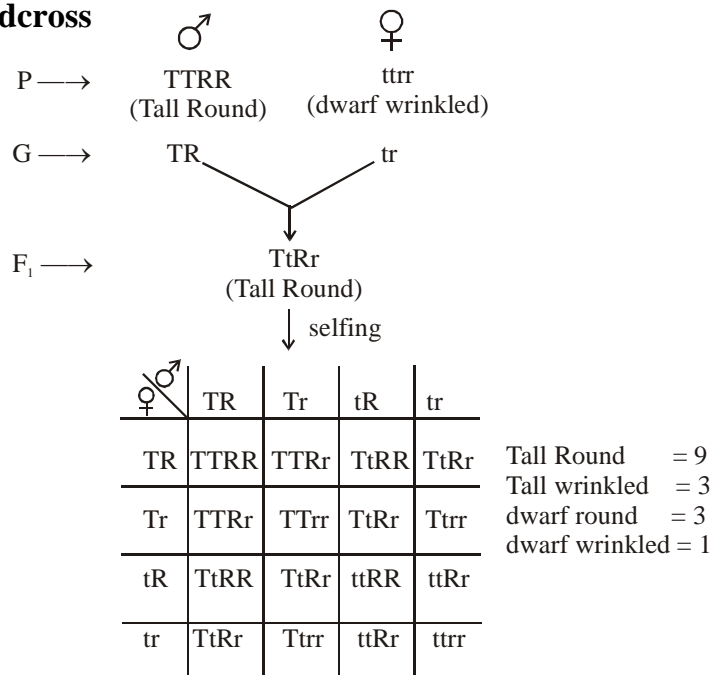
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- \* Dominant Character : – Expressed in any condition.
- \* Recessive Character : – Expressed in homozygous condition only.
- \* Phenotype : – Physical or chemical expression of a character.
- \* Genotypes : – Composition of character in terms of alleles.
- \* Allele or Allelomorph (Bateson) : – Alternative form of the same factor responsible for determining contrasting character.



- \* Chromosome :- These are oval, rod or thread like DNA complexes which function as hereditary vehicles because they store, replicate and transcribe coded hereditary information.
- \* Types of chromosome –
  - (a) Autosome– Same in both sex
  - (b) Sex chromosome– XX in females, XY in male (In humans)

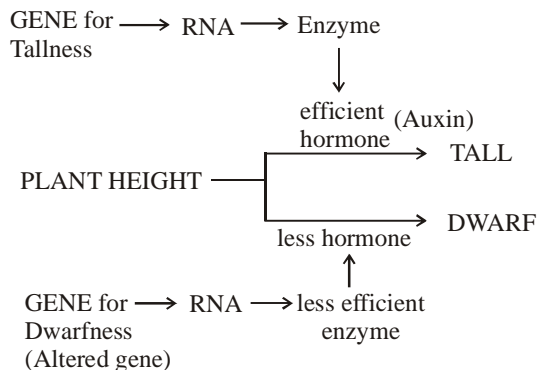
### 4.3.4 Dihybridcross



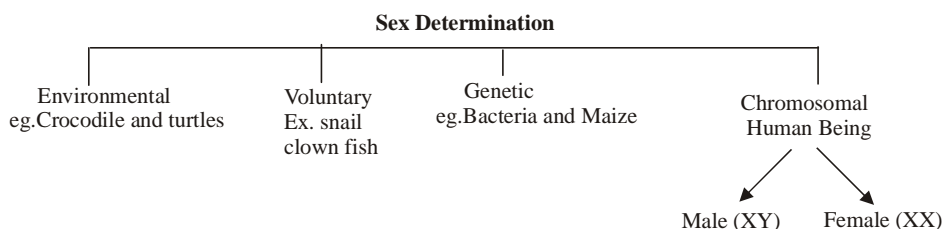
Phenotype	9:3:3:1
Genotype	1:2:2:1:4:1:2:2:1

