BEACON OF LIGHT

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Under the Guidance of

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CLASS XII

BIOLOGY

2020-21

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CLASS XII (2020 - 21) BIOLOGY(THEORY)

Time:3 Hours **Max. Marks:70**

Unit	Title	Marks
VI	Reproduction	14
VII	Genetics and Evolution	18
VIII	Biology and Human Welfare	14
IX	Biotechnology and its Applications	12
X	Ecology and Environment	12
	Total	**70**

Unit-VIREVISED SYLLABUS OF CLASS XII FOR 2020-21
BIOLOGY

Unit-VI Reproduction

Chapter-2: Sexual Reproduction in Flowering Plants
Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; outbreeding devices; pollen-pistil interaction; double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes- apomixis, parthenocarpy, polyembryony; Significance of seed dispersal and fruit formation.

Chapter-3: Human Reproduction
Male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis - spermatogenesis and oogenesis; menstrual cycle; fertilisation, embryo development upto blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

Chapter-4: Reproductive Health
Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); birth control - need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies - IVF, ZIFT, GIFT (elementary idea for general awareness).

Unit-VII Genetics and Evolution

Chapter-5: Principles of Inheritance and Variation
Heredity and variation: Mendelian inheritance; deviations from Mendelism – incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosome theory of inheritance; chromosomes and genes; Sex determination - in human being, birds and honey bee; linkage and crossing over; sex linked inheritance - haemophilia, colour blindness; Mendelian disorders in humans -thalassemia; chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Chapter-6: Molecular Basis of Inheritance
Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central Dogma; transcription, genetic code, translation; gene expression and regulation - lac operon; Genome, Human and rice genome projects; DNA fingerprinting.

Unit-VIII Biology and Human Welfare

Chapter-8: Human Health and Diseases
Pathogens; parasites causing human diseases (malaria, dengue, chikungunya, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Chapter-10: Microbes in Human Welfare
Microbes in food processing, industrial production, sewage treatment, energy generation and microbes as bio-control agents and bio-fertilizers. Antibiotics; production and judicious use.

Unit-IX Biotechnology and its Applications

Chapter-11: Biotechnology - Principles and Processes
Genetic Engineering (Recombinant DNA Technology).

Chapter-12: Biotechnology and its Application
Application of biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, biopiracy and patents.

Unit-X Ecology and Environment

Chapter-13: Organisms and Populations
Organisms and environment: Habitat and niche, population and ecological adaptations; population interactions - mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution.

Chapter-15: Biodiversity and its Conservation
Biodiversity - Concept, patterns, importance; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, Sacred Groves, biosphere reserves, national parks, wildlife, sanctuaries and Ramsar sites.

Deleted Portions of Class XII BIOLOGY for 2020-21

Unit Unit-VI Reproduction

Chapter-1: Reproduction in Organism
Reproduction, a characteristic feature of all organisms for continuation of species; modes of reproduction - asexual and sexual reproduction; asexual reproduction - binary fission, sporulation, budding, gemmule formation, fragmentation; vegetative propagation in plants.

Unit-VII Genetics and Evolution

Chapter-7: Evolution
Origin of life; biological evolution and evidences for biological evolution (palaeontology, comparative anatomy, embryology and molecular evidences); Darwin's contribution, modern synthetic theory of evolution; mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection; Gene flow and genetic drift; Hardy – Weinberg's principle; adaptive radiation; human evolution.

Unit-VIII Biology and Human Welfare

Chapter 9: Strategies for Enhancement in Food Production
Animal husbandry, Plant breeding, tissue culture, single cell protein.

Unit-X Ecology and Environment

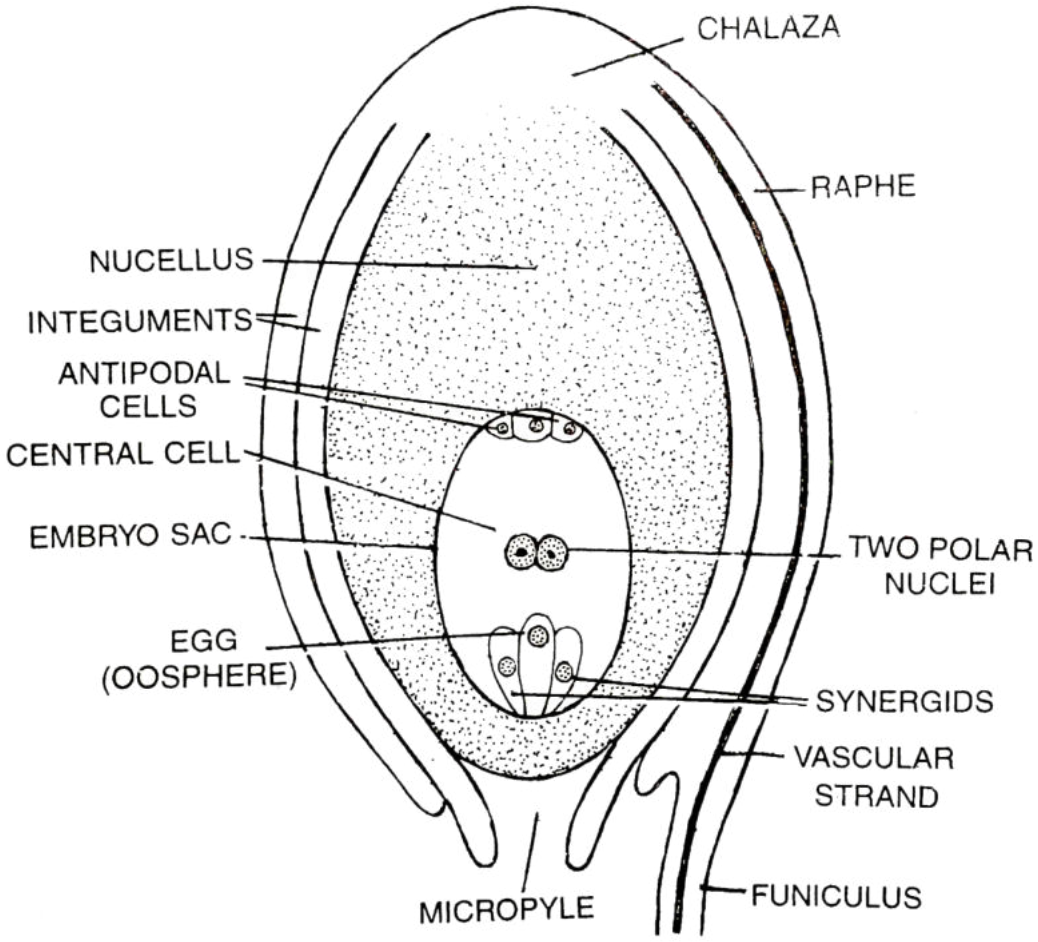
Chapter-14: Ecosystem
Ecosystems: Patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy; nutrient cycles (carbon and phosphorous); ecological succession; ecological services - carbon fixation, pollination, seed dispersal, oxygen release (in brief).

Chapter 16: Environmental Issues
Air pollution and its control; water pollution and its control; agrochemicals and their effects; solid waste management; radioactive waste management; greenhouse effect and climate change impact and mitigation; ozone layer depletion; deforestation; exemplifying case study as success story addressing environmental issue(s).

CH 2— Sexual Reproduction in Flowering Plants

Revised Syllabus: Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; outbreeding devices; pollen-pistil interaction; double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes- apomixis, parthenocarpy, polyembryony; Significance of seed dispersal and fruit formation.

1.ANATROPOUS OVULE



2.OUTBREEDING DEVICES

- Continued self-pollination result in inbreeding depression.
- As majority of the flowers are bisexual, there is a need for the plants to develop methods by which it can prevents self-pollination and promote cross pollination.
- The outbreeding devices enables them to achieve it.
    - Pollen release and stigma receptivity are not synchronized,
    - Different position of the stigma and the anther so that the pollen grains do not come in contact with the stigma
    - Self-incompatibility: genetic mechanism that prevents the self-pollen from pollen germination or pollen tube growth.
    - Production of unisexual flowers.

- In case of monecious plants (maize, castor) where both the male and female flowers are present on the same plant – it prevents autogamy but not geitonogamy.

3.APOMIXIS AND POLYEMBRYONY

- It is a form of asexual reproduction that mimics sexual reproduction.
- Process of production of seeds without fertilization.
- Example- Some species of Asteraceae and grasses.
- Method-1:
    - Diploid egg cell is produced without reduction division and it develops onto embryo without fertilization.
- Method-2:
    - Nucellar cells surrounding the embryo sac starts dividing, protrudes into the embryo sac and develops into embryo. (Citrus, Mango)
    - Such cases each ovule have more than one embryo – **POLYEMBRYONY**

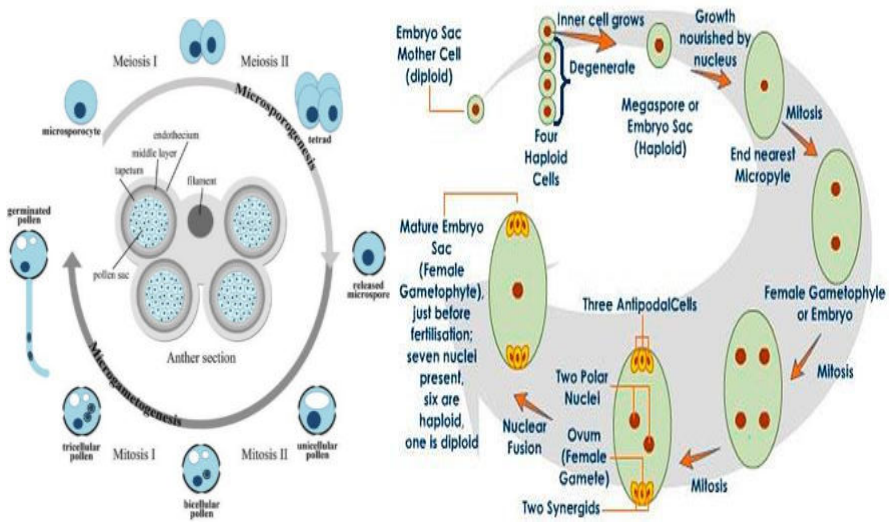
4.SPOROGENESIS- MICRO AND MEGA

Ø Microsporogenesis

- Each of the cell of the sporogenous tissue acts as the pollen mother cell (PMC) or microspore mother cell.
- The process of formation of microspore from PMC is called microsporogenesis.
- The PMC undergoes meiotic cell division to form microspore tetrads (haploid cells arranged in cluster of 4 cells).
- The microspores dissociate from each other and give rise to the pollen grain as the anther matures and dehydrates

Ø Megasporogenesis

- The process of formation of the megaspore from the megaspore mother cell is called megasporogenesis.
- A single megaspore mother cell (MMC) is formed in the micropylar region of the nucellus of the megasporangium (ovule).
- The MMC undergoes meiotic cell division resulting in 4 megaspores.



