

-: GOD GRACE :-

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BIO-ZOOLOGY

[REVISED EDITION (Q & A) – 2021 ONLY]
(PART –I)

1. Reproduction in Organisms
2. Human Reproduction
3. Reproductive Health
4. Principles of Inheritance and Variation
5. Molecular Genetics
6. Evolution

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I: REPRODUCTION OF ORGANISMS

BOOK BACK QUESTION

(Note :- Question no :1– 4 answers are available in your book)

6. Name the phenomenon where the female gamete directly develops into a new organism with an avian example.
- ☉ Phenomenon - Parthenogenesis.
 - ☉ In some organisms female gamete (ovum) is directly develop into a complete individual by physical or chemical induction. e.g., Turkey, Chicken, Pigeon.
7. What is parthenogenesis? Give two examples from animals
- ☆ The process of development of an egg into a complete individual without fertilization is known as parthenogenesis . Eg. Annelid and sea urchin eggs.
8. Which type of reproduction is effective -Asexual or sexual and why?
- ❖ . Sexual reproduction is an effective method of reproduction than asexual method because Sexual reproduction contributes to the evolution of the species by adding variation in a population.
 - ❖ . Variation occurs because of the fusion of male and female gametes (sexual reproduction) carrying different sets of chromosomes.
11. Give reasons for the following:-
- a. Some organisms like honey bees are called parthenogenetic animals
Reason : Male Honey bee (Drones) is develop from unfertilized egg so they are called a parthenogenetic animals.
 - b. A male honey bee has 16 chromosomes where as its female has 32 chromosomes.
Reason : 1. A male honey bee – Develop from unfertilized eggs.
 2. Female honey bee - Develop from fertilized eggs.

13) How is juvenile phase different from reproductive phase?

S.N	Juvenile phase	Reproductive phase
1.	It is a Time period between birth to just before reproductive phase	It is an actual Reproductive phase
2.	This phase also known as primary growth phase or vegetative phase	This phase is known as secondary growth phase or sexual maturity

14) What is the difference between syngamy and fertilization ?

no	Syngamy	Fertilization
1.	1. It is the process of fusion of dissimilar gametes (male and female gametes)	It is the process of fusion of dissimilar gametes (male and female gametes)
2.	Syngamy term is used to denote fusion of gamete occur mostly in invertibrate or lower grade organisms	Fertilization term is used to denote fusion of gamete occur in higher invertebrate and all vertebrates

ADDITIONAL QUESTIONS

1. What is paedogenetic parthenogenesis?

- ★ In this the larvae produce a new generation of larvae by parthenogenesis.
- ★ Eg : Sporocysts and Reclia larvae of liver fluke.

2. Difference Oviparous and Viviparous :-

Viviparous	Oviparous
It is the type of development in which the young ones are born alive after being nourished in the uterus through placenta . Eg :Mammals.	The young hatch from eggs laid outside the mother's body. Eg: Reptiles and Birds.

3. What are the types of natural parthenogenesis? Types are :-

1. Arrhenotohy :- Only males are produced eg.honey bees.
2. Thelytohy :- Only females are produced. Eg.Solenobia
3. Amphitohy :- Egg may develop into individuals of any sex.

4. Define Parthenogenesis & Mention its types :-

- ☆ Development of an egg into complete individuals without fertilization is called parthenogenesis.
- Types: 1. Natural Parthenogenesis.
2. Artificial Parthenogenesis.

12. Write different types of syngamy :-

1. **Autogamy** - Male and female gametes are produced by the **same cell or same organism** and both the gametes fuse together to form a zygote. e.g. Actinosphaerium and Paramecium.
2. **Exogamy** - the male and female gametes are produced by **different parents** and they fuse to form a zygote. So it is biparental. e.g. Human – dioecious or unisexual animal.
3. **Hologamy** - In lower organisms, **organisms themselves behave as gametes** and the fusion of such mature individuals is known as hologamy. e.g. Trichonympha.
4. **Paedogamy** - **union of young individuals produced immediately after the division** of the adult parent cell by mitosis.
5. **Merogamy** - fusion of small size and morphologically different gametes (merogametes).
6. **Isogamy** - it is the fusion of **morphological and physiological identical gametes** . e.g. Monocystis.
7. **Anisogamy** – it is the **fusion of dissimilar gametes** is called anisogamy. e.g. higher invertebrates and all vertebrates.

2: HUMAN REPRODUCTION

BOOK BACK QUESTION

(Note :- Question no :1– 16 answers are available in your book)

17) Mention the differences between spermiogenesis and spermatogenesis :-

S.N	Spermatogenesis	Spermiogenesis
1.	It is the process of formation of haploid spermatozoa from germinal cells	It is the process of differentiation of spermatozoon from a spermatid
2.	It involves conversion of a diploid structure into haploid structures	It changes a haploid structure into another haploid structure.

18) At what stage of development are the gametes formed in new born male and female?

1. Male - Spermatogenesis starts at the age of puberty. It is initiated by the release of Gonadotropin.
2. Female - At puberty secondary oocyte and ovum is formed from primary oocytes by mitotic division.

19) Expand the acronyms :-

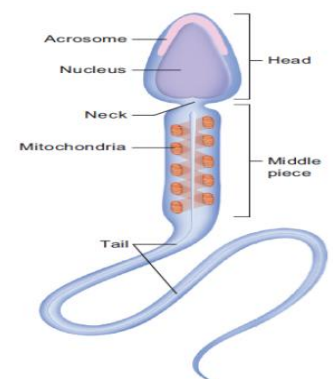
- a) **FSH** – Follicle Stimulated hormone.
- b) **LH** – Leutinising hormone
- c) **HCC** – Human placental gonadotropin.
- d) **HPL** – Human Placental Lactogen

20) How is polyspermy avoided in humans?

- ❖ Once fertilisation is happened **cortical granules** from the cytoplasm of the ovum form a barrier called the fertilisation membrane around the ovum and preventing further penetration of other sperms.
- ❖ Thus polyspermy is prevented.

23) Draw a labelled sketch of a spermatozoan and explain the structure ?

- ◆ The human sperm is a flagellated, motile gamete.
- ◆ It is composed of head, neck and a tail.
- ◆ The head comprises of acrosome and nucleus.
- ◆ **Acrosome** is a helps to penetrate the ovum during Fertilization.
- ◆ The neck is very short and it contains the proximal centriole and the distal centriole.
- ◆ The middle piece possesses mitochondria . It produces energy in the form of **ATP** molecules for the movement of sperms.
- ◆ Tail is the longest part of the sperm and is slender and tapering.



24) What is Inhibin ? State its functions?

- * **Sertoli cell** is in the stratified epithelium of seminiferous tubule, it secrete a hormone inhibin.
- * It is involved in the negative feedback control of sperm production.

25) Mention the importance of the position of testes in humans?

- Testes are a pair of ovoid bodies lying in the scrotum.
- The scrotum is a sac of skin that hangs outside the abdominal cavity.
- Since viable sperms cannot be produced at normal body temperature.
- The scrotum is placed outside the abdominal cavity to provide a temperature **2-3°C** lower than the normal internal body temperature.
- Thus the scrotum acts as a **thermoregulator** for spermatogenesis.

26) What is the composition for semen?

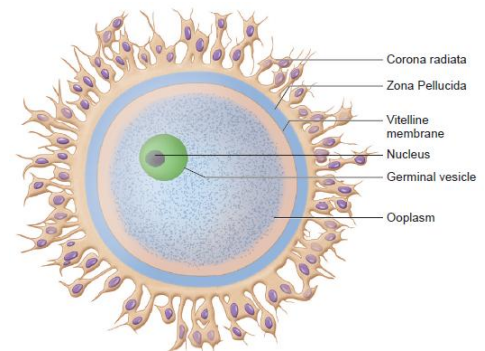
- ★ Semen is a milky white fluid with sperms and the seminal plasma.
- ★ It is an alkaline fluid with fructose sugar, ascorbic acid, prostaglandin, and vesiculase.
- ★ Vericulase is a coagulating enzyme. It enhances sperm motility.

28) Define Gametogenesis ?