### 4.3.5 How do these Traits get Expressed?

DNA → RNA → protein (enzyme) (This sequence is known as central dogma)  
 Enzyme perform all the reaction in an organism & gives a particular phenotype. Enzymes are coded by RNA (translation) while RNA is coded by DNA (transcription)



- $\Rightarrow$  **Every organism** have two sets of all genes, one inherited from each parent.
- $\Rightarrow$  **Every germ cell** have only one set of genes (haploid).
- $\Rightarrow$  Each gene set is present as a separate independent pieces called chromosome
- $\Rightarrow$  Each cell have two copies of each chromosome; one each from male & female parent

**Illustration 4**

The inherited traits are influenced by –

- (A) Maternal DNA only
- (B) Paternal DNA only
- (C) Both (A) and (B)
- (D) No influence will be seen

**Solution**

$\therefore$  (C)

**Illustration 5**

When we cross a tall plant (TT) with a short plant (tt), all plants of  $f_1$  generation are tall. Is all the tall plants in  $f_1$  generation exactly same as the tall plants in parent generation?

- (A) yes, the plant of  $f_1$  generation are same as the tall plants in parent generation
- (B) No, the plant of  $F_1$  generation are not same as parents. They may be heterozygous tall also.
- (C) No, the plants of  $F_1$  generation are not same. They are heterozygous dwarf.
- (D) none of the above

**Solution**

$\therefore$  (B)

**Illustration 6**

We cross a pea plant, one plant with round and green seed (RRYY) and other with wrinkled and yellow seed (rryy) characters. The  $F_1$  generation will be round and yellow seed (RrYy). When the  $F_1$  generation cross pollinated, the ratio for  $F_2$  generation will be –

- (A) 9 : 3 : 3 : 1
- (B) 3 : 9 : 3 : 1
- (C) 3 : 1
- (D) none of the above

**Solution**

∴ (A)

**Illustration 7***Do genes control the characteristics or traits –*

- (A) yes, as they are responsible for expression of character or trait  
 (B) no, they do not control the characters  
 (C) Genes are required only where the expression of enzyme is required  
 (D) none of the above

**Solution**

∴ (A)

**Illustration 8***Chemical basis of heredity is –*

- (A) Gene (B) DNA (C) RNA (D) None of the above

**Solution**

∴ (B)

**Illustration 9***Product of asexual reproduction is –*

- (A) clone (B) offspring (C) Both (A) & (B) (D) None of the above

**Solution**

∴ (A)

**Illustration 10***A monohybrid cross have a phenotypic ratio of –*

- (A) 9 : 3 : 3 : 1 (B) 3 : 1 (C) 1 : 2 : 2 : 4 (D) None of the above

**Solution**

∴ (B)

**Illustration 11***Individual can be a male when the sex-chromosome are –*

- (A) XX (B) XXY (C) YY (D) XY

**Solution**

∴ (D)

**Try yourself**

- A man with blood group 'A' marries a woman with blood group 'O' and daughter has blood group 'O'. Which of the traits-blood groups is dominant?  
 (A) A (B) O (C) Data not sufficient (D) None of these
- Mendel is famous for his work on  
 (A) Pea (B) Drosophila (C) Neurospora (D) Tomato
- An allele is said to be dominant if  
 (A) It is expressed only in heterozygous combination  
 (B) It is expressed only in homozygous combination  
 (C) It is expressed in both homozygous and heterozygous condition  
 (D) It is expressed in second generation

4. If a homozygous red-flowered plant is crossed with a homozygous white-flowered plant, the offspring would be (Red is dominant)
- (A) Half red-flowered (B) Half white-flowered (C) All red-flowered (D) Half pink-flowered

## 4.4 EVOLUTION

Variation formed during reproduction both because of errors in DNA copying and as a result of sexual reproduction cause evolution in a long run.

There are different ways in which individuals with a particular trait may increase in a population.

(i) change in the frequency of certain genes in a population over generation that bring about evolution.

Change in frequency of gene is also referred as **genetic drift**, which provide diversity without any adaptation. (Ex.- stamping on the bushes by elephant)

(ii) Natural Selection: Green beetle selected over red as crow can't spot them readily on green leaf.