5.Pollen-Pistil interaction

- All the events–from pollen deposition on the stigma until pollen tubes enter the ovule–are together referred to as pollen-pistil interaction.
- Pollination might lead to the deposition of pollen grains of various plant species.
- The process of pollination does not guarantee fertilization.
- Only if the right type of pollen (compatible pollen grain of the same species) is landing on the stigma, it might lead to fertilization.
- If the pollen grain is the right type (compatible) then the post-pollination events continues leading to fertilization.
- If the pollen grain is wrong type (incompatible) the pistil rejects it.
- An incompatible pollen is rejected by:
    - Prevention of pollen germination
    - Prevention of pollen tube growth
- The decision of compatible and non-compatible pollen is due to the continuous chemical talk between the pollen grain and the pistil.
- Pollen germination:
    - Compatible pollen grain germinates to form pollen tube through germ pore.
    - The content of the pollen grain moves into the pollen tube.
- Pollen tube travels through the style and reaches the ovary.
- It enters the ovule through the micropyle and then enters one of the synergids through the filiform apparatus.
- The filiform apparatus guides the entry of the pollen tube.

6. DOUBLE FERTILIZATION and TRIPLE FUSION

- The pollen tube releases two male gametes to the cytoplasm of the synergids.
- One male gamete fuse with the nucleus of the egg forming a diploid cell called zygote.
    - This fertilization event is called syngamy.
- The remaining male gamete fuse with the two polar nuclei of the central cell and produces primary endosperm nucleus (PEN) that is triploid in nature.
    - This fertilization event is called triple fusion as it involves the fusion of 3 haploid nuclei.
- As there are two fertilization events taking place at the same time in the embryo sac, this phenomenon is called double fertilization.
    - This event is unique to the angiospermic plants.
- Fate of double fertilization:

- The central cell after triple fusion becomes Primary endosperm cell and develops into Endosperm.
- The zygote divides and develops into the embryo.

CH 3—Human Reproduction

Revised Syllabus: Male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis - spermatogenesis and oogenesis; menstrual cycle; fertilisation, embryo development upto blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

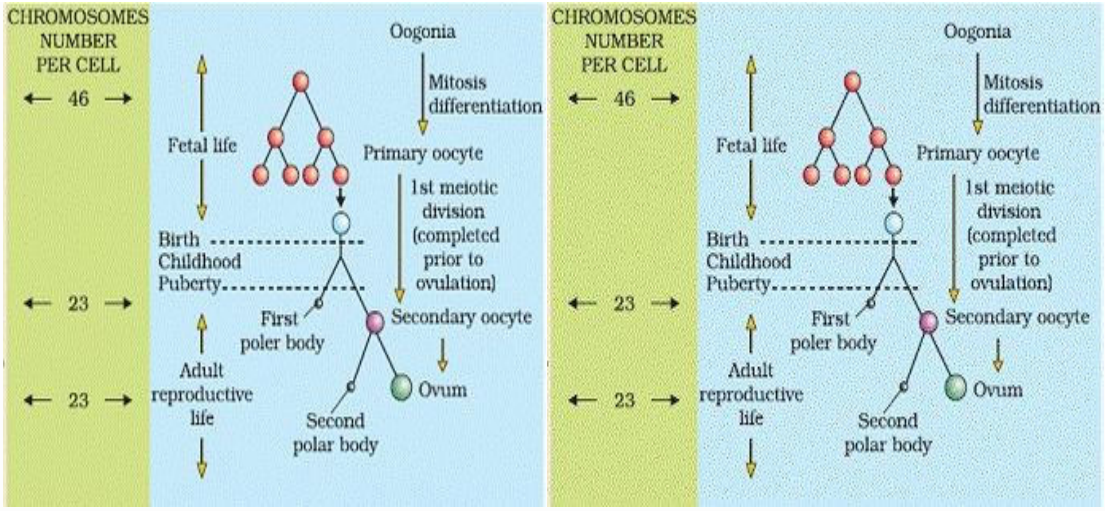
1.Gametogenesis-spermatogenesis and oogenesis

Spermatogenesis- in testes immature, male germ cells (spermatogonia) produce sperm by spermatogenesis that begin at puberty.

- The spermatogonia present at the inner side of seminiferous tubules multiply by mitotic division and increase in number. Each spematogonium contain 46 chromosomes.
- Spermatogonia forms spermatocyte that undergo meiotic division to reproduce secondary spermatocytes having 23 chromosomes.
- The spermatids are transformed into spermatozoa by the process called **spermiogenesis**. The sperm heads remain embedded in sertoli cells and are released from seminiferous tubules by the process of **spermiation.**

Oogenesis : The process of formation of mature female gametes is called oogenesis. It started during embryonic development stage when millions of ogonia (gamete mother cells) are formed in each fetal ovary.

- The gametes mother cells start division and enter into prophase-I of meiotic division and get temporally arrested at that stage called **primary oocytes**.
- Each primary oocyteget surrounded by a layer of granulosa cell than it is called the **primary follicle**.
- At puberty, about 60,000- 80,000 primary follicles are left in each ovary.



2. Menstrual cycle

Menstrual cycle: The reproductive cycles in female primates is called menstrual cycle. It start at puberty and is called **menarche**.

Phases of Menstrual Cycle

The menstrual cycle consists of following four phases:

(1) **Menstrual Phase:**

(i) In a 28 days menstrual cycle, the menses takes place on cycle days 3-5. (ii) The production of LH from the anterior lobe of the pituitary gland is reduced. (iii) The withdrawal of this hormone causes degeneration of the corpus luteum and, therefore progestrone production is reduced. (iv) Production of oestrogen is also reduced in this phase. (v) The endometrium of uterus breaks down & menstruation begins. (vi) The cells of endometrium secretions, blood & unfertilised ovum constitutes the menstrual flow.

(2) **Follicular Phase:**

(i) This phase usually includes cycle days 6-13 or 14 in a 28 days cycle. (ii) The follicle stimulating hormone (FSH) secreted by the anterior lobe of the pituitary gland stimulates the ovarian follicle to secrete oestrogens. (iii) Oestrogen stimulates the proliferation of the endometrium of the uterine wall. (iv) The endometrium becomes thicker by rapid cell multiplication and this is accompanied by an increase in uterine glands & blood vessels.

(3) **Ovulatory Phase:**

(i) Both LH & FSH attain a peak level in the middle of cycle (about 14^{th} day).
(ii) Oestrogen concentration in blood increases. (iii) Rapid secretion of LH induces rupturing of graffian follicle and thereby the release of ovum.
(iv) In fact LH causes ovulation.

(4) **Luteal Phase:**

(i) Includes cycle days 15 to 28. (ii) Corpus luteum secretes progestrone. (iii) Endometrium thickens.

3.Graphical/Diagrammatic representation of menstrual cycle

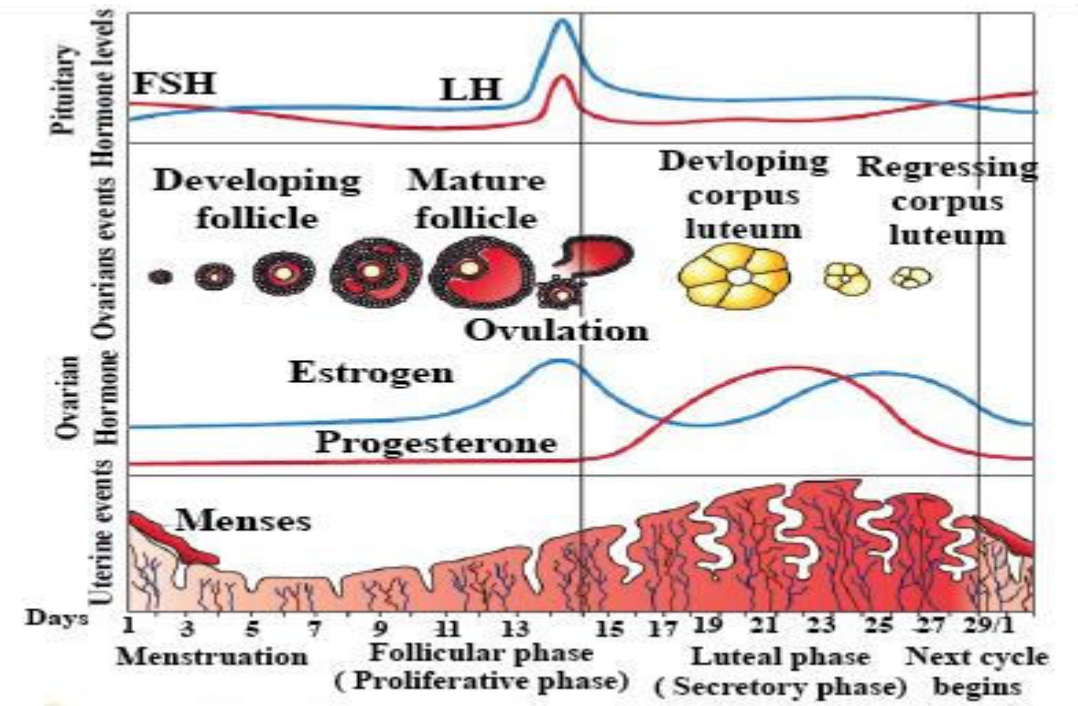


Figure 3.9 Diagrammatic presentation of various events during a menstrual cycle

4.Hormonal control during menstrual cycle

Hormonal Control of MC

(i) FSH stimulates the ovarian follicles to produce oestrogens. (ii) LH stimulates corpus luteum to secrete progestrone. (iii) Menstrual phase is caused by the increased production of oestrogens. (iv) LH causes ovulation (v) Proliferative phase is caused by the increased production of oestrogens. (vi) Secretory phase is caused by increased production of progestrone.