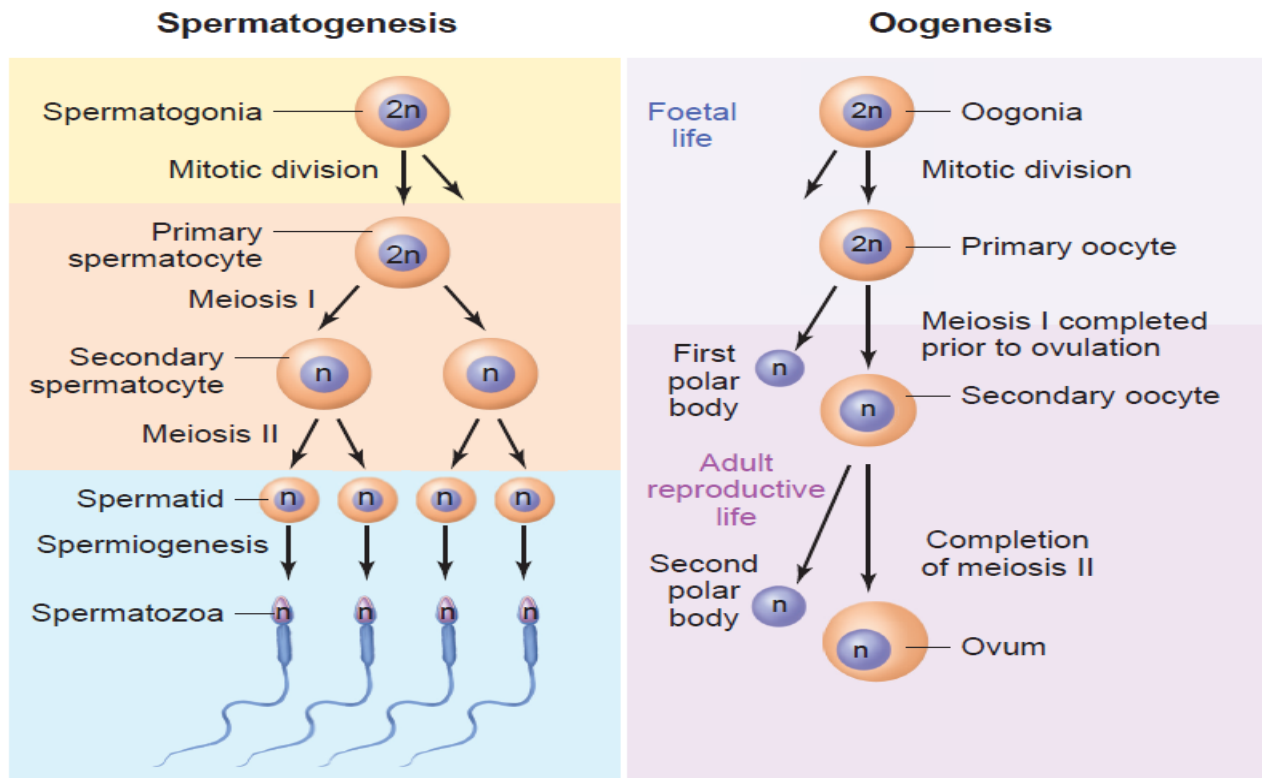
- ❖ Gametogenesis is the formation of gametes.
- ❖ Sperms and ova are produced from primary sex organs like testis and ovary.
- ❖ Meiosis plays a significant role in gametogenesis.

29) Describe the structure of the human ovum with a neat labelled diagram?

- ⊙ Human ovum is microscopic, non-cleidoic and alecithal.
- ⊙ Its cytoplasm is called Ooplasm. Ooplasm contains large nucleus called germinal vesicle.
- ⊙ It has outer thick coat of follicular cells called corona radiata.
- ⊙ The middle thick layer is called zona pellucida.
- ⊙ The inner thin transparent layer is called vitelline membrane.
- ⊙ Between the vitelline membrane and zona pellucida is a narrow space perivitelline space.



30) Give a schematic representation of spermatogenesis and Oogenesis in humans?



32) Explain the role of oxytocin and relaxin in parturition and lactation?

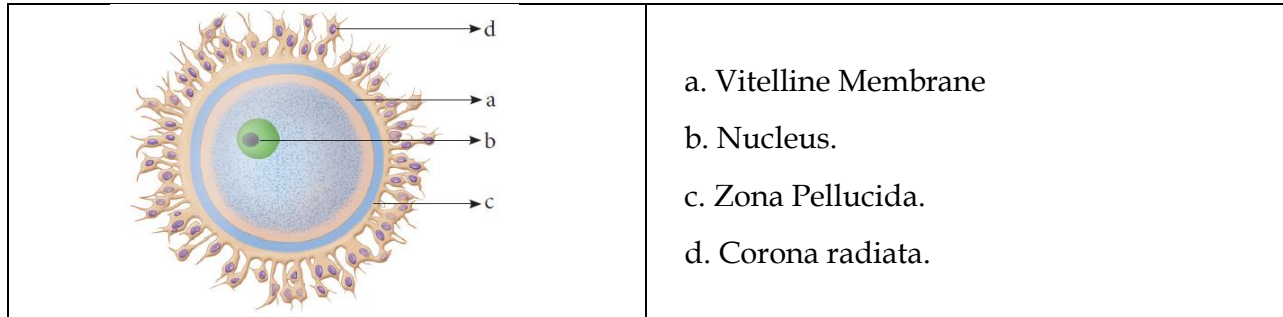
1. **Relaxin** :-

- * It relaxes pelvic joints and by dilation of the cervix with continued powerful contractions.
- * The amnion ruptures and amniotic fluid flows through vagina.
- * The placenta and the remains of the umbilical cord is called 'after birth' is expelled out after delivery.

2. **oxytocin** :-

- * It causes the ejection of milk from the alveoli of mammary glands.
- * During lactation, it stimulates the contraction of the empty uterus. Now uterus return to pre-pregnancy size.

33) Identify the given image and label its parts marked as a,b,c and d



ADDITIONAL QUESTIONS

1. Mention the significance of Epididymis in the testis?

- ❖ It temporarily stores the sperm and it helps in physiological maturation of sperm.
- ❖ Sperms acquire increased motility and fertilising capacity.

2. What are the accessory glands in female reproductive system and its function ?

- 1) The Bartholin's gland - is posterior to the left and right of the opening of the vagina. Its secrete mucus to lubricate the vagina.
- 14) The Skene's glands - are located on the anterior wall of the vagina and around the lower end of the urethra. They secrete a lubricating fluid.

1. What are Sertoli cells and its uses ?

- ⊙ They are elongated and pyramidal and provide nourishment to the sperms till maturation.
- ⊙ They also secrete inhibin hormone.

2. Roll of hormone in Spermatogenesis ?

- 1) **Gonadotropin Releasing Hormone (GnRH)** - initiated the puberty
- 2) **Follicle Stimulating Hormone (FSH)** - testicular growth and enhances the production of **Androgen**
- 3) **Lutenizing Hormone (LH)** – it acts on the Leydig cells and stimulates the synthesis of **testosterone** which in turn stimulates the process of spermatogenesis.

3. Monozygotic (Identical) :- twins are produced when a single fertilized egg splits into two during the first cleavage. They are of the same sex, look alike and share the same genes.

4. Dizygotic (Fraternal) :- twins are produced when two separate eggs are fertilized by two separate sperms. The twins may be of the same sex or different sex and are non-identical.

5. Siamese (United) :- twins are the conjoined twins who are joined during birth.

6. What is Let-Down” reflex ?

* Oxytocin causes the “**Let-Down” reflex** the actual ejection of milk from the alveoli of the mammary glands.

5-MARK QUESTION

7. POLY CYSTIC OVARY SYNDROME (PCOS) :-

- ⊕ PCOS is a complex endocrine system disorder that affects women in their reproductive years.
- ⊕ Polycystic means ‘many cysts’. It refers to many partially formed follicles on the ovaries, which contain an egg each.
- ⊕ But they do not grow to maturity or produce eggs that can be fertilized.
- ⊕ Women with PCOS may experience irregular menstrual cycles, increased androgen levels, excessive facial or body hair growth (**hirsutism**), acne, obesity, reduced fertility and increased risk of diabetes.
- ⊕ Treatment for PCOS includes a healthy lifestyle, weight loss and targeted hormone therapy.