### Illustration 12

*If some species of one generation has less weight due to starvation and has not cause change in DNA and again it continues in next generation. Is it this an example of evolution?*

(A) yes, it is an example of evolution

(B) no, because change in non-reproductive tissue cannot be passed on to the DNA of the germs cell.

(C) Yes, it in an example of evolution because less weight continues in next generation.

(D) none of the above

### Solution

∴ (B)

### Illustration 13

*Who gave the idea of evolution of species by natural selection –*

(A) Gregore Johannan Mendel

(B) Charles Robert Darwin

(C) Both (A) & (B)

(D) none of the above

### Solution

∴ (B)

### Try yourself

5. Which of the following provides evidence for evolution?
- (A) direct observation of genetic changes in populations  
 (B) shared characteristics of organisms  
 (C) the fossil record (D) All of the above
6. Change in frequency of gene is
- (A) Genetic drift (B) Genotype (C) Selection (D) None
7. The term evolution in Biology means that
- (A) Fossils are old (B) Life began in sea  
 (C) Living things constantly change (D) Beagle
8. Origin of life is due to
- (A) Spontaneous generation (B) Will of God  
 (C) Effect of sun rays on mud (D) None of the above





(iii) Autotrophic & heterotrophic

(iv) Exoskeleton & Endoskeleton

The more characteristics two species will have in common, the more closely they are related, & have a common ancestor

Ex. Human and apes

Classification of a species is in fact a reflection of their evolutionary relationship.

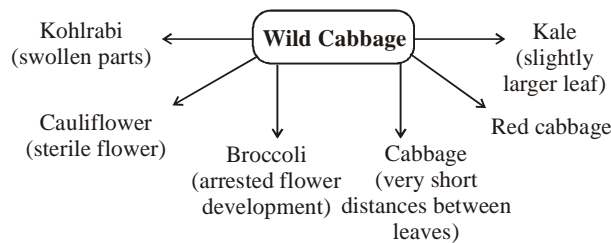
#### Tracing Evolutionary Relationships:-

- Homologous organ: Same origin
- Analogous organ: Same function
- Fossils** :- Preserved traces of living organisms. Age of fossils is determined by–
  - Digging into earth (appear at less depth will be recent)
  - Radio carbon dating- by detecting the ratios of different isotopes of the same element in the fossil material. Study of fossil is called Paleontology.
- Evolution by stages**

Ex 1. Simple rudimentary eye  $\xrightarrow[\text{fitness advantage}]{\text{because of}}$  complex developed eye's  
(In Flatworm) (Human)

Ex 2. Feathers in reptile  $\longrightarrow$  Birds  
(For insulation in cold weather) (flying)

Ex 3. Dissimilar looking structures evolve from a common ancestral design. (Artificial selection)



- Molecular Phylogeny:** Comparing the DNA of different species – It gives us a direct estimate of how much the DNA has changed during the formation of species (most extension method to define evolutionary relationships). It is better method as character may change with environment but DNA composition is constant.

#### Illustration 17

*A girl and her cousin can be related as –*

- the father of girl and father of her cousin are brothers*
- They have common ancestor, their grandparents*
- Both of the above*
- none of the above*

#### Solution

∴ (B)

#### Illustration 18

*Both Bat and Birds uses wings to fly but the structure and components of the wings of both are different. This is an –*

- Homologous characteristics*
- Analogous characteristics*
- Both of them*
- none of them*

**Solution**

∴ (B)

**Illustration 19**

*We can find how old the fossil are by –*

(A) *diging the earth and start finding fossil, fossil found closer to the surface are more recent then the fossils found deeper.*

(B) *By detecting the ratios of different isotopes of the same element in the fossil material.*

(C) *Both (A) & (B)*

(D) *None of the above*

**Solution**

∴ (C)

**Illustration 20**

*Homologous organ are –*

(A) *dissimilar origin and dissimilar structure*

(B) *Dissimilar origin but similar function*

(C) *Same origin, different function*

(D) *Similar origin with dissimilar function*

**Solution**

∴ (C)