5.Development of Embryo in human

- The haploid gametes fuse together to form diploid zygote. As the zygote moves towards the uterus, the mitotic division starts and form cleavage to change into 2, 4,8,16 celled blastomeres.
- The blastomeres with 8 to 16 cells are called morula. Morula divide to change into blastocysts .The blastomeres in the blastocyst are arranged into an outer layer called **trophoblast** and an inner group of cells attached to trophoblast called the **inner cell mass**. The outer layer of blastocyst is called trophoblast that attach with endometrium of uterus, called **implantation** that leads to pregnancy.

CH 4—Reproductive Health

Revised Syllabus: Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); birth control - need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies - IVF, ZIFT, GIFT (elementary idea for general awareness).

1. BARRIER METHODS-IUTs- Intra Uterine Devices etc.

Barrier methods- here, barriers are used to prevent the physical contact of sperms and ovum.
Condoms-

1. The barriers which are made of thin rubber latex sheath to cover the penis or vagina in males and females respectively are called condoms.
2. Also prevent the spread of sexually transmitted diseases
    - Condoms trap the ejaculate and prevent semen from entering the vagina

Example**- Nirodh,** is a popular brand of condoms for males.
Diaphragms, cervical caps and vaults- made up of rubber which are inserted in female reproductive tract to cover the cervix during coitus to prevent conception by blocking the entry of sperms through the cervix.

Intra uterine devices-

- Inserted by doctors in the uterus through the vagina which increases the phagocytosis of sperms within the uterus.
- These are available as non-medicated IUDs such as **CuT, Cu7, multiload 375** and hormone releasing IUDs such as **LNG-20, Progestasert.**

Oral contraceptive pills-

- Small doses of progesterone or **progesterone- estrogen** combinations are used by the females in the form of tablets.
- These are taken daily for 21 days starting from the fifth day of menstrual cycle and after a gap of 7 days it has to be repeated again.
- Hormonal pills prevent ovulation and implantation by inhibiting the secretions of FSH and LH from the pituitary glands.
- **Saheli**, an oral contraceptive pill is a non- steroid preparation used by females.

Injections of hormones-

- **Progesterone** along with other **estrogen** are used by females as injections under the skin,
- The effective period is longer than pills but action is similar.

2. INFERTILITY and ART- Assisted Reproductive Technology

INFERTILITY
Inability to give birth to a child or inability to conceive is called infertility.

The reasons for infertility can be physical, hereditary, drugs, psychological etc.

The couples could be assisted to have their own child through certain special techniques called as **assisted reproductive technologies.**
Assisted reproductive technologies-

1. In vitro fertilization (IVF)-

- IVF involves fertilization of ovum outside the body followed by embryo transfer (EF).
- Ova from the wife/donor female and sperms from the husband/donor male are collected and are induced to get fuse to form zygote in the laboratory.
- The zygote is then transferred into the fallopian tube called as **zygote intra-fallopian transfer (ZIFT).**

- If the embryo is with more than 8 blastomeres, it is transferred into the uterus called as **intra uterine transfer (IUT).**
- The transferred embryo completes their further development within the uterus.


Fig. embryo formed by IVF Fig. injection of sperm into ovum

2. Gamete intra fallopian transfer (GIFT)- Here, ovum is collected from a donor female and is transferred into the fallopian tube of another female who cannot produce ovum, but can provide suitable environment for fertilization and further development of embryo.

3. Intra cytoplasmic sperm injection (ICSI)- In this method, sperm is directly injected into the ovum under lab conditions.

4. Artificial insemination or intra uterine insemination - Here the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus of the female

IMPORTANT QUESTIONS :

• CH-2 Sexual reproduction in Flowering plants:

1. State two advantages of an apomictic seed to a farmer.
2. 2.Explain three different modes of pollination that can occur in a chasmogamous flower.
3. 3.What is cleistogamy? Write one advantage and one disadvantage of it, to the plant.
4. 4.Draw an L.S. of pistil showing pollen tube entering into the embryo sack. Label the following:

a) Nucellus
b) Antipodals
c) Synergids
d) Micropyle

5. Write the functions of the following
    a) Synergids
    b) Micropyle
6. What are the constituents of an egg apparatus in the mature embryo sac of an angiosperm ?
7. Name the innermost layer of Microsporangium.
8. Which material constitutes the hard outer layer of pollen grain called exine ?
9. Enlist the outbreeding devices in flowering plants.
10. What is sporopollenin ?
11. Differentiate between monocarpellary and multicarpellary gynoecium.
12. How is the pericarp different from the perisperm ?
13. Differentiate between microsporogenesis and megasporogenesis. Which type of cell division occurs during these events ? Name the structures formed at the end of these events.
14. What is triple fusion ? Where and hoe does it takes place ? Name the nuclei involved in it.
15. What is self- incompatibility? Why does self pollination not lead to seed formation in self-incompatible species ?
16. With a neat, labelled diagram , describe the parts of a typical angiosperm ovule .
17. With a neat diagram, explain the 7-celled, 8-nucleate nature of the female gametophyte.
18. Directions: In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (c) If Assertion is true but Reason is false. (d) If both Assertion and Reason are false.
    1. Assertion : Autogamy is a transfer of pollen grains from an anther to the stigma of the same flower on the same plant.
       Reason : Xenogamy is pollination between two flowers on different plants.

2. Assertion : Pollen mother cells (PMCs) are the first male gametophytic cells.
   Reason : Each PMC gives rise to two pollens
3. Assertion: Hydrophily is a major mode of pollination in most of the aquatic plants in angiosperms.
   Reason: Almost all the aquatic dicot and monocot plants require water for the transport of male gametes and for fertilisation.
4. Assertion : Double fertilization is characteristic feature of angiosperms.
   Reason : Double fertilization involves two fusions.
5. Assertion : Endosperm is a nutritive tissue and it is triploid.
   Reason : Endosperm is formed by fusion of secondary nucleus to second male
6. gamete. It is used by developing embryo.

CH-3: Human reproduction

Q.1. State the significance of the following stages during the lifetime of a female.

1. Menarche
2. Menopause

Q.2.a. How many spermatozoa does one secondary spermatocyte produce?

b. Where in zygote does the first cleavage division occur?

Q.3. Why does corpus luteum stay active throughout pregnancy and in the absence of fertilization, is active only for 10-12 days?

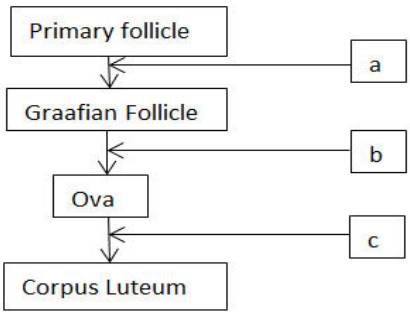
Q.4. What is foetal ejection reflex? How does it cause parturition?

Q.5. What are the functions of placenta other than its endocrine function?

Q.6. Why is breastfeeding recommended during the initial stages of infant growth?

Q.7. What are the different stages of the follicular phase of the menstrual cycle taking place in ovary and uterus?

Q.8. Mention the names of the hormones responsible for ovarian changes during the menstrual cycle in the boxes provided.



Q.9. Draw a schematic diagram depicting oogenesis. (Label without description)

Q.10. Mention the changes taking place during the transition of a primary follicle to Graafian follicle in the oogonia.

Q.11. Explain the role of pituitary gonadotropins during the follicular and ovulatory phases of the menstrual cycle. Describe the shifts in steroidal secretions.

Q.12. Explain in detail the difference between the meiotic division of oogenesis and spermatogenesis.

Q.13. Explain in detail the various developmental stages of the zygote until implantation with suitable diagrams.

Q.14. With the help of a neat labelled diagram of the female reproductive system, depict the following sites:

(a)production of gamete
(b)site of fertilization
(c)site of implantation
(d)birth canal

Q.15. What is the female reproductive system?

.Q.16What is Menopause?

Q.17. What is the menstrual cycle? Name the Hormones, which controls the menstrual menstrual cycle.

Q18. Directions: In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (c) If Assertion is true but Reason is false. (d) If both Assertion and Reason are false.