8. Discribe on extra embryonic membranes :-

* The extra embryonic membranes namely the **amnion, yolk sac, allantois** and **chorion**.

* It protect the embryo from dessication, mechanical shock and help the absorption of nutrients and exchange of gases

1. Amnion :-

- ⊗ Double layered, translucent membrane filled with amniotic fluid.
- ⊗ Give buoyant environment to protect the embryo from injury.
- ⊗ Regulate the temperature of foetus.
- ⊗ Provide a medium for movement of foetus.

2. Yolk Sac :-

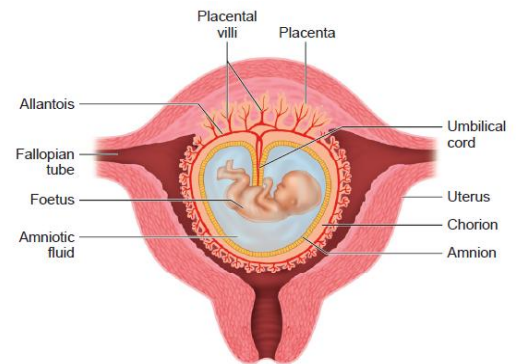
Forms a part of the gut and source of the earliest blood vessels and blood cells.

3. Allantois :-

- ⊗ It is at the caudal end of yolk sac and small out pocketing of embryonic tissue.
- ⊗ Structural base of umbilical cord and links embryo to the placenta. It becomes the part of the urinary bladder.

4. Chorion :-

- ⊙ Outer most membrane and it encloses the embryo and all other membranes.
- ⊙ Helps in the formation of placenta.



9. The major reproductive events in human beings are as follows:-

- 1) **Gametogenesis** - Formation of gametes by spermatogenesis and oogenesis.
- 2) **Insemination** - Transfer of sperms by the male into the female genital tract.
- 3) **Fertilization** - Fusion of male and female gametes to form zygote, called Fertilization.
- 4) **Cleavage** - Rapid mitotic divisions of the zygote which convert the single celled into a multicellular.
- 5) **Implantation** - Attachment of blastocyst to the uterine wall.
- 6) **Placentation** - Formation of placenta which is the intimate connection between foetus and uterine wall of the mother for exchange of nutrients.
- 7) **Gastrulation** - Process by which blastocyst is changed into a gastrula with three primary germ layers.
- 8) **Organogenesis** - Formation of specific tissues, organs and organ systems from three germ layers.
- 9) **Parturition** - Expulsion of the foetus from the mother’s womb

ONE WORD ANSWER

- 1) The male reproductive hormone Testosterone are secreted by – **Leydig cells / Interstitial cells.**
- 2) The viable sperms can be produced at temperature - **2 to 3°C.**
- 3) The scrotum acts as a _____ for spermatogenesis - **thermoregulator**
- 4) The ovary remains attached to the pelvic wall by an ovarian ligament called – **Mesovarium.**
- 5) Which wall involve in cyclic changes during the menstrual cycle – **Endometrium.**
- 6) The spermatids are transformed into mature spermatozoa (sperms) by the process called – **Spermiogenesis.**
- 7) The sperm production remains nearly constant at a rate of about _____ sperms per day- **200 million.**
- 8) which proteolytic enzyme helps to penetrate the ovum during Fertilization – **hyaluronidase.**
- 9) It produces energy in the form of ATP molecules for the movement of sperms - **Mitochondria.**
- 10) The males produce more than _____ sperms in their life time- **500 billion.**
- 11) The smallest human cell - **sperm**
- 12) The largest human cell. - **ovum or egg**
- 13) Which type of egg in human ovum - **Alecithal type.**
- 14) The menstrual or ovarian cycle occurs approximately once in every - **28/29 days.**
- 15) In female reproductive system which cell secrete the oestrogen - **follicle cells.**
- 16) The release of the ovum (secondary oocyte) from the ovary is called - **ovulation.**
- 17) The average age of menopause occur in - **45-50 years.**
- 18) If the fertilized ovum is implanted outside the uterus it results in - **Ectopic pregnancy.**
- 19) Human pregnancy of the gestation period about - **280 days or 40 weeks.**
- 20) Colostrum is also rich in _____ antibodies - **IgA.**
- 21) It refers to the failure of spermatogenesis - **Azoospermia.**
- 22) It is the first ejaculation of the semen - **Spermarche.**

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3 : REPRODUCTIVE HEALTH

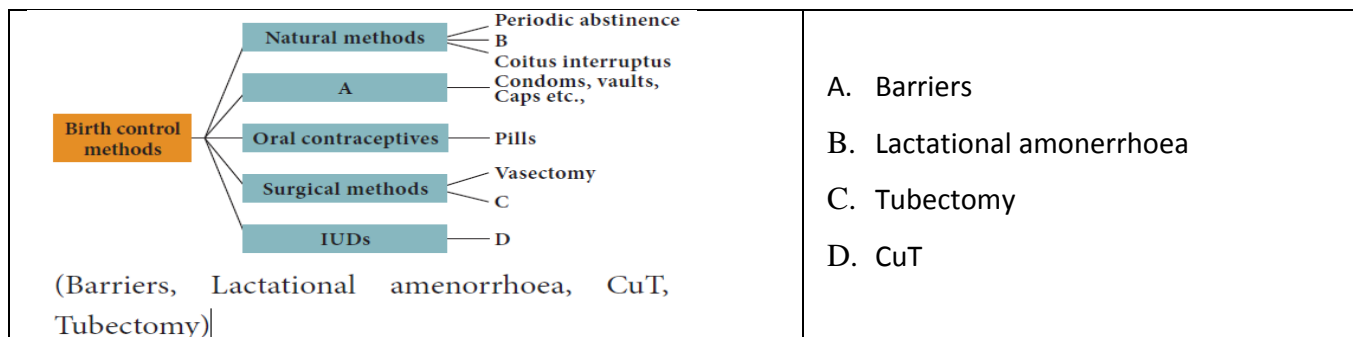
BOOK BACK QUESTION

(Note :- Question no :1– 8 answers are available in your book)

9) What is amniocentesis? Why a statutory ban is imposed on this technique?

- Ⓐ Amniocentesis is generally performed in a pregnant woman between the 15th - 20th weeks of pregnancy.
- Ⓑ By inserting a long, thin needle through the abdomen into the amniotic sac to withdraw a small sample of amniotic fluid. The amniotic fluid contains cells shed from the foetus.
- Ⓒ It helps to detect chromosomal abnormality in the foetus.
- Ⓓ It is misused to detect the sex of the foetus. It creates chance for female foeticide.

10) Select the correct term from the bracket and complete the given branching tree



11) Correct the following statements :-

- a) Transfer of an ovum collected from donor into the fallopian tube is called ZIFT.
Ans :- Transfer an ovum collected from donor into the fallopian Tube – GIFT
- b) Transferring of an embryo with more than 8 blastomeres into uterus is called GIFT.
Ans :- Transfer of the zygote with more than 8 blastomeres into the fallopian tube - ZEFT
- c) Multiload 375 is a hormone releasing IUD.
Ans :- Multiload 375 is a copper releasing IUD.

12) Which method do you suggest the couple to have a baby, if the male partner fails to inseminate the female or due to very low sperm count in the ejaculate?

- * Intra Uterine Insemination (**IUD**) is suggested.
- * This is a procedure to treat infertile men with low sperm count.
- * Semen is collected from the husband or a healthy donor.
- * Semen is introduced into the uterus through vagina by a catheter.
- * Ovaries are stimulated to produce more ova.
- * Sperms swim towards the fallopian tubes and fertilize the egg, resulting in normal pregnancy.

13) Expand the following :-

- a) **ZIFT** - Zygote Intra - Fallopian Transfer.
- a) **ICSI** - Intra Cytoplasmic Sperm Injection.

14) What are the strategies to be implemented in India to attain total reproductive health?

1. Family Planning programme since 1951 and is periodical assessed every decade.
2. Reproductive and child Health care (RCH) programmes.
3. **Creating awareness** and providing medical assistance to build a healthy society.
4. Introducing **sex education** in schools to provide information about adolescence.
5. Educating couples and those in the marriageable age groups about the available **birth control methods**.
6. Awareness about care for pregnant women **post natal care** of mother and child.
7. Encouraging the government and non-governmental agencies to identify **new birth control** methods.