**Illustration 21**

*Evolutionary development of a species can be best studied by –*

(A) *DNA analysis*

(B) *finding age by carbon dating*

(C) *studying fossils of this species*

(D) *All the above*

**Solution**

∴ (A)

**Illustration 22**

*Different varities of cabbage are generated by selection from wild cabbage. This is done by –*

(A) *Artificial selection*

(B) *Natural selection*

(C) *Both (A) & (B)*

(D) *None of the above*

**Solution**

∴ (A)

**Illustration 23**

*In evolutionary terms, we have more in common with –*

(A) *a chinese school-boy* (B) *a chimpanze* (C) *a spider* (D) *a bacterium*

**Solution**

∴ (A)

**Try yourself**

12. An example of homologous organ

(A) Our arm and a dog's fore-leg

(B) Our teeth and an elephant's tusks

(C) Potato and runners of grass

(D) All of the above

13. Which is the example of homologous organ?  
 (A) Forelimb of man and wings of bird (B) Wings of bird and wings of insects  
 (C) Vermiform appendix and nictitating membrane (D) Archaeopteryx and Balano glossus
14. In natural selection  
 (A) the genetic composition of the population changes at random over time  
 (B) new mutation are generated over time  
 (C) all individuals in a population are equally likely to contribute offspring to the next generation  
 (D) individual that possess particular inherited characters survive and reproduce at a higher rate than other individuals.

#### 4.7 EVOLUTION SHOULD NOT BE EQUATED WITH 'PROGRESS'

When new species appear, the old species do not disappear (It depends on environment). The new species are formed, not necessary better than old.

Ex. Beetle illustration, human & chimpanzee (It is not true that human have evolved from chimpanzee)

- ⇒ Evolution is simply the generation of diversity & the shaping of the diversity by environmental selection.  
 ⇒ Many older & simple characteristic bearing organism are better surviving than new & complex characteristic organism.

Ex. Bacteria & human, both are existing

##### Illustration 24

*Evolution should not be equated with progress because –*

- (A) *Evolution is simply generation of diversity*  
 (B) *Evolution is just shaping of the diversity by environmental selection*  
 (C) *Both (A) & (B)*  
 (D) *None of the above*

##### Solution

∴ (C)

##### Illustration 25

*When new species appear, the old species do not disappear (it depends on environment). The new species formed –*

- (A) *better than old* (B) *not better than old*  
 (C) *not necessary better than old* (D) *None of the above*

##### Solution

∴ (C)

*Try yourself*

15. Evolution is better assumed like form  
 (A) Stair (B) Tree Branches (C) Both (D) None

#### 4.8 HUMAN EVOLUTION

- Studied by– (a) excavating  
 (b) time dating  
 (c) fossil study  
 (d) Determining DNA sequences

Humans originated in Africa

- ↓
- Few migrated to West Asia, Central Asia, Eurasia, South Asia, East Asia
- ↓
- Few migrated to Islands of Indonesia
- ↓
- Few migrated to Islands of Philippines
- ↓
- Few migrated to Islands of Australia
- ↓
- Few migrated to Islands of Bering land bridge
- ↓
- Few migrated to Islands of America
- Modern men is *Homo sapiens*. We are mentally better but physically weaker than our ancestors
- \* The origin of life = Oparin (1936)
- \* The origin of species = Charles Darwin (1859)
- \* Atom – molecule → organic compounds → complex organic compounds
- ↓
- Eukaryotes ← Prokaryotes ← Proto cell ← Coacervates

**Illustration 26**

*Human evolution is studied by –*

- (A) excavating      (B) time dating      (C) fossil study      (D) All the above

**Solution**

∴ (D)

**Illustration 27**

*Humans originated in Africa, few migrated to –*

- (A) West asia      (B) Eurasia      (C) South asia      (D) All the above

**Solution**

∴ (D)