1. Assertion : In human male, testes are extraabdominal and lie in scrotal sacs. Reason : Scrotum acts as thermoregulator and keeps testicular temperature lower by 2°C for normal spermatogenesis.
2. Assertion: Spermatogenesis starts at the age of puberty. Reason: There is a siginificant increase in level of gonadotropin releasing hormone at puberty.
3. Assertion: The sperm head contains a cap-like structure called acrosome. Reason: Acrosome is filled with enzymes that help in fertilisation of the ovum.
4. Assertion: Production of FSH increases, while that of LH decreases in the ovulation phase. Reason: Due to decrease in the level of LH, ovulation (releasing of ova) takes place.
5. Assertion: Twins may arise from a single egg or from two eggs. Reason: One egg gives rise to identical twins by separation of blastomeres and two eggs produce non-identical twins.

CH-4: Reproductive Health

1. What is the main objective of “Assisted Reproductive Technology” programme?
2. How does the estrogen-progesterone combination act as a contraceptive measure?
3. .What is Amniocentesis Test?
4. .What are the common health issues associated with reproductive health?
5. Why are non-medicated methods not as effective as the copper ions releasing Intra-Uterine Devices?

6. Explain in-vitro fertilization and embryo transfer in brief.
7. Describe any three assisted reproductive techniques practised to treat infertility.
8. Directions: In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (c) If Assertion is true but Reason is false. (d) If both Assertion and Reason are false.
    1. Assertion: A wide range of contraceptive methods are available for family planning. Reason: Natural method includes condoms, diaphragms, etc., while barrier methods use of included method like periodic abstinence, lactational amenorrhea, etc.
    2. Assertion: Artificial insemination is method of introduction of semen inside the female. Reason: This technique is used in those cases where males have low sperm count.
    3. . Assertion: A small part of the vas deferens is removed or tied up in vasectomy. Reason: In tubectomy, a small part of the fallopian tube is removed or tied up.
    4. Assertion: In barrier methods, ovum and sperms are prevented from physical meetings. Reason: Barriers, methods are used during coitus, to prevent the entry of ejaculated semen into the female reproductive tract.
    5. Assertion: Intra cytoplasmic sperm injection (ICSI) is a procedure to form an embryo in vitro. Reason: Sperm is directly injected into the ovum.

Chapter-5: PRINCIPLES OF INHERITANCE AND VARIATION

Revised Syllabus: Heredity and variation- Mendelian inheritance; deviations from Mendelism – incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosome theory of inheritance; chromosomes and genes; Sex determination - in human being, birds and honey bee; linkage and crossing over; sex linked inheritance - haemophilia, colour blindness; Mendelian disorders in humans -thalassemia; chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Inheritance : Transmission of characters from parents to offsprings.

Variation: Difference between individuals.

Genes: Units of inheritance located on the chromosomes.

Alleles: Alternative forms of a gene.

Dominant allele : An allele that is always expressed when present, regardless of whether the organism is homozygous or heterozygous for that gene.

Recessive allele : The factor that is not able to express itself in presence of dominant gene.

Haploid -The condition of having only one set of chromosomes per cell (n)

Diploid -The condition of having two sets of chromosomes per cell (2n)

Genotype - The genetic make-up of an individual.

Phenotype - The physical or chemical expression of genes.

Chromatin - The complex of DNA, RNA and proteins that makes up uncondensed eukaryotic chromosomes.

Chromosome - Structures within the nucleus of eukaryotic cells composed of chromatin and visible at cell division
Homologous chromosomes - chromosomes that are similar in morphology (shape and form) and genetic constitution. In animals one set comes from the father and the other from the mother.

Non disjunction -Failure of pairs of homologous chromosomesor sister chromatids to separate during meiosis or mitosis.

Punnett square : A graphical representation to calculate the probability of all possible genotypes of offsprings in a genetic cross.

Homozygous - possessing a pair of identical alleles for a particular locus (gene) {TT/tt}.

Heterozygous - possessing a pair of unlike alleles for a particular locus (gene){Tt}

Carrier - A heterozygous individual not expressing a recessive trait but capable of passing it on to its offspring.

Monohybrid cross -Study of inheritance of one character at a time.

Dihybrid cross - Study of inheritance of two characters at a timea genetic cross that takes into account the effect of alleles at two separate loci (two different genes). E.g. Cross between pea plants having yellow wrinkled seeds with another plant having green smooth seeds.

Back Cross: when a F1 individual is crossed with a parent.

Test Cross : Type of back cross where a F1 individual is crossed with a homozygous recessive parent.

It can be used as a tool to find out the genotype of an organism with dominant phenotype i.e. whether it is homozygous or heterozygous.

Problem: Black coat/fur colour in dogs is dominant over white coat colour. A dog having black coat may be homozygous(BB) or heterozygous(Bb). How will you find its genotype?

Solution: Dog with black coat colour (i.e. whose genotype is unknown) will be allowed to mate with a dog having white fur(bb)

Case 1

Parents BB (black) * bb(white)

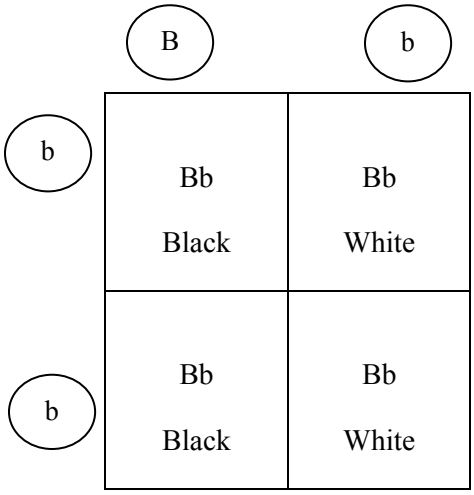
Gametes B b

F1 Bb (Black)

Case 2

Parents Bb (Heterozygous black) * bb(White)

Gametes B b b



Conclusion: If the litter(progeny) has all black puppies, the dog in question is homozygous.

If the progeny has 50 % black puppies and 50% white puppies The dog is heterozygous.

So Test cross can be used to find out the genotype of an organism.

Mendel's Laws

Law of Dominance : When two homozygous individuals with one or more sets of contrasting characters are crossed, the alleles (characters) that appear in F1 are dominant and those which do not appear in F1 are recessive.

.(Practice cross given in Fig 5.4)

Law of Segregation /(Law of purity of gametes)

Though the parents have 2 alleles but these two alleles segregate or separate during gamete formation. Gametes are always pure for the character as one gamete contains only one allele

Characteristics	**Incomplete Dominance**	**Co Dominance**
Dominance	1. The dominant allele is not completely dominant over the other.	The two alleles are not related as dominant or recessive. Both are equally expressive.
Phenotype	**2.**Phenotype of the offspring is intermediate of the two parental characters.	Both the parental phenotypes are expressed together in their offspring.
Example	**3.** In Snap dragon when plants with red flower is crossed with plant having white flowers it results into pink coloured flower bearing plant.	Blood group inheritance in humans. Both A & B alleles are equally dominant over allele O.

Multiple allelism : When more than two alleles govern a character. e.g. 3 alleles A,B,O for blood group in Human beings.

Pleiotropy: When one gene controls more than one character. Example A human genetic disorder called Marfan syndrome is caused by a mutation in one gene, yet it affects many aspects of growth and development, including height, vision, and heart function.

Polygenic Inheritance: When one characteristic is controlled by two or more genes. Often the genes are large in quantity but small in effect. Examples of human polygenic inheritance are height, skin color, eye color and weight. It is also called Quantitative inheritance. Human skin colour is controlled by 3 genes (6 alleles) and number of dominant genes decides the phenotype.

Inheritance of two genes (Dihybrid cross)

Law of independent assortment : Based on observation of dihybrid cross, it states that inheritance of one pair of characters is independent of the other pair of characters. # .(Practice cross given in Fig 5.7)

Sutton & Boveri's **chromosomal theory of inheritance** states that genes are found at specific locations on chromosomes, and that the behavior of chromosomes during meiosis can explain Mendel's laws of inheritance.

*Table 5.3 in NCERT For comparison between Genes and chromosome

Sex Determination

Human Beings(XX-XY mechanism) *:* Male is heterogametic as it produces two type of Gametes . Gamete containing X chrmosome and gamete containing Y chrmosome . Female produces only one type of gamete ie Gamete containing X chrmosome.

Birds (ZW-ZZ mechanism) : Male is homogametic(ZZ), Female heterogametic(ZW)

Honey Bee Sex is normally determined by the fertilization or non-fertilization of eggs, rather than the presence or absence of sex chromosomes. In haplodiploid systems, male progeny normally develops from unfertilized eggs, which are haploid

and have just one set of chromosomes. The male is haploid while the female is diploid.. Male bees are haploid because they develop parthenogenetically from unfertilized eggs. . Meiosis does not occur during the formation of sperms. Females grow from fertilized eggs and are hence diploid. Queen bee picks up all the sperms from the drone during nuptial flight .Difference between worker bees(diploid females) and Queen is due to feeding of royal jelly to queen bee.

Mutation:

Sudden inheritable change in genes is called mutation.

Point mutation: Mutation due to change in a single base pair of DNA.

Frame shift Mutation :It is a genetic **mutation** caused by a deletion or insertion in a DNA sequence that shifts the way the sequence is read

PEDIGREE ANALYSIS

A pedigree is a diagram displaying a family's history of a trait. Analyzing pedigrees can reveal (1) whether a trait is dominant or recessive, (2) the type of chromosome, autosomal or sex, a trait is linked to, (3) genotypes of family members, and (4) probabilities of phenotypes in future generations.

the main clues for identifying an autosomal dominant disorder are that the phenotype tends to appear in every generation of the pedigree and that affected fathers and mothers transmit the phenotype to both sons and daughters.