15) Differentiate foeticide and infanticide. :-

Foeticide	Infanticide
Foeticide Aborting the female in the mother's womb	Infanticide Killing the female child after her birth.

19) The procedure of GIFT involves the transfer of female gametes into the fallopain tube, can gametes be transferred to the uterus to achieve the same result? Explain.

- ❖ This is a procedure (**IUI**) to treat infertile men with low sperm count.
- ❖ The semen is collected either from the husband or from a healthy donor.
- ❖ And it is introduced into the uterus through the vagina by a catheter.
- ❖ After stimulating the ovaries to produce more ova.
- ❖ The sperms swim towards the fallopian tubes to fertilize the egg, resulting in normal pregnancy.

20) Amniocentesis, the foetal sex determination test, is banned in our country, Is it necessary? comment.

- * The ban of Amniocentesis is necessary in our country. Because :-
- * It is misused to detect the sex of the foetus. It creates chance for female foeticide.

21) Open Book Assessment

Healthy reproduction, legally checked birth control measures and proper family planning programmes are essential for the survival of mankind' Justify.

1. Healthy reproduction - is a state of well being in all aspects of reproduction, so as to make the people contribute to a healthy society.
2. Birth control or family planning - can help people design their family small and healthy and their reproductive life smooth and happy.
3. To restrict population growth and to keep small family, the skewed choice of male child over female is done.
4. So by giving awareness to the school children.
5. The coming society will be Reproductive Healthy, a criteria essential for the survival of mankind.

ADDITIONAL QUESTIONS

1. Difference between vasectomy & Tubectomy :-

s.n	Vasectomy	Tubectomy
1.	It is a surgical procedure for male sterilization	It is the surgical sterilization in woman.
2.	Both vas deference are cut and tied through on scrotum	Oviduct is cut and tied through vagina
3.	It prevents the entry of sperm in to the urethra	It prevent the fertilization

2. **Zygote intra-fallopian transfer (ZIFT) :-**

- ♣ As in IVF, the zygote upto 8 blastomere stage is transferred to the fallopian tube by laparoscopy.
- ♣ The zygote continues its natural divisions and migrates towards the uterus where it gets implanted.

3. **Gamete intra-fallopian transfer (GIFT) :-**

- * Transfer of an ovum collected from a donor into the fallopian tube.
- * In this the eggs are collected from the ovaries and placed with the sperms in one of the fallopian tubes.
- * The zygote travels toward the uterus and gets implanted in the inner lining of the uterus.

4. **Write a short note on cervical cancer.**

1. Definition: It is the abnormal growth of cervical cells earned by STV namely Human Papilloma Virus
2. Symptoms: Pelvic pain, increased vaginal discharge & abnormal vaginal bleeding.
3. Risk factors: Prolonged use of contraceptive pills, having multiple sexual partners.
4. Diagnosis: Pap smear
5. Prevention: modification of life style, healthy diet, avoiding tobacco.

5. **Chorionic villus sampling (CVS) :-** It is a prenatal test that involves taking a sample of the placental tissue to test for chromosomal abnormalities.

6. **Write three causes of infertility**

- 1) Undescended testes and swollen veins in scrotum.
- 2) Tight clothing in men may raise the temperature in the scrotum & affects production.
- 3) Females may develop antibodies against her partner's sperm.

7. **Suggest a solution for the prevention of male infertility to the patients with Azoospermia?**

- ⊕ Micro- testicular sperm extraction is suggested (TESE).
- ⊕ Sperm is removed from the testis by surgery.
- ⊕ Incision is made in scrotum , Seminiferous tubules are dilated.
- ⊕ Testicular tissue are removed from the area of active sperm production.

8. **The various steps involve in the In vitro fertilization (IVF) or Test Tube Baby?**

- 1) Ovarian stimulation - Human chorionic Gonadotropin (hcG) is injected.
- 2) Eggs are prepared and stripped from the surrounding cells.
- 3) Sperm is prepared by special media. Sperms and eggs are brought together.
- 4) Then the zygote is allowed to divide to form 8 celled blastomere.
- 5) Then transferred into the uterus for a successful pregnancy.
- 6) The transfer of an embryo in 8 cell stage into uterus is called Embryo Transfer Technique

9. **Foetoscope :-**

- ☆ It is used to monitor the foetal heart rate and other functions during late pregnancy and labour.
- ☆ The average foetal heart rate is between 120 and 160 beats per minute.
- ☆ An abnormal foetal heart rate or pattern may mean that the foetus is not getting enough oxygen and it indicates other problems.
- ☆ A hand-held doppler device is often used during prenatal visits to count the foetal heart rate.
- ☆ During labour, continuous electronic foetal monitoring is often used.

ONE WORD

1. It is known as anti-sterility vitamin as it helps in the normal functioning of reproductive structures – **Vitamin E**
2. Sex hormones were discovered by - **Adolf Butenandt**.
3. World Population Day - **11th July** .
4. World AIDS Day - **1st December** .
5. NACO (National AIDS Control Organisation) was established in - **1992**.
6. They are commonly called as international diseases - **Syphilis and gonorrhoea**.
7. The world to initiate the ‘Family planning programme’ since - **1951**.
8. It refers to ‘aborting the female in the mother’s womb - **Female foeticide**.
9. It is ‘killing the female child after her birth - **infanticide** .
10. Prevention of children from sexual offences act is - **POCSO Act**.
11. This delay in ovarian cycles is called - **lactational amenorrhoea**.
12. All women are born with ovaries, but some do not have functional uterus it is called **Mayer-Rokitansky syndrome**.

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4 : Principles of Inheritance and Variation

BOOK BACK QUESTION

(Note :- Question no :1– 21 answers are available in your book)

22) What is haplodiploidy?

- ⊗ The sex of the off spring is determined by the numbers of sets of chromosomes ex : Honey bee, wasp, Ants
- ⊗ Fertilized egg develops into females. (Queen / worker honeybee).
- ⊗ Unfertilised eggs develop into males (drones) by parthenogenesis.
- ⊗ The males have half the number of chromosomes (**haploid**).
- ⊗ The Females have double the number (**diploid**)
- ⊗ Hence the sex determination is called **haplodiploidy**. It is seen in hymenopteran insects.

23) Distinguish between heterogametic and homogametic sex determination systems.

Heterogametic.	Homogametic
The individuals (male) produce two types of gametes so they are said to be heterogametic.	Individuals (female) produce only one type (X,X) of So they are said to be homogametic.

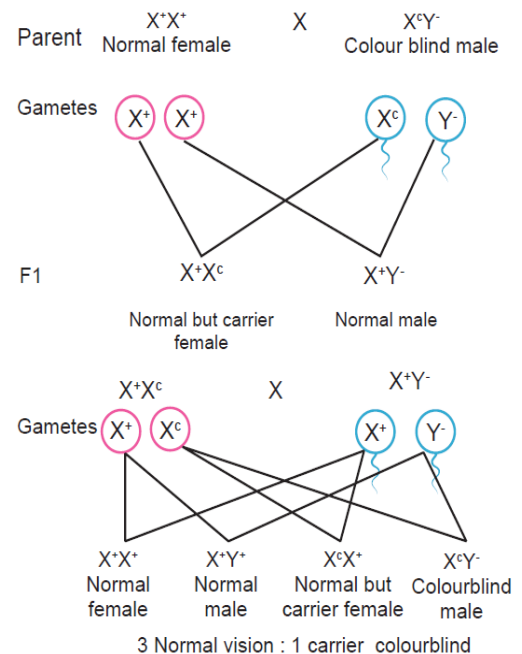
24) What is Lyonisation? (Lyon's hypothesis / Dosage compensation Barr body)

- ‡ In the XY Chromosomal system of sex determination, males have only one X Chromosome and the females have two X Chromosomes.
- ‡ This condensed body was called sex chromatin by them, and referred as **Barr body**.
- ‡ In females, these X Chromosome becomes tightly coiled into a heterochromatin (Lyon's hypothesis).
- ‡ The number of Barr bodies observed in cell was one less than the number of X-chromosome.
- ‡ XO female have no Barr body, whereas XXY males have one Barr body.