**Try yourself**

16. The theory of origin of life was given by  
(A) Oparin      (B) Darwin      (C) Weismann      (D) Lemarck
17. Darwin gave origin of species in  
(A) 1852      (B) 1854      (C) 1859      (D) 1856
18. The idea of “Survival of fittest” was given by  
(A) Darwin      (B) Herbert Spencer      (C) Germplasm DNA      (D) Mendel
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## *EXERCISE-I*

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1. Define heredity.
2. What is the science which deals with the study of heredity and variations known as?
3. Who is known as father of genetics?
4. Define clone.
5. State Mendel's first law of heredity.
6. What are genotypes and phenotypes?
7. What is gene?
8. What is meant by haploid organism?
9. How is variation brought about in a sexual reproduction.
10. What are homologous organs?
11. What are vestigial organs?
12. Define evolution.
13. Write full form of DNA.
14. Explain the rules of heredity?
15. How can you say that trait are independently inherited?
16. What is P, F<sub>1</sub> & F<sub>2</sub>.
17. What plant was used as a study material by Mendel?
18. Explain 3 : 1?
19. Why are males considered to be heterogametic?
20. Why did Mendel select Pisum sativum to carry out his experiments?
21. Explain cross fertilization & self fertilization.
22. How are Traits expressed?
23. Why in Tt, t is not expressed?

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## *EXERCISE-II*

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1. How many sets of gene present in :-  
(i) organism                      (ii) germ cell
2. Describe the physical and chemical structure of chromosome.
3. Name an organism where sex is not genetically determined.

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- Define organic evolution. Discuss in detail the palaeontological evidence for the organic evolution.
- Give one practical application of Mendel Law.
- How is sex determined in human beings?
- Define genetics. What is the contribution of Mendel in this branch of Biology?
- Explain sex determination in humans.
- Define speciation. Explain Factor leading to speciation.
- What are homologous organs? How do they provide evidence in support of evolution?
- Dissimilar looking structures evolve from a common ancestral design. Explain.
- Discuss the contribution of Mendel in genetics.
- How are evolutionary relationship traced?

## ***EXERCISE-III***

### **SECTION-A**

● **Fill in the blanks**

- The ratio phenotypic for the monohybrid cross is \_\_\_\_\_.
- Characters that are expressed in any conditions are called \_\_\_\_\_ and characters that are expressed only in homozygous conditions are called \_\_\_\_\_.
- \_\_\_\_\_ is physical and chemical expression of a character.
- Every organism have \_\_\_\_\_ sets of all genes, one inherited from \_\_\_\_\_.
- The formation of new species is known as \_\_\_\_\_ basis of heredity.
- Genes are \_\_\_\_\_.
- \_\_\_\_\_ are preserved traces of living organism.
- Classification of a species is infact a relation of their \_\_\_\_\_.

### **SECTION-B**

● **Multiple choice question with one correct answers**

- Genetics is the study of  
(A) Inheritance                      (B) Cell structure                      (C) Only plants                      (D) Only animals
- If two parents have the genotypes  $AA \times aa$ , the probability of having an  $aa$  genotype in the  $F_1$ , generation is  
(A) 25 percent                      (B) 50 percent                      (C) 75 percent                      (D) None of these
- Sex-linked disorders such as colour blindness and hemophilia are  
(A) caused by gene on the X-chromosome                      (B) caused by gene on the autosome  
(C) caused by gene on the Y-chromosome                      (D) Expressed only in men
- Your arm is homologous with  
(A) a seal flipper                      (B) an octopus tentacle                      (C) a bird wing                      (D) both (A) &(C)
- Which option represents test cross  
(A)  $TT \times TT$                       (B)  $Tt \times tt$                       (C) Both (A) & (B)                      (D) None

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## SECTION-C

- **Assertion & Reason**

Instructions: In the following questions as Assertion (A) is given followed by a Reason (R). Mark your responses from the following options.

- (A) Both Assertion and Reason are true and Reason is the correct explanation of 'Assertion'
- (B) Both Assertion and Reason are true and Reason is not the correct explanation of 'Assertion'
- (C) Assertion is true but Reason is false
- (D) Assertion is false but Reason is true

1. **Assertion:** Chemical basis of heredity is DNA.