In a pedigree displaying autosomal trait, affected individuals are of both sex: that is both male and female individuals could be affected in 1:1 ratio.

In a pedigree displaying sex linked trait, more number of males will be affected.

If both parents do not have the trait and the child does, it is recessive. If one parent has the trait and the child does or does not, it is dominant.

MENDELIAN DISORDERS

Haemophilia Haemophilia is a mostly inherited genetic disorder that impairs the body's ability to make blood clots, a process needed to stop bleeding. This results in people bleeding for a longer time after an injury, easy bruising, and an increased risk of bleeding inside joints or the brain. It is a Sex linked Recessive disorder.Usually the male suffers from this disease while female is carrier.

Sicke cell anaemia It is an autosomal recessive trait . Hb^A is normal allele while Hb^S is the allele if present in homozygous condition cause the disease. It is due to a point mutation which substitutes Glutamic acid by Valine at the 6th positionof beta globin chain

.**Thalassemia** is an inherited blood disorder in which the body makes an abnormal form of hemoglobin. When there isn't enough hemoglobin, the body's red blood cells don't function properly and they last shorter periods of time. .It is an autosomal recessive disorder. .Thalassemia minor is a less serious form of the disorder. There are two main forms of thalassemia that are more serious. In alpha thalassemia, at least one of the alpha globin genes has a mutation or abnormality. In beta thalassemia, the beta globin genes are affected. The symptoms of thalassemia can vary. Some of the most common ones include bone deformities, especially in the face, dark urine, delayed growth and development, excessive tiredness and fatigue, yellow or pale skin.

Chromosomal Disorders

Aneuploidy : Condition which is characterised by having an abnormal no of chromosomes due to gain or loss of a chromosome in a haploid set. It is caused due to non dis junction of chromatids during cell cycle.

Polyploidy: Increase in a whole set of chromosomes in an organism is called polyploidy.

It is due to failure of cytokinesis after telophase stage of cell division.

TURNER'S SYNDROME	**KLINEFELTER'S SYNDROME**
It is caused due to lack of X chromosome i.e., XO instead of XX	It is caused by presence of an extra sex chromosome (XXY instead of XY).
44 autosomes+ X0 (45 chromosomes)	44 autosomes+ XXY (47 chromosomes)
Rudimentary ovaries. Sterile females.	Masculine development. Male gonads present but sterile. Gynecomastia (Breast development) also expressed.

DOWN's Syndrome : Due to trisomy of 21st chromosome the affected individual is short statured, has furrowed tongue and open mouth. retarded mental growth and psychomotor development.

PRACTICE QUESTIONS

1. If the condition of a karyotype is 2n+-1, it is

   a) Euploidy b) aneuploidy c) polyploidy d) allopolyploidy

2. Why is colour blindness more frequent in males than females?

3. What is the probability that the daughter will suffer from Haemophilia if her father is haemophilic and her mother is carrier for haemophilia. Explain with the help of cross.

4. A normal visioned woman,whose father is colour blind, marries a normal visioned man. What would Be probability of her sons and daughters to be colour blind? Explain with the help of pedigree chart.

5. What are the possible blood groups of a child if parents have blood group A and B. Find out the probability of each blood group with the help of a punnet square.

6. A true breeding homozygous pea plant with green pods and axial flowers as dominant characters, is crossed with a recessive homozygous pea plant with yellow pods and terminal flowers.

   (a) Work out the cross up to F2 gene giving the phenotypic ratios of F1 and F2 generation respectively.

   (b) State the Mendelian principle which can be derived from such a cross and not from monohybrid cross.

7. Give the type of sex determination mechanism with example of each type.
   (a) Female XX with Male XO
   (b) Female ZW with male ZZ
8. Why do sons of a haemophilic father never suffer from haemophilia?
9. A woman aged 45 years gave birth to an abnormal child with small round head, flattened nose, furrowed tongue and usually open mouth. Name the genetic disorder. What causes it?
10. How will be the child affected if it has grown from the zygote formed by fertilization of an XX carrying egg with a Y carrying sperm? Name the disorder.
11. A colour blind child has been born to a normal visioned couple. How is it possible? Work out with a cross and mention the possible sex of the child.
12. In which type of inheritance the genotypic and phenotypic ratios are same in F2 generation? Name an organism in which it occurs.
13. How can you say that sex of a human child is determined by the father and not the mother.
14. It was observed when white coloured cattle are crossed with red coloured cattle, it produces roan-coloured cattle i.e., having both red and white hair on the body. What type of inheritance is it? What is its cause?

CHAPTER-6: MOLECULAR BASIS OF INHERITANCE

Revised Syllabus: Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central Dogma; transcription, genetic code, translation; gene expression and regulation - lac operon; Genome, Human and rice genome projects; DNA fingerprinting.

Structure of DNA

1. DNA is made of two polynucleotide chains
2. The backbone is made by sugar-phosphate with the bases projecting inside.
3. The two chains are anti-parallel to each other. One chain has the polarity 5′→ 3′ whereas the other chain has 3′→ 5′.
4. Adenine forms two hydrogen bonds with Thymine of opposite strand.
5. Cytosine forms three hydrogen bonds with Guanine of opposite strand.
6. The two chains are coiled in a right-handed manner.
7. One turn covers 3.4 nm.
8. There are 10 base pairs in each turn.
9. The distance between base pairs in a helix is 0.34 nm.
10. Practice of Figure 6.2 of NCERT Text Book

Central Dogma

Francis Crick proposed the Central dogma which states that the genetic information flows from DNA → RNA → Protein.

Packaging of DNA in Eukaryotes (Nucleosome)

1. There is a set of positively charged basic proteins called histones.
2. Eight histone molecules combine to form histone octamer.
3. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.
4. Histone H1 acts as linker.
5. A typical nucleosome contains 200 base pairs of DNA helix.
6. Repeating units of Nucleosomes constitute chromatin in nucleus.
7. Practice of Figure 6.4a of NCERT Text Book

Griffith's Experiment (Transforming Principle)

1. Frederick Griffith, performed experiments with *Streptococcus pneumoniae* and mice.
2. This bacterium has two strains:
   S-strain which has mucilage coat and causes pneumonia, so it is virulent.
   R-strain has no mucilage coat and is non-virulent.
3. Griffith injected R-strain into mice. The mice remained alive.
4. Griffith injected S-strain into mice. The mice died.
5. Griffith injected heat-killed S-strain into mice. The mice remained alive.
6. Griffith injected R-strain and heat-killed S-strain into mice. The mice died and he found living S-strain of bacteria in the dead mice.

Conclusion: He concluded that some 'transforming principle' transferred from the heat-killed S-strain into R-strain. Due to this, R-strain of bacteria synthesised mucilage coat and became S-strain of bacteria (virulent).

Hershey and Chase Experiment

1. They worked with viruses that infect bacteria called bacteriophages.
2. The bacteriophage has only DNA and protein coat.
3. Hershey and Chase performed an experiment to find whether it was protein or DNA that produces new viruses after infection in bacteria.
4. They grew two types of viruses:
   (i) viruses with radioactive DNA due to P^{32} but normal protein coat
   (ii) viruses with radioactive protein coat due to S^{35} but normal DNA
5. *E. coli* bacteria were infected by the two types of viruses separately.
6. After the infection, the virus particles were separated from the bacteria by centrifugation.
7. The bacteria infected with viruses that had radioactive DNA, were radioactive. It showed entry of DNA into the bacteria.
8. The bacteria infected with viruses that had radioactive protein, were non-radioactive. It showed that proteins did not enter the bacteria.
9. Practice of Figure 6.5 of NCERT Text Book

Conclusion: Therefore, DNA is the genetic material.

Meselson and Stahl's Experiment (to show that replication of DNA is semi-conservative)

1. They grew *E. coli* in $^{15}NH_4Cl$ for many generations.
2. New DNA got ^{15}N and is heavy.
3. This heavy DNA molecule could be distinguished from the normal DNA by centrifugation in a cesium chloride (CsCl) density gradient.
4. They transferred the *E. coli* into normal $^{14}NH_4Cl$ and took samples after 20 minutes and after 40 minutes.
5. The samples were separated on CsCl gradients to measure the densities of DNA.
6. DNA of sample after 20 minutes (1st generation) had a hybrid or intermediate density.
7. DNA of sample after 40 minutes (2nd generation) was composed of equal amounts of hybrid DNA and of normal DNA.
8. Practice of Figure 6.7 of NCERT Text Book

Conclusion: Replication of DNA is semi-conservative.

DNA Replication

1. In prokaryotes, there is a definite region in DNA where the replication starts. Such regions are called origin of replication.
2. The replication begins with a small opening of the DNA helix called replication fork.
3. The DNA-dependent DNA polymerases catalyse polymerisation only in one direction, i.e., $5' \rightarrow 3'$. Therefore, on one strand, the replication is continuous (**Leading strand**), while on the other strand, it is discontinuous (**Lagging strand**).
4. The discontinuously synthesised fragments are called Okazaki Fragments.
5. The Okazaki Fragments are joined by the enzyme DNA ligase.
6. Practice of Figure 6.8 of NCERT Text Book

Transcription

Initiation: 1. DNA-dependent RNA polymerase binds to promoter.
2. It uses nucleoside triphosphates as substrate and polymerises following the rule of complementarity.
3. Initiation-factor (s) is required to initiate the transcription.

Elongation: RNA polymerase facilitates opening of the helix and continues elongation.