25) What is criss-cross inheritance?.OR (colour blind man X normal visioned woman) (Annual -2020)

OR (Sex linked characters in human being)

- ⊗ A marriage between a colour blind man and a normal vision woman.
- ⊗ It will produce normal visioned male and female individual generation but the females are **carriers**.
- ⊗ The marriage between a F1 normal visioned carrier woman normal visioned male will produce:
 1. one normal visioned female,
 2. one carrier female,
 3. one normal visioned male and
 4. **one colour blind male**.
- ⊗ Colour blind trait is inherited from the male parent to his g through carrier daughter. Which is an example of **criss-cross pattern** of inheritance.
- ⊗ “ This type of inheritance of recessive sex linked character father to daughter and then from the daughter to her sons” known as **criss cross inheritance**.



26) Why are sex linked recessive characters more common in the male human beings?

- * The X-linked genes have no corresponding alleles in the Y chromosome.
- * The Y linked genes have no corresponding allele in X chromosome.
- * The Y linked genes inherit along with Y chromosome and they phenotypically express only in the male.
- * Sex linked inherited traits are more common in males than females because, males are hemizygous and therefore express the trait when they inherit one mutant allele.

27) What are holandric genes?

- The genes present in the differential region of Y chromosome are called Y- linked or **holandric genes**.
- Y linked genes inherit along with y-chromosome and phenotypically express only in the male.

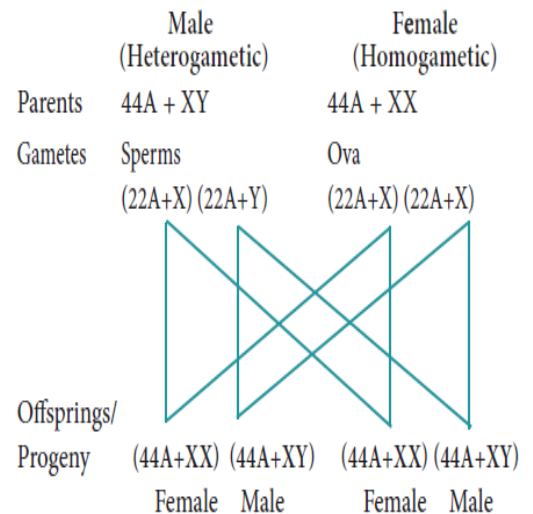
30) Explain the genetic basis of ABO blood grouping man.

- ‡ Three autosomal alleles are on chromosome 9.
- ‡ These alleles determine the blood group.
- ‡ The gene for blood group is labeled as 'I' (I - Isoagglutininogen - antigen)
- ‡ I gene has 3 allelic forms $I^A I^B I^O$
- ‡ I^A specifies A antigen, I^B for B antigen
- ‡ I^O allele specifies no antigen.
- ‡ The phenotypic combinations is -A,B,AB, and O.
- ‡ The genotypes are $I^A I^A, I^A I^O, I^B I^B, I^B I^O, I^A I^B,$ and $I^O I^O$

Genotype	ABO blood group phenotype	Antigens present on red blood cell	Antibodies present in blood plasma
$I^A I^A$	Type A	A	Anti -B
$I^A I^O$	Type A	A	Anti -B
$I^B I^B$	Type B	B	Anti -A
$I^B I^O$	Type B	B	Anti -A
$I^A I^B$	Type AB	A and B	Neither Anti -A nor Anti-B
$I^O I^O$	Type O	Neither A nor B	Anti -A and anti - B

31) How is sex determined in human beings ?

- * Gene determining sex in human beings are located in sex chromosomes called allosomes.
- * Sex determination is based on chromosomal differences between male and female.
- * Females have XX chromosomes and Males have XY chromosomes.
- * Females are homogametic. They produce only one type (X) gamete.
- * Males are heterogametic. They produce 2 types (X,Y) of gametes (sperms).
- * The egg fertilised by X sperm produce female.
- * The egg fertilised by Y sperm produce male.



32) Explain male heterogamety.

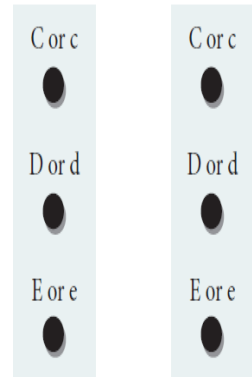
- ⊗ In this method of sex determination the males are **heterogametic** producing dissimilar gametes.
- ⊗ It is of two kinds XX-XO type and XX-XY type.
- ⊗ **XX-XO** of sex determination is seen in bugs, some insects such as cockroaches and grasshoppers.
- ⊗ **XX-XY** of sex determination is seen in human beings and in *Drosophila*.

33) Brief about female heterogamety. –

- * In this method of sex determination, the homogametic male possesses two 'X' chromosomes as in certain insects and certain vertebrates like fishes, reptiles and birds producing a single type of gamete; while females produce dissimilar gametes.
- * The female sex consists of a single 'X' chromosome or one 'X' and one 'Y' chromosome.
- * Thus the females are heterogametic and produce two types of eggs.
- * To avoid confusion with the XX-XO and XX-XY types of sex determination, the alphabets 'Z' and 'W' are used here instead of X and Y respectively.
- * Heterogametic females are of two types, ZO-ZZ type and ZW-ZZ type.

34) Give an account of genetic control of Rh factor (or) Fisher and Race hypothesis:-

- ⊕ Rh factor involves 3 different pairs of alleles located on 3 different closely linked genes on the chromosome pair.
- ⊕ This system is more commonly in use today, and uses the 'Cde' nomenclature.
- ⊕ The three pairs of Rh alleles (Cc, Dd and Ee) occur at 3 different loci on homozygous chromosome pair-1.
- ⊕ The possible genotypes will be one C or c, one D or d, one E or e from each chromosome.
- ⊕ For e.g. CDE/cde; CdE/cDe; cde/cde; CDe/CdE etc.,
- ⊕ All genotypes carrying a dominant 'D' allele will produce Rh+positive phenotype.
- ⊕ The double recessive genotype 'dd' will give rise to Rh-negative phenotype.



35) Explain the mode of sex determination in honeybees.

- ☞ In honeybees mechanism of sex determination called **haplodiploidy** mechanism.
- ☞ In this system, the sex of the offspring is determined by the number of sets of chromosomes it receives.
- ☞ **Fertilized eggs** develop into **females** (Queen or Worker) and **unfertilized eggs** develop into **males** (drones) by parthenogenesis.
- ☞ It means that the **males** have half the number of chromosomes (**haploid**).
- ☞ The **females** have double the number (**diploid**).
- ☞ Hence the name **haplodiploidy** for this system of sex determination in honey bees.

36) What are the applications of Karyotyping ?

1. It helps in gender (male and female) identification.
2. It is used to detect the chromosomal aberrations like deletion, duplication, translocation, nondisjunction of chromosomes.
3. It helps to identify the abnormalities of chromosomes like aneuploidy.
4. It is also used in predicting the evolutionary relationships between species.
5. Genetic diseases in human beings can be detected by this technique.

37) Explain the inheritance of sex linked characters in human being.

- * Inheritance of traits by genes located in sex chromosomes is called sex linked inheritance.
- * Genes in the differential region of X chromosome are called X linked genes.
- * Genes in the differential region of Y chromosome are called Y linked genes (or) Holandric genes.
- * The Examples for X - linked inheritance are Colour blindness , Haemophilia

ADDITIONAL QUESTION

1. Wiener Hypothesis :-

- ☆ Wiener proposed the existence of eight alleles (R1, R2, R0, Rz, r, r1, r11, ry) at a single Rh locus.
- ☆ All genotypes carrying a dominant 'R allele' (R1, R2, R0, Rz).
- ☆ Will produce Rh+positive phenotype and double recessive genotypes (rr, rr1, rr11, rry) will give rise to Rh-negative phenotype.

2. Kin Selection :-

- ⊙ All other females in honey bees which are diploid having developed from fertilized eggs help to raise the queen's eggs.
- ⊙ So contribute to the queen's (honey bees) reproductive success and indirectly to their own, a phenomenon known as **Kin Selection**.