**Reason:** Cellular DNA is the information source for making protein in the cell.

2. **Assertion:** Genes are functional segment DNA.

**Reason:** Genes are responsible for the expression of an enzyme.

3. **Assertion:** Variation are formed during reproduction.

**Reason:** Errors in DNA copying and sexual reproduction do not causes evolution.

4. **Assertion:** Speciation is the phenomenon by which new spp. comes into existence.

**Reason:** Genetic drift does not lead to speciation.

5. **Assertion:** The birds have pneumatic or hollow bones with air sacs

**Reason:** These adaptations help them during flight

## SECTION-D

- **Match the following (one to one)**

**Column-I** and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. Only One entries of column-I may have the matching with the same entries of column-II and one entry of column-II Only one matching with entries of column-I

1. **Column I**

- (A) Minor differences in progeny
- (B) Gregor Mendel
- (C) Heridity
- (D) Change in frequency of gene
- (E) Charles Darwin

**Column II**

- (P) Theory of evolution
- (Q) Transmission of characters from parents to child
- (R) Genetic drift
- (S) Due to inaccuracies in copying of DNA
- (T) Law of inheritance

2. **Column I**

- (A) Monohybrid cross
- (B) Sex-chromosomes
- (C) Artificial selection
- (D) Analogous organ
- (E) New species formed

**Column II**

- (P) Wings of Bat and Bird
- (Q) Not necessary better then old
- (R) One pair (xx/XY)
- (S) production of different varities of cabbage from wild cabbage
- (T) 3 : 1

# EXERCISE-IV

## SECTION-A

• **Multiple choice question with one correct answers**

- Mendel formulated some laws which are known as  
(A) Law of germplasm (B) Law of origin of species  
(C) Law of speciation (D) Law of inheritance
- Term 'GENE' was given by  
(A) Mendel (B) Morgan (C) Bateson (D) Boveri
- Mendel choose pea plants because  
(A) They were cheap  
(B) They were having seven pairs of contrasting characters  
(C) They were attractive (D) Of great economic importance
- The resemblance of individual to their progenitors is due to  
(A) Heredity (B) Genetics (C) Evolution (D) None of these
- Linkage is contradicted to \_\_\_\_\_ law of Mendel  
(A) Mutation (B) Independent assortment (C) Dominance (D) Crossing over
- Law of purity of gametes is also known as  
(A) Law of inheritance (B) Law of variation  
(C) Law of independent assortment (D) Law of segregation
- Mendel formulated the law of purity of gametes on the basis of  
(A) Dihybrid cross (B) Monohybrid cross (C) Back cross (D) Test cross
- A white flowered mirabilis plants rr was crossed with red coloured RR, if 120 plants are produced in F<sub>2</sub> generation. The result would be  
(A) 90 uniformly red and 30 white (B) 90 Non-uniformly coloured and 30 white  
(C) 60 Non-uniformly coloured and 60 white (D) All coloured and 40 white

## SECTION-B

• **Multiple choice question with one or more than one correct answers**

- Mendel law's of inheritance include  
(A) Law of Dominance (B) Law of segregation  
(C) Law of independent assortment (D) Law of variation
- Human originated in Africa and migrated to  
(A) Philippines (B) India  
(C) Indonesia (D) Bering land bridge
- Which of the following is originated from wild cabbage?  
(A) Broccoli (B) Kale (C) Kohlrabi (D) Brassica

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## SECTION-C

- **Comprehension**

**Passage-1**

Genetics is the branch of biology that deals with heredity and variations and heredity is the ability of a living organism to pass on its characters to its offspring. The transmission of dissimilar character is called variation. In asexual reproduction only very minor differences between progeny are seen, due to small inaccuracies in DNA copying where as great diversity is generated in case of sexual reproduction variations affects the survival of an organism. Depending on the nature of variation, different individual would have different kinds of advantages.