Termination: 1. Once RNA polymerase reaches the terminator region, the newly formed RNA falls off.
2. Termination-factor (r) is required terminate the transcription.
3. Practice of Figure 6.10 of NCERT Text Book

Additional Events in Transcription in Eukaryotes

Exons: The functional part of *hn*RNA
Introns: The non-functional part of *hn*RNA.
Splicing: Removal of introns and joining of exons in a definite order.
Capping: Methyl guanosine triphosphate is added to the 5′ end of *hn*RNA.
Tailing: Adenylate residues (200-300) are added at 3′ end of *hn*RNA.
Figure 6.11 of NCERT Text Book

Salient Features of Genetic Code

1. The codon is triplet. 61 codons code for amino acids
2. The code is degenerate as some amino acids are coded by more than one codon.
3. The codon is read in mRNA in a contiguous manner.
4. The code is nearly universal.
5. AUG has dual functions. It is initiation codon and it also codes for Methionine.
6. Three codons do not code for any amino acid, hence they function as stop codons or terminator codons (UAA, UAG, UGA).

Lac Operon

Practice of Figure 6.14 of NCERT text Book

Point Mutation

It results due to loss or gain of a single gene. An example of point mutation is a change of single base pair in the gene for beta globin chain that results in the change of glutamate to valine. It causes **sickle cell anaemia.**

Frameshift Mutation

Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion. Such mutation is called frameshift mutation.

DNA Fingerprinting

1. DNA isolation
2. Digestion of DNA by restriction endonucleases
3. Separation of DNA fragments by electrophoresis
4. Transferring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon
5. Hybridisation using labelled VNTR probe
6. Detection of hybridised DNA fragments by autoradiography.
7. Practice of Figure 6.16 of NCERT Text Book

Applications of DNA Fingerprinting

1. Used as a tool in forensic investigations.
2. To settle paternity disputes.
3. As a tool to study evolution.

QUESTIONS FOR PRACTICE

1. Draw a labelled diagram of a nucleosome.
2. Explain DNA replication with the help of a diagram.
3. Describe various steps of Griffith's experiment that led to the conclusion of the 'transforming principle'.
4. Describe the Hershey and Chase experiment. Write the conclusion drawn by the scientists after their experiment.
5. Describe Meselson and Stahl's experiment that was carried on *E. coli.* Write the conclusion they arrived at after the experiment.
6. Explain the process of DNA replication with the help of a schematic diagram.
7. Explain the process of transcription in prokaryotes. How is the process different in eukaryotes?
8. State the central dogma. Who proposed it?
9. Explain the processing the *hn*RNA needs to undergo before becoming functional mRNA in eukaryotes.
10. Give an example of codon which has dual function.
11. Mention the role of the codons AUG and UGA during protein synthesis.
12. Differentiate between unambiguous and degenerate codons.
13. What are the salient features of the genetic code?
14. What is point mutation? Give an example.
15. Draw a diagram of double stranded polynucleotide chain of DNA.
16. What is splicing?
17. What is capping in processing of RNA?
18. What is tailing in processing of RNA?
19. What is the difference between exons and introns?
20. What are Okazaki fragments?
21. What is frame-shift mutation?
22. Show lac operon with the help of a labelled diagram.
23. Write two applications of DNA fingerprinting.

CHAPTER: 8 HUMAN HEALTH & DISEASES

Revised Syllabus: Pathogens; parasites causing human diseases (malaria, dengue, chikungunya, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Ways to Ensure Good Health

- Balanced diet
- Personal hygiene
- Exercise
- Awareness about prevention and control of diseases
- Proper waste disposal and control of vectors
- Vaccination

Pathogenic Diseases

- Pathogens are the parasites that enter the human body through various means, then multiply, and interfere with normal vital activities.

Bacterial Diseases

- **Typhoid**
  - Pathogen − *Salmonella typhi*
  - Spreads through − Contaminated food and water
  - Site of infection − Small intestine
  - Symptoms − High fever, stomach pain, headache, loss of appetite, constipation, and intestinal perforations in severe cases ○ Confirmatory test − Widal test
- **Pneumonia**
  - Pathogens − *Streptococcus pneumoniae* and *Haemophilus influenzae*
  - Spreads through − Droplets/aerosols released from infected person, sharing of glasses or utensils
  - Site of infection − Alveoli (gets filled with fluid, difficulty in breathing)
  - Symptoms − Fever, chills, cough, headache, lips and nails become grey in severe cases

Viral Diseases

- **Common cold**
  - Pathogen − Rhino viruses
  - Site of infection − Nose and respiratory passage
  - Spreads through − Droplets released from coughing or sneezing, or contaminated objects
  - Symptoms − Nasal congestion and discharge, sore throat, cough, headache, tiredness

Protozoan Diseases

- **Malaria**
  - Pathogen − *Plasmodium* sps. (*P.vivax, P. falciparum, P. malaria*)
  - Vector − Female *Anopheles* mosquito
  - Symptoms − High grade fever, chills

- **Amoebiasis**
  - Pathogen − *Entamoeba histolytica*
  - Vector − Housefly
  - Site of infection − Large intestine
  - Symptoms − Constipation, abdominal pain, cramps, stools with mucous, and blood clots

Fungal Diseases

- **Ringworms**
  - Pathogens − Genera *Microsporum*, *Trichophyton*, and *Epidermophyton*
  - Spreads through − Towels, clothes, comb (Fungus is acquired from soil)
  - Symptoms − Appearance of dry, scaly lesions on various body parts with intense itching

Diseases Caused by Worms

- **Elephantiasis (filariasis)**
  - Pathogen − *Wuchereria* (*W.malayi* and *W.bancrofti*)
  - Spreads through − Bite of female mosquito vector
  - Symptom − Chronic inflammation of the organs, usually the lymphatic vessels of lower limb

Life Cycle of *Plasmodium*

- *Plasmodium* requires two hosts to complete its life cycle.
- When female *Anopheles* mosquito bites a healthy human being, it releases *Plasmodium*, which lives in its body as sporozoite (infectious form).
- The parasites multiply (asexual reproduction) in the liver cells and finally burst the liver cells. Sporozoites are released in blood.
- Parasites enter RBCs and further multiply (asexual reproduction) here and finally burst RBCs also.
- Bursting of RBCs is accompanied by release of a toxic substance called haemozoin (associated with fever and chills).
- In the RBCs, only sporozoites change into gametocytes (sexual stage). Gametocytes multiply.
- When the diseased person is bitten by a female *Anopheles* mosquito, gametocytes are introduced into the mosquito.
- Gametocytes fertilise and develop inside the intestine of mosquito to form sporozoites.
- Sporozoites are stored in the salivary glands of mosquito and are released into the healthy person who is bitten by this mosquito.

Immunity

- The ability of body to fight the disease-causing organisms is called immunity.

Difference between active immunity and passive immunity

- Active Immunity

○ This is the naturally acquired immunity produced in the host body in response to an

antigen.

○ Immunization and body naturally getting immune to a microbe that had caused

infection previously are examples of active immunity.

- Passive immunity
  - ○ When readymade antibodies are provided to an individual to protect against foreign agents
  - ○ Colostrums present in mother's milk contain IgA. Also, the foetus gets antibodies from mother through placenta.

How does vaccination help?

- Vaccines are nothing but inactivated pathogens.
- These inactivated pathogens when introduced in the body produce a primary immune response and antibodies are produced against the pathogen.
- Memory B and Tcells are produced.
- Now when the pathogen again attacks the person, memory B and Tcells generate a massive immune response and the pathogen is killed.

Problems of immune system

- **Allergies**
  - ○ Exaggerated immune response to certain antigens present in environment
  - ○ Allergens − Substances in response to which allergy is produced E.g., dust, pollen, etc.
  - ○ Antibodies involved − IgE type
  - ○ During allergic reactions, chemicals such as histamines and serotonins are released.
  - ○ Symptoms − Sneezing, watery eyes, difficulty in breathing, etc. ○ Allergy test − Patient is injected with small doses of allergens to monitor his response.
  - ○ Antihistamines, adrenalins, and steroids may be given so that the symptoms of allergy subside.
- **Autoimmunity**
  - ○ In autoimmunity, body generates immune response against its own cells.
  - ○ Reasons − Genetic and other unknown reasons
  - ○ Example − Rheumatoid arthritis is an autoimmune disease. **Human immune**

system

AIDS (Acquired Immuno Deficiency Syndrome)

- Caused by HIV (Human Immunodeficiency Virus) [HIV is a retrovirus (RNA virus)]
  - **Transmission of HIV occurs through:**
    - ○ Sexual contact with infected person
    - ○ Sharing infected needles (as in case of intravenous drug abusers)
    - ○ Transfusion of contaminated blood
    - ○ Infected mother to child through placenta

- Time lag between infection and appearance of symptoms − Few months to many years (5-10 years)
- **Diagnosis of AIDS −** By ELISA (Enzyme Linked Immuno Sorbent Assay)
- **Treatment −**No permanent cure; antiretroviral therapies can prolong the life of patient
  - **Prevention of AIDS**
    - Ensuring use of disposable syringes
    - Screening blood from blood banks
    - Advocating safe sex
    - NACO (National AIDS Control Organization) and many NGOs are doing a lot to create awareness among people.

Cancer

- Normal cells have the property of contact inhibition (stoppage of growth on coming in contact with other cells), but cancer cells lose this property.
- As a result, cancer cells divide continuously to give rise to mass of cells (tumours).
- Tumours are of 2 types − benign and malignant.
- Benign tumours − Remain confined to their original location and do not spread
- Malignant tumours− These exhibit **metastasis** i.e., the cells sloughed from such tumours reach distant sites and wherever they reach, new tumour is formed.
- Malignant tumours actually represent cancer. The cells actively divide, grow, and starve the normal cells of vital nutrients.
- **Causes of cancer**
  - **Carcinogens −** Physical, chemical, and biological agents that cause cancer Example ionizing radiations (Xrays and gamma rays), nonionizing radiations (UV)
  - **Oncogenic (cancercausing) viruses**− They have viral oncogenes (cancer causing genes).
  - Sometimes normal genes in our body called protooncogenes get converted into cellular oncogenes that cause cancer.