3. Haemophilia :-

- Haemophilia is commonly known as bleeder's disease, which is more common in men than women.
- This hereditary disease was first reported by John Cotto in 1803.
- Haemophilia is caused by a recessive X-linked gene.
- A person with a recessive gene for haemophilia lacks a normal clotting substance (thromboplastin) in blood, hence minor injuries cause continuous bleeding, leading to death.
- The females are carriers of the disease and would transmit the disease to 50% of their sons even if the male parent is normal.
- Haemophilia follows the characteristic criss - cross pattern of inheritance.

4. Karyotyping – Idiogram :-

- ❖ It is a technique through which a complete set of chromosomes is separated from a cell and the chromosomes are arranged in pairs.
- ❖ The individual chromosomes are cut from the photograph and are arranged in an orderly fashion in homologous pairs. This arrangement is called a **karyotype**.
- ❖ An **Idiogram** refers to a diagrammatic representation of chromosomes.

5. Pedigree analysis :-

- γ Pedigree is a "family tree", drawn with standard genetic symbols, showing the inheritance pathway for specific phenotypic characters.
- γ Pedigree analysis is the study of traits as they have appeared in a given family line for several past generations.

5 : Molecular Genetics

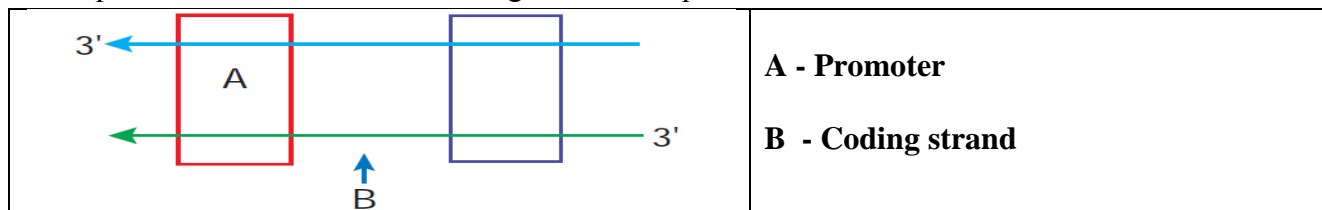
BOOK BACK QUESTION

(Note :- Question no :1– 14 answers are available in your book)

15) Give reasons: Genetic code is ‘universal’:-

- * The genetic code is universal. It means that all known living systems use nucleic acids and the same three base codons (triplet codon) direct the synthesis of protein from amino acids.
- * For example, the mRNA (UUU) codon codes for phenylalanine in all cells of all organisms.

16) Name the parts marked ‘A’ and ‘B’ in the given transcription unit :-



18) Differentiate - Template strand and Coding strand.:-

S.N	Template strand	Coding strand
1.	Template strand is directed in the 5' → 3' direction	Coding strand is directed in the 3' → 5' direction
2.	Transcribed into mRNA	Not transcribed into mRNA
3.	Contains anti codons	Contains codons
4.	Contains the same nucleotide sequence as the rRNA	Contains the complementary nucleotide sequence as the tRNA

19) Mention any two ways in which single nucleotide polymorphism (SNPs) identified in human genome can bring revolutionary change in biological and medical science.?

- * Scientists have identified about 1.4 million locations where single base DNA differences (SNPs – **Single nucleotide polymorphism** – pronounce as ‘snips’) occur in humans.
- * Identification of ‘**SNIPS**’ is helpful in finding chromosomal locations for disease associated sequences and tracing human history.

20) State any three goals of the human genome project.

1. Identify all the genes (approximately 30000) in human DNA.
2. Determine the sequence of the three billion chemical base pairs that makeup the human DNA.
3. To store this information in databases and Improve tools for data analysis.

21) In *E.coli*, three enzymes β - galactosidase, permease and transacetylase are produced in the presence of lactose. Explain why the enzymes are not synthesized in the absence of lactose.

- A **repressor protein** binds to the operator region of the operon and prevents translation, as a result, **β -galactosidase** is not produced.
- In the absence of preferred carbon source such as glucose, if lactose is available as an energy source for the bacteria then lactose enters the cell as a result of **permease** enzyme.
- **Lactose** acts as an inducer and interacts with the repressor to inactivate it.

- The repressor protein binds to the operator of the operon and prevents RNA polymerase from transcribing the operon.
- In the presence of inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer.
- This allows RNA polymerase to bind to the promoter site and transcribe the operon to produce *lac* mRNA which enables formation of all the required enzymes needed for lactose metabolism.

22) Distinguish between structural gene, regulatory gene and operator gene.

1. **Structural genes (z,y,a)** - it has 3 genes namely *lac z,y* and *lac a*. The *lac 'z'* gene codes for β -galactosidase, *lac 'y'* gene codes for permease and '*a*' gene codes for transacetylase.
2. **Regulatory gene (i)** - the '*i*' gene transcribes a repressor mRNA and after its translation, a repressor protein is produced.
3. **Promoter (p)** - In *lac* operon, a polycistronic structural gene is regulated by a common promoter and regulatory gene.
4. **Operator gene (o)** - The repressor protein binds to the operator of the operon and prevents RNA polymerase from transcribing the operon. This allows RNA polymerase to bind to the promoter site and transcribe the operon to produce *lac* mRNA.

23) A low level of expression of *lac* operon occurs at all the windows for treatment of various genetic disorders. Justify the statement. ?

- ◆ Lactose present in the external medium can enter the bacterium only when the bacterium contain the enzyme permease.
- ◆ So, formation of permease require a low level expression of *lac* – operon.

24) HGP is the windows for treatment of various genetic disorders, justify the statement.

- ✱ To examine a persons DNA and to identify genetic abnormalities
- ✱ To diagnose disease and provide genetic counseling
- ✱ To solve challenges in healthcare.

25) Why the human genome project is called a mega project ?.

1. The international human genome project was launched in the year 1990.
2. It was a mega project and took 13 years to complete.
3. The human genome is about 25 times larger than the genome of any organism.
4. Human genome is said to have approximately 3×10^9 bp.

28) What are the three structural differences between RNA and DNA ?

no	DNA	RNA
1.	It is double stranded	It is single stranded
2.	Deoxy ribose sugar is present	Ribose sugar is present
3.	Adenine, guanine, cytosine and thymine	Adenine, guanine, cytosine & Uracil
4.	Chemically & Structurally less stable	Chemically & Structurally more stable

29) Name the anticodon required to recognize the following codons:

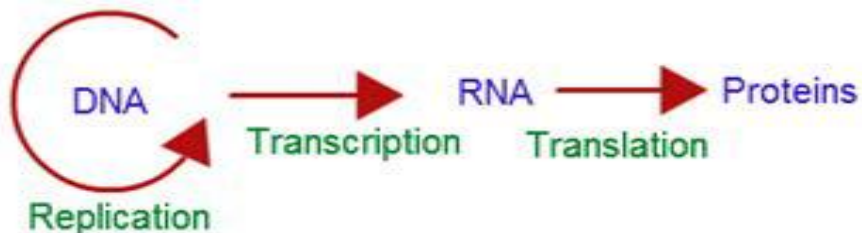
Codons	AAU	CGA	UAU	GCA
Anticodon	UUA	GCU	AUA	CGU

31) If the coding sequence in a transcription unit is written as follows:

The Sequence of DNA : 5' TGC ATG CAT GCA TGC ATG CAT GCA TGC 3'

The sequence of mRNA: 3'ACG UAC GUA CGU ACG UAC GUA CGU ACG 5'

32) How is the two stage process of protein synthesis advantageous?



1. **Transcription** - It is the process of copying genetic information from one strand of DNA into RNA .

This process takes place in presence of DNA dependent RNA polymerase.

2. **Translation** – transcribed mRNA can be translated into Proteins.

33) Why did Hershey and Chase use radioactively labelled phosphorous and sulphur only? Would they have got the same result if they use radiolabelled carbon and nitrogen?

- * All nucleic acids contain phosphorus , but not in protein.
- * All protein contain sulphur but not in nucleic acids.
- * So they designed an experiment using radioactive isotopes of Sulphur (^{35}S) and phosphorus (^{32}P) to keep separate track of the viral protein and nucleic acids during the infection process.
- * They haven't got the same result if they used radio labelled carbon and nitrogen. Because :
- * Carbon is an organic molecules found in all cells.
- * Nitrogen is structural molecules found in proteins, cell membrane and DNA.