1. Branch of biology deals with heredity & variations –  
 (A) Genetics                      (B) Cell biology                      (C) Zoology                      (D) Palaeontology
2. Transmission of dissimilar character.  
 (A) Heredity                      (B) progeny                      (C) variation                      (D) None of these
3. Great diversity is generated in case of  
 (A) Asexual reproduction    (B) sexual reproduction    (C) both (A) & (B)    (D) None of these

**Passage-2**

Gregor Johann Mendel (1822-1884) known as the father of Genetics. Mendel was educated in a monastery and went on to study science and mathematics at the university of Vienna. After the failure in examination for a teaching certificate, he came back to his monastery and started his experiments on garden pea. Mendel used a number of contrasting visible characters of garden pea – round/wrinkled seeds, tall/short plant, white/violet flowers and so on. After his studies on garden pea he gave the law of inheritance.

Mendel gave three laws – law of Dominance, law of segregation, law of independent assortment.

1. Mendel is known as \_\_\_\_\_.
2. On which plant Mendel worked?
3. How many laws did Mendel give?
4. In which examination did Mendel fail?

## SECTION-D

- **Match the following (one to many)**

**Column-I** and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. One or more than one entries of column-I may have the matching with the some entries of column-II and one entry of column-II may have one or more than one matching with entries of column-I

- | 1. <b>Column I</b>         | <b>Column II</b>   |
|----------------------------|--------------------|
| (A) Phenotypic ratio       | (P) 1 : 2 : 1      |
| (B) Genotypic ratio        | (Q) 3 : 1          |
| (C) Monohybrid cross/ratio | (R) 9 : 3 : 3 : 1  |
| (D) Dihybrid cross ratio   | (S) $Tt \times tt$ |

# Answers

## Knowledge base questions

- |        |        |        |        |         |
|--------|--------|--------|--------|---------|
| 1. (A) | 2. (A) | 3. (A) | 4. (D) | 5. (A)  |
| 6. (B) | 7. (C) | 8. (C) | 9. (D) | 10. (D) |

## Try Yourself

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (C)  | 2. (A)  | 3. (C)  | 4. (C)  | 5. (D)  |
| 6. (A)  | 7. (C)  | 8. (D)  | 9. (C)  | 10. (D) |
| 11. (D) | 12. (D) | 13. (A) | 14. (D) | 15. (B) |
| 16. (A) | 17. (C) | 18. (A) |         |         |

## Exercise-III

1. 3:1
3. Phenotypes
5. Speciation
7. Fossils

### Section-A

2. dominant, recessive
4. two, each parent
6. Physical
8. Evolutionary relationship

### Section-B

- |        |        |        |        |        |
|--------|--------|--------|--------|--------|
| 1. (A) | 2. (D) | 3. (A) | 4. (D) | 5. (B) |
|--------|--------|--------|--------|--------|

### Section-C

- |        |        |        |        |        |
|--------|--------|--------|--------|--------|
| 1. (A) | 2. (B) | 3. (C) | 4. (C) | 5. (A) |
|--------|--------|--------|--------|--------|

### Section-D

- |                                  |                                      |
|----------------------------------|--------------------------------------|
| 1. (A-S),(B-T),(C-Q),(D-R),(E-P) | 2. (A-T), (B-R), (C-S), (D-P), (E-Q) |
|----------------------------------|--------------------------------------|

## Exercise-IV

- |        |        |        |        |        |
|--------|--------|--------|--------|--------|
| 1. (D) | 2. (C) | 3. (B) | 4. (A) | 5. (B) |
| 6. (D) | 7. (B) | 8. (A) |        |        |

### Section-A

### Section-B

- |            |            |            |
|------------|------------|------------|
| 1. (A,B,C) | 2. (A,C,D) | 3. (A,B,C) |
|------------|------------|------------|

### Section-C

### Passage-1

- |        |        |        |
|--------|--------|--------|
| 1. (A) | 2. (C) | 3. (B) |
|--------|--------|--------|

### Section-D

- |  |
|--|
| 1. (A)-(QR), (B)-(P), (C)-(P,Q,S), (D)-(R) |
|--|

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