Commonly Abused Drugs

Opioids (Heroin)

- Source: Acetylation of morphine extracted from the latex of poppy plants (*Papaver somniferum*)
  - Consumed by: Snorting or injection
  - Properties: White, bitter and odourless
- Mode of action: Binds to opioid receptors present in the CNS and GI tract
  - Effect: It is a depressant; slows down body functions

Cannabinoids

- Source: Inflorescences of the plant *Cannabis sativa*
- Consumed by: Inhalation or oral ingestion
- Mode of action: Binds to cannabinoid receptors present in the brain ● Effect: Affects the cardiovascular system

Ill Effects of Smoking

Increased risk of diseases like bronchitis, emphysema, coronary heart disease, gastric ulcer and cancer (throat, lung and urinary bladder) ● Increased carbon monoxide levels in blood, leading to oxygen deficiency

Causes of alcohol/ Drug Abuse

● Alcohol / drug abuse normally starts in adolescence (period between 1218 yrs − transition phase between childhood and adulthood). ● Many adolescents are motivated towards drugs/ alcohol due to curiosity and experimentation.

● Peer pressure, academic stress, unstable family structure further incline youth towards alcohol/ drug abuse.

● Perception of consuming alcohol / drug being cool and progressive and use of alcohol/drug in television, movies, etc. further promote this habit.

Effects of Alcohol/ Drug Abuse

● Immediate effect − Vandalism, violence, and reckless behaviour ● Drop in academic performance, lack of interest in personal hygiene, rebellious behaviour, and change in eating and sleeping patterns, weight and appetite fluctuations

● Mental, psychological, and financial loss not only to the user, but also to his family

● Those who take drugs intravenously have a high risk of acquiring deadly diseases such as AIDS and hepatitis B.

● Damage to nervous system and liver (cirrhosis)

● Use of anabolic steroids by sportsperson have adverse effects:

○ In females − Increase of masculinity,aggressiveness, depression, abnormal menstrual cycle, facial hair growth, enlargement of clitoris, and deepening of voice

○ In males − Acne, aggressiveness, depression, reduction in size of testicles, decreased sperm production, enlargement of prostate gland, breast enlargement, premature baldness

● Ultimately, prolonged use of alcohol/drugs leads to coma and death.

(QUESTION BANK)

1. Name the diagnostic test which confirms typhoid.
2. Name the two major groups of cells required to attain specific immunity.
3. You have heard of many incidences of Chickengunya in our country. Name the vector of the disease.
4. Breast fed babies are more immune to diseases than the bottle fed babies. Why?
5. Name the pathogen which causes malignant malaria.
6. Which microorganism is used to produce hepatitis B Vaccine?
7. What is the reason of shivering in malarial patient?
8. Where are B-cells and T-cells formed? How do they differ from each other?
9. Given below are the pathogens and the diseases caused by them. Which out of these pairs is not correct matching pair and why?
   (a) *Wuchereria* . Filariasis
   (b) *Microsporum* . Ringworm
   (c) *Salmonella* . Common Cold
   (d) *Plasmodium* . Malaria
10. What would happen to the immune system, if thymus gland is removed from the body of a person?
11. Lymph nodes are secondary lymphoid organs. Describe the role of lymph nodes in our immune response.
12. What is the role of histamine in inflammatory response? Name few drugs which reduce the symptoms of allergy.
13. What are Cannabinoids? From which plant Cannabinoids are obtained? Which part of the body is affected by consuming these substances?
14. In the figure, structure of an antibody molecule is shown. Observe it and Give the answer of the following questions.
    (i) Label the parts A, B and C.
    (ii) Which cells produce these chemicals?
    (iii) State the function of these molecules.
15. Mention any three causes of drug abuse. Suggest some measures for the prevention and control of drug abuse.
16. A person shows unwelcome immunogenic reactions while exposed to certain substances.
    (a) Name this condition.
    (b) What common term is given to the substances responsible for this condition?
    (c) Name the cells and the chemical substances released which cause such reactions.
17. What is innate immunity? List the four types of barriers which protect thebody from the entry of the foreign agents.
18. Fill the blanks 1,2,3,4,5,6 in the given table.

Name of disease	***Causative organism***	***Symptoms***
- Pneumonia	*Streptococcus*	(1)
-. Typhoid	(2)	High fever, weakness headache, stomach pain
(3)	*Rhinoviruses*	Nasal Congestion, and discharge sorethroat cough, headache cough, headache
Ascariasis	*Ascaris*	(4)
Ringworm	*(5)*	*Dry, Scaly lesions on various body parts, Intense itching, redness.*
(6)	*Entamoeba histolytica*	*Constipation, cramps, abdominal pain, Stools with excess mucous and*

CHAPTER 10: MICROBES IN HUMAN WELFARE

Revised Syllabus: MICROBES IN FOOD PROCESSING, INDUSTRIAL PRODUCTIONS, SEWAGE TREATMENT, ENERGY GENERATION AND MICROBES AS BIOCONTROL AGENTS AND BIOFERTILIZERS, ANTIBIOTICS PRODUCTION AND JUDICIOUS USE.

Microbes **(protozoa, bacteria, fungi, and plant viruses) are present everywhere in** soil, water, air, inside our bodies. Microbes cause diseases in Human beings, animals, plants but several microbes are also useful to man in diverse ways.

MICROBES IN HOUSEHOLD PRODUCTS

LAB (Lactic Acid Bacteria)

- Example - Production of curd from milk.LAB produces lactic acid that partially digest milk protein and coagulate it to form curd.
- Small amount of curd is added to milk for curdling.
- Curd is rich in **vitamin B12**.

FERMENTATION

- Formation of **alcohol from sugar in absence of oxygen.** Dosa, Idli, dough is fermented by bacteria and due to fermentation, in **presence of CO2** (produce), dough is puffed up.
- The dough, which is used for making bread, is fermented by using **baker's yeast (SACCHAROMYCES CEREVISIAE).**
- Many drinks like "Toddy**",** a traditional drink of some parts of southern India is made by fermenting **SAP from palm trees.**
- **Cheese making- Swiss cheese** is made by bacteria; **PROPIONIBACTERIUM SHARMANII** and large holes seen are due to production of a large amount of carbon dioxide.

MICROBES IN INDUSTRIAL PRODUCTS

- Beverages
- Antibiotics

are produced by microbes in very large vessels called **fermenters.**

FERMENTED BEVERAGES

- Yeast is used in the production of beverages lik**e wine, beer, whisky, brandy, or rum.**
- Depending on the type of raw material used for fermentation and the type of processing **(with or without distillation**) different types of alcoholic drinks are obtained.
- **Without distillation - Wine , Beer**
- **With distillation - Whisky, Brandy**

ANTIBIOTIC Antibiotics are chemical substances which are produced by some microbes and can kill or retard the growth of other (disease causing) microbes.

Penicillin was the first antibiotic to be discovered, named after the mould **PENICILLIUM NOTATUM.**

CHEMICALS, ENZY*M*ES AND OTHER BIO ACTIVE MOLECULES

- Microbes are also used for commercial and Industrial production of certain chemicals like organic acids and alcohols and enzymes
- Examples of acid producers:

1. Aspergillus Niger 2. Acetobacter Aceti 3. Clostridium Butlicum 4. LactoBacillus

- **YEAST (SACCHAROMYCES CEREVISI*A*E) - Commercial production of ethanol**

MICROBES USED FOR THE PRODUCTION OF ENZYMES:

- Lipases for detergent formulation
- Streptokinase used as "clot buster"
- Trichoderma polysporum cyclosporine a, used as an immunosuppressive agent in organ transplant patients.

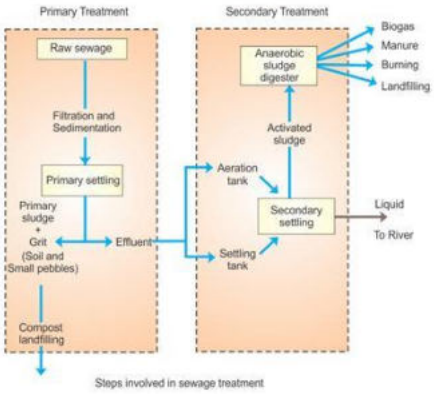
MICROBES IN SEWAGE TREATMENT:

- The municipal wastewater is called **sewage**. It contains large amounts of organic matter and microbes, many of which are pathogenic.
- Sewage is treated in sewage treatment plants to make it less polluting.

Treatment is carried out in two stages:

- PRIMARY TREATMENT - Removal of particles(large and small) through filtration and sedimentation.All solids that settle form the **primary sludge**, and the **supernatant** forms the **effluent**.
- SECONDARY TREATMENT OR BIOLOGICAL TREATMENT- .

PRIMARY TREATMENT	SECONDARY TREATMENT
It is a physical process	It is a biological process
Primary treatment involves the removal of large sized floating and suspended solids.	Secondary treatment involves decomposition of organic matter by microbial action which produce methane, hydrogen sulphide, and carbon dioxide.
BOD is not affected in this treatment.	BOD is less by secondary treatment.



Steps involved in sewage treatment

MICROBES IN PRODUCTION OF BIOGAS :

- Biogas is a mixture of gases produced by the microbial activity and which may be used as a fuel.
- The main gas produced during fermentation of cheese masking, dough, production of beverages , the main gas produced was co2.
- Certain bacteria which grow anaerobically on cellulosic material produce large amount of methane, these are called methanogens eg. METHANOBACTERIUM.

Q. Can we human beings are able to digest the cellulose present in our foods?

Ans. No, Our bodies are unable to breakdown cellulose. This is because of the structure it has.

(REFER TO FIGURE 10.8 FROM NCERT. PAGE N. 186 (NEEDS PRACTICE OF THE FIGURE.)

MICROBES BIOCONTROL AGENTS -

Biocontrol refers to the use of **biological methods** for **controlling** plant diseases and pests.

Biological control of pests and diseases :

- The biological control method involves the use of the living organisms which act as the **predator**s for the pests and harmful insects
- . The main advantage of the biological control method in the control of agricultural pests.
- They are non-polluting, non-toxic and inexpensive.

MICROORGANISMS	CATEGORY	ACTION
Trichoderma species	Fungus	Kills pathogen in the root system
Bacillus thuringiensis	Bacteria	Kills the insect pest (Bt-cotton)

MICROBES AS BIOFERTILIZERS

What is biofertilizer?

- It is a large population of a specific or a group of beneficial microorganisms for enhancing the productivity of soil.
- Either by fixing **atmospheric nitrogen** or by solubilising soil phosphorus or by stimulating Plant growth through synthesis of growth promoting substances.

- There is a head need these days to push for use of biofertilizers in place of chemical fertilizers

Types of biofertilizers

- RHIZOBIUM - Have symbiotic association with roots of leguminous plants,help in atmospheric nitrogen fixation.
- AZOSPIRILLUM And AZOTOBACTER - Free living in soil and help in nitrogen 2-fixation enrich nitrogen 2-content of soil.
- CYANOBACTERIA - eg: Anabaena and Nostoc, help in Nitrogen fixation, increase fertility of soil.
- MYCORRHIZA - Symbiotic association of fungi with roots of higher plants.

Important terms :

1. **GAP - GANGA ACTION PLAN**
2. **KVIC - KHADI AND VILLAGE INDUSTRIES COMMISSION**
3. **TMV- TOBACCO MOSAIC VIRUS**
4. **YAP- YAMUNA ACTION PLAN**
5. **IPM- INTEGRATED PEST MANAGEMENT**

QUESTIONS -

Q. 1. An antibiotic called "Wonder Drug" was used to treat the wounded soldiers of America during World War-II. Name the drug and the scientist who discovered it.?

Ans. Penicillin, Alexander Fleming.

Q. 2. Which Ministry of Govt, of India had initiated Ganga Action Plan and Yamuna Action Plan? What are the objectives of these plans?

Ans. The Ministry of Environment and Forests. The objective of Ganga Action Plan and Yamuna Action Plan is to save these Rivers from pollution. It was proposed to build a large number of sewage treatment plants. So that only treated sewage may be discharged into these rivers.

Q. 3. What is biochemical oxygen demand (BOD) test? At what stage of Sewage treatment this test is performed?

Ans. The BOD test measures the rate of uptake of oxygen by microorganisms in a sample of water. Biological treatment or Secondary treatment.

Q. 4. Lactic Acid Bacteria is commonly used in the conversion of milk into curd. Mention any two other functions of LAB that are useful to humans?

Ans. i) LAB in human intestine synthesizes Vitamin B12. ii) LAB in human stomach checks the growth of harmful microbes.

NOTE: - In addition, learn answers of Question No. 3, 5, 6, 7, 9 and 12 of Chapter 10 of NCERT Text Book.

Chapter11Biotechnology: principles and processes

Revised Syllabus:
Genetic Engineering (Recombinant DNA Technology).

Biotechnology: According to 'European Federation of Biotechnology' (EFB), **biotechnology is defined as the integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services.**

1. **Principles of Biotechnology: The two core techniques of modern biotechnology are:**

Genetic engineering

Maintenance of sterile condition

2. The advantages of biotechnological application over traditional hybridization are:

*Results are obtained in less time.

*Only desirable genes are multiplied.

3. When foreign gene is inserted in host DNA, the resultant gene is called **recombinant DNA.**

First artificial recombinant DNA was constructed by Stanley Cohen and Herbert Boyer in 1972. They linked antibiotic resistance genes in the plasmid of ***Salmonella typhimurium.***

4. steps carried out in constructing first recombinant DNA:there are three basic steps:-

1) Identification of desired gene
2) Introduction of identified DNA into host
3) Maintenance of the recombinant DNA in host and in its progeny.

5.Tools of recombinant DNA technology:

1)Restriction enzymes **2**) Polymerase enzyme **3**)Ligase **4**)Vectors **5**)Host organism/cell

6. Restriction Endonucleases

• Restriction enzymes were discovered in 1963 in ***E. coli*** which inhibited the growth of bacteriophage in the bacterial cell.

• First restriction enzyme isolated was **Hind II . It always cuts the DNA molecule at specific locations** with specific base pairs.

• This specific sequence at which a restriction enzymes cut DNA is called **recognition sequence.**

#Functioning of RE

• RE inspect the length of DNA

• When a specific palindromic sequence is located by RE, it binds to DNA and cuts both the strands of DNA by breaking the sugar phosphate backbone, little away from the centre but between the same base sequence. This produces **sticky ends**.

This helps in joining two DNA molecules, one desired and the other vector DNA by **DNA ligase**. The resultant DNA is recombinant DNA

It is then inserted into the desired host like

E coli. When this bacteria divides, the inserted DNA also divides along with the bacteria

• Specific sequences are **palindromic nucleotide sequences** that read same both forward and backward.

eg. For **EcoRI**, specific palindromic sequence is

5’————-G A A T T C————3’

3’————-C T T A A G————5’

#Mechanism of action of endonucleases:

 # Practice <u>Figure 11.1</u>: steps in formation of recombinant DNA by action of restriction endonucleases enzyme EcoRI

7.Separation and Isolation of DNA Fragments:

when the DNA is cut by RE, , many fragments of DNA are formed.

Gel electrophoresis is a technique for separating DNA fragments based on their size:

> The solid medium in which the fragments of DNA separate out is agarose gel,extracted from a sea weed.

> The agrose gel acts as a sieve and separates the fragments of DNA according to their sizes.

> DNA is negatively-charged molecule, When electric field is applied, DNA moves towards positively-charged anode through agarose gel matrix.
> Small fragment will move faster than the larger ones
> DNA is visualized by staining it with **Ethidium bromide (EtBr).**
> Bright orange bands of DNA are visible under UV light.
> Desired fragment is cut and purified from agarose gel. This is called **DNA elution**.
> The extracted DNA is then subjected to the formation of recombinant DNA

8.Cloning Vectors

The vectors are the DNA molecules that can carry a foreign DNA segment into the host cell.
Vectors maybe-
 # Plasmids-these are autonomously replicating circular extrachromosomal DNA.
 # Bacteriophage is a virus infecting bacteria.
A cloning vectors must have following features:
 # Origin of replication (ori): It is a sequence where replication starts.
Selectable marker: It helps in identifying and eliminating non-transformants and allows the growth of transformants.
 # Cloning sites: It is a site or sequence on vector DNA which is recognized by a restriction enzyme and is used to link alien DNA, the vector requires very few (mostly single) recognition sites for the restriction enzymes.

9. Vectors for Cloning genes in Plants and Animals

• ***Agrobacterium tumifaciens***, a soil bacteria and tumour causing retroviruses are used to insert the desired gene in plants and animals, respectively. Normally ***A. tumifaciena*** causes tumour by transferring Ti plasmid, a tumour-causing gene in plants. Ti plasmid is disarmed in such a way that it can transfer desirable gene but cannot cause tumour.
• Retrovirus, adenovirus, papillomavirus are also now used as cloning vectors in animals

10. Competent Host for Transformation with Recombinant DNA

• DNA being hydrophilic cannot pass through cell membranes, so bacteria's cell membrane is modified so that it can take DNA easily. Such bacterial cells are called **competent cells.**
•They are made competent by treating them with divalent cations such as Ca++ Then the cells are incubated on ice followed by heat shock in which brief exposure at 42°C is given. This enables bacteria to take up recombinant DNA.
• Another way is injecting DNA directly into nucleus of animal cells with the help of **micro-injection**
* A **biolistic or gene gun** is also used in plants where gold or tungsten particles are coated with DNA and then are bombarded into cell.
• Use of a disarmed pathogen is another method by which recombinant DNA is transferred into host.

11.Process of Recombinant DNA Technology

This is Carried Out in Following Steps:

>Isolation of genetic material (DNA)

• Purified DNA is isolated by treating bacterial or plant or animal cells with following enzymes to degrade cell wall and or cell membrane and other components

#Lysozyme for bacterial cell wall
 # Cellulase for plant cell wall
#Chitinase for fungal cell wall.
#Protease To degrade proteins such as histones
#Ribonuclease To degrade RNA

• Then pure DNA is precipitated by adding chilled ethanol

> Cutting of DNA at Specific Locations

•Both foreign and vector DNA is incubated with restriction enzymes under optimal conditions and then gel electrophoresis is done to check the progression of digestion.
•The desired DNA is joined with vector DNA with enzyme **ligase**. This results in recombinant DNA

> Amplification of Gene of Interest using Polymerase Chain Reaction (PCR)

• Multiple copies of gene of interest are synthesized in vitro

• DNA template and two acts of primers, which are small, chemically synthesize oligonucleotides that are complementary to the regions of DNA,

Taq polymerase enzyme are used which make multiple copies in three steps.

•**Denaturation**: Two strands of DNA separates by heating DNA

•**Annealing** primers attach at complementary positions on DNA.

•**Extension**: Taq DNA polymerase adds deoxynucleotides and a new strand of DNA is synthesized**.**

 # Practice Figure 11.6 PCR (