34) Explain the formation of a nucleosome :-

- The DNA double helix **length 2.2 m.**, is much more complex.
- Chromatin consists of repeating units called **nucleosomes**.
- Two molecules of the 4 histone proteins H2A, H2B, H3 and H4 are organized to form a unit of 8 molecules called **histone octamere**.
- The negatively charged DNA is wrapped around, the positively charged histone octamere to form a structure called **nucleosome**.
- Nucleosome contains **200 bp** of DNA helix and it is coiled on the outside of nucleosome.
- Adjacent nucleosomes are connected by linker DNA(H1) that is exposed to enzymes.
- The DNA makes 2 complete turns around the histone octameres and the two turns are sealed off by an H1 molecule.
- Chromatin without H1 has a **beads-on-a-string** appearance in which DNA enters and leaves the nucleosomes at random places.
- Further folding is due to interaction between H1 of one nucleosomes. DNA is a **solenoid** and packed about 40 folds.

35) It is established that RNA is the first genetic material. Justify giving reasons.

Ψ A typical cell contains about **10 times** as much RNA as DNA.

Ψ The high RNA play a **variety of roles** in the cell.

Ψ **Fraenkel-Conrat and Singer** (1957) first demonstrated that **RNA** is the genetic material in TMV virus.

- Ψ In the early 1980's (Leslie Orgel, Francis Brick and Carl Woese-3 molecular biologists) proposed the '**RNA world**' as the first stage in the evolution of life. .
- Ψ RNA catalysed all molecules necessary for survival and replication.
- Ψ The term 'RNA world' first used by **Walter Gilbert** in **1986**.
- Ψ There is now enough evidence to suggest that **essential life processes** (such as metabolism, translation, splicing etc.,) evolved around RNA.
- Ψ RNA has the ability to act as **both genetic material and catalyst**.
- Ψ This hypothesizes reveals that RNA as the first genetic material on earth.
- Ψ **Andrew Fire** and **Craig Mellow** (recipients of Nobel Prize in 2006) were of the opinion that RNA is an active ingredient in the chemistry of life.

ADDITIONAL QUESTION

1. **One gene-one enzyme hypothesis** :-

- * **George Beadle & Edward Tatum** in the early 1940's on *Neurospora* led them to proposed this hypothesis.
- * which states that one gene controls the production of one enzyme.

2. **One gene-one polypeptide hypothesis** :-

- It was observed that an enzyme may be composed of more than one polypeptide chain and a gene can code for only one polypeptide chain.
- One gene controls the production of only one polypeptide chain of an enzyme molecule.

3. **Difference between the Euchromatin – Hetero chromatin** :-

No	Euchromatin	Hetero chromatin
1.	In a typical nucleus, some regions of chromatin are loosely packed (lightly stained)	The chromatin that is tightly packed (stained darkly)
2.	Transcriptionally active	Transcriptionally inactive.

4. **What are genetic codon?**

- Ψ The genetic codon is a triplet code and 61 codons code for amino acids.
- Ψ Three codons do not code any amino acid and act as stop codon.

5. **What is operon?**

- * Operon is defined as a cluster of genes with related functions

6. **What are the uses of HGP.**

- 1) To examine a persons DNA and to identify genetic abnormalities
- 2) To diagnose disease and provide genetic counseling
- 3) To solve challenges in healthcare, agriculture, energy and environmental remediation

7. **What are the advantages of DNA finger printing.**

- 1) Forensic analysis: It can be used in identification of a person involved in criminal activities
- 2) Pedigree analysis: Inheritance pattern of genesthro generation and to detect inherited of diseases.
- 3) Conservation of wild life: to protect endangered species.

8. **What is pharmacogenomics?**

- ★ This is a new field which combine pharmacology and genomics.
- ★ This is effective in developing safe medication.

1. The salient features of genetic code :-

- 1) The genetic codon is a **triplet code** and 61 codons code for amino acids and 3 codons do not code for any amino acid and function as **stop codon** (Termination).
- 2) The genetic code is universal. It means that all known living systems use nucleic acids and the same three base codons (triplet codon) direct the synthesis of protein from amino acids.
- 3) A degenerate code means that more than one triplet codon could code for a specific amino acid. For example, codons GUU, GUC, GUA and GUG code for valine.
- 4) Non-ambiguous code means that one codon will code for one amino acid.
- 5) The code is always read in a fixed direction i.e. from 5'→3' direction called polarity.
- 6) AUG has dual functions. It acts as a initiator codon and also codes for the amino acid methionine.
- 7) UAA, UAG (tyrosine) and UGA (tryptophan) codons are designated as termination (stop) codons and also are known as “non-sense” codons.

2. Write about the methodologies of HGP (March -2020)

- 1) Identifying all the genes that are expressed as RNA (**ETSS** – Expressed Sequence Tags).
- 2) The other approach was sequence annotation.
- 3) That contains all the coding and non-coding sequences.
- 4) Later assigning different regions in the sequences with functions.
- 5) The total DNA converted into random fragments of relatively smaller sizes.
- 6) This cloning results in amplification of pieces of DNA fragments.
- 7) Bacteria and yeast are two commonly used hosts and these vectors are called as **BAC** and **YAC**.
- 8) The fragments are sequenced using automated **DNA sequencers**.
- 9) The genetic and physical maps on the genome are restriction endonuclease and **microsatellites**.
- 10) The latest method of sequencing even longer fragments is by a method called **Shotgun sequencing**.

3. What are Operons ? How many operon groups are present in E.coli ? (March -2020)

- ✪ The clusters of gene with related functions are called operons.
- ✪ 75 different operons present in E.coli.

-: GOD GRACE :-

6 : EVOLUTION

BOOK BACK QUESTION

(Note :- Question no :1– 16 answers are available in your book)

17. List out the major gases seems to be found in the primitive earth.

- * Ammonia, methane, hydrogen and water vapour.
- * The atmosphere was oxygen free and the combination of CO₂, NH₃.

20. How does Hardy-Weinberg's expression ($p^2+2pq+q^2=1$) explain that genetic equilibrium is maintained in a population? List any four factors that can disturb the genetic equilibrium.

- ★ The allele frequencies in a population are stable and are constant from generation to generation in the absence of gene flow, genetic drift, mutation recombination and natural selection.
- ★ Evolution is a change in the allele frequencies in a population over time. Hence population in hardy Weinberg is not evolving
- ★ Explain the equilibrium :-
 - ☞ A large population of beetles appear in two colours dark grey(black) and light grey and their colour is determined by 'A' gene 'AA' and 'Aa' beetles are light grey.
 - ☞ 'A' allele has frequency (P) of 0.3 and 'a' allele has a frequency (q) of 0.7 Then $p + q = 1$
 - ☞ If a population is in hardy Weinberg equilibrium, the genotype frequency can be estimated by hardy wein berg equation
$$(P + q)^2 = P^2 + 2 pq + q^2 \quad (P=0.3, q = 0.7)$$
$$P^2 = (0.3)^2 = 0.09 \quad = 9\% \text{ AA}$$
$$2pq = 2 (0.3) (0.7) = 0.42 = 42\% \text{ Aa}$$
$$q^2 = (0.7)^2 = 0.49 \quad = 49\% \text{ aa}$$
- ★ Hence the beetle population appears to be in Hardy Weinberg equilibrium,. Factors effecting the Hardy Weinberg law : 1).Gene flow. 2).Mutation. 3).Crossing over. and 4). Natural selection.

21. Explain how mutations, natural selection and genetic drift affect Hardy Weinberg equilibrium.

- 1) **No mutation** – No new alleles are generated by mutation nor the genes get duplicated or deleted.
- 2) **Random mating** – Every organism gets a chance to mate and the mating is random with each other with no preferences for a particular genotype.
- 3) **No gene flow** - Neither individuals nor their gametes enter or exit the population.
- 4) **Very large population size** - The population should be infinite in size.
- 5) **No natural selection**- All alleles are fit to survive and reproduce.
- 6) If any one of these assumptions were not met, the population will not be in Hardy- Weinberg equilibrium.
- 7) Only if the allele frequencies changes from one generation to the other, evolution will take place.

22. How did Darwin explain fitness of organisms?

- ⊖ He noted a huge variety and remarkable similarities among organisms and their **adaptive features** to cope up to their environment.
- ⊖ He proved that **fittest organisms** can survive and leave more progenies than the unfit ones through natural selection. For example :Industrial (in England) **melanism** is a classical case of Natural selection exhibited by the peppered moth.

23. Mention the main objections to Darwinism.

- 1) Darwin failed to explain the mechanism of **variation**.
- 2) Darwinism explains the **survival of the fittest** but not the arrival of the fittest.
- 3) He focused on small fluctuating variations that are mostly **non-heritable**.
- 4) He did not distinguish between **somatic** and **germinal variations**.
- 5) He could not explain the occurrence of **vestigial organs**, over specialization of some organs like large tusks in extinct mammoths, oversized antlers in the extinct Irish deer, etc.,

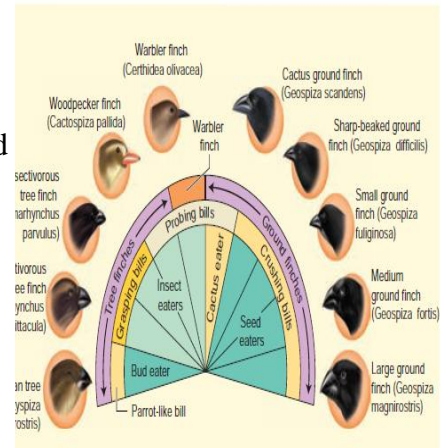
24. Taking the example of Peppered moth, explain the action of natural selection. What do you call the above phenomenon?

- ☛ Industrial **melanism** is a classical case of Natural selection exhibited by the **moth, *Biston betularia***.
- ☛ These were available in two colours, **white** and **black**.
- ☛ Before industrialization peppered moth both white and black coloured were common in England.
- ☛ **Pre-industrialization** witnessed white coloured background of the wall of the buildings hence the white coloured moths escaped from their predators.
- ☛ **Post industrialization**, the tree trunks became dark due to smoke and soot let out from the industries.
- ☛ The black moths camouflaged on the dark bark of the trees and the white moths were easily identified by their predators.
- ☛ Hence the **dark coloured moth population was selected** and their number increased when compared to the white moths.
- ☛ Nature offered positive selection pressure to the black coloured moths.
- ☛ Organisms that can adapt will survive and produce more progenies resulting in **increase in population** through **natural selection**.

25. Darwin's finches and Australian marsupials are suitable examples of adaptive radiation – Justify the statement.

1. Darwin finches :-

- ☛ Their common ancestor arrived on the Galapagos about 2 million years ago.
- ☛ During that time, Darwin's finches have evolved into 14 recognized species differing in body size, beak shape and feeding behavior.
- ☛ Changes in the size and form of the beak have enabled different species to utilize different food resources such as insects, seeds, nectar from cactus flowers and blood from iguanas, all driven by Natural selection.
- ☛ Genetic variation in the ALX1 gene in the DNA of Darwin finches is associated with variation in the beak shape.



1. Marsupials :-

- ☛ Marsupials in Australia and placental mammals in North America are separated from the common ancestor more than 100 million year ago and each lineage continued to evolve independently.
- ☛ Despite temporal and geographical separation, marsupials in Australia and placental mammals in North America have produced varieties of species living in similar habitats with similar ways of life.
- ☛ Their overall resemblance in shape, locomotory mode, feeding and foraging are superimposed upon different modes of reproduction.
- ☛ This feature reflects their distinctive evolutionary relationships.
- ☛ Over 200 species of marsupials live in Australia along with many fewer species of placental mammals. Just as the placental mammals have radiated across North America.

26. Who disproved Lamarck's Theory of acquired characters ? How ?

- † Lamarck's "Theory of Acquired characters" was disproved by **August Weismann**.
- † Who conducted experiments on mice for 20 generations by **cutting their tails** and breeding them. All mice born were **with tail**.
- † Weismann proved that change in the somatoplasm will not be transferred to the next generation but changes in the **germplasm will be inherited**.

27. How does Mutation theory of De Vries differ from Lamarck and Darwin's view in the origin of new species.

- * **Hugo de Vries** proposed by Mutation theory are " sudden random changes that occur in an organism that is not heritable".
- * His experiments in the Evening Primrose(*O. lamarckiana*)and observed variations in them due to mutation.
- * According to de Vries, sudden and **large variations** were responsible for the origin of new species.
- * Whereas Lamarck and Darwin believed in gradual accumulation of all variations as the causative factors in the origin of new species.

ADDITIONAL QUESTIONS

1. Big bang theory :-

- * Theory explains origin of universe as a singular huge explosion in physical terms.
- * The primitive earth consist of ammonia, methane, hydrogen and water vapour.
- * UV rays from the sun split up water molecules into hydrogen and oxygen.
- * When temperature cooled and the water vapour condensed to form rain.
- * Ammonia, methane in the atmosphere combined with oxygen to form carbon-dioxide and other gases

2. Vestigial organs :-

- Structures that are of no use to the possessor, and are not necessary for their existence are called vestigial organs.
- These organs are included coccyx, wisdom teeth, ear muscles, body hair, mammae in male, nictitating membrane of the eye.

3. Gene flow:-

Movement of genes through gamets or movements of individuals in and out of a population is referred to as gene flow.

4. Mutation :-

Mutation is the original source of all genetic variation. Mutation rare for most organisms is low. Hence new mutations on an allele frequencies from one generation to the next is usually not large.

5. What are coacervates?

Coacervates are the first pre-cells which gradually transformed into living cells, according to theory of chemical evolution.

6. Connecting link

- ✂ The organisms which possess the characters of two different groups are called connecting links.
- ✂ Example 1. *Peripatus* (Annelida and Arthropoda), 2. *Archeopteryx* (Reptiles and Aves).

7. What is Atavistic organs?

Sudden appearance of vestigial organs in highly evolved organisms is called atavistic organs.

E.g. Presence of tail in a human baby is an atavistic organ.

1. Lamarck's theory :-

† **Jean Baptiste de Lamarck**, was the first to postulate the theory of evolution in his famous book 'Philosophie Zoologique' in the year 1809. The 2 principles of Lamarckian theory are:

- I. **The theory of use and disuse** - Organisms that are used often will increase in size and those that are not used will degenerate. Neck in giraffe is an example of use and absence of limbs in snakes.
- II. **The theory of inheritance of acquired characters** - Characters that are developed during the life time of an organism are called acquired characters and these are then inherited.

2. Modern synthetic theory :-

† **Sewall Wright, Fisher, Mayer, Huxley, Dobzhansky, Simpson and Haeckel** explained Natural Selection.

- 1) **Gene mutation** - refers to the changes in the structure of the gene. It is also called gene/ point mutation. It alters the phenotype of an organism and produces variations in their offspring.
- 2) **Chromosomal mutation** - refers to the changes in the structure of chromosomes due to deletion, addition, duplication, inversion or translocation. This too alters the phenotype of an organism and produces variations in their offspring.
- 3) **Genetic recombination** - is due to crossing over of genes during meiosis. This brings about genetic variations in the individuals of the same species and leads to heritable variations.
- 4) **Natural selection** - does not produce any genetic variations but once such variations occur it favours some genetic changes while rejecting others.
- 5) **Reproductive isolation** - helps in preventing interbreeding between related organisms.

3. Darwin's theory of Natural Selection :-

- 1) **Over production (or) prodigality of production** - All living organisms increase their population in larger number. For example, Salmon fish produces about 28 million eggs during breeding season
- 2) **Struggle for existence** - Organisms struggle for food, space and mate. As these become a limiting factor, competition exists among the members of the population.
- 3) **Universal occurrence of variations** - No two individuals are alike. There are variations even in identical twins. The useful variations struggle and such variations are passed on to the next generation.
- 4) **Origin of species by Natural Selection** - According to Darwin, nature is the most powerful selective force. He compared origin of species by natural selection to a small isolated group. Darwin believed that the struggle for existence resulted in the survival of the fittest. Such organisms become better adapted to the changed environment.

-: GOD GRACE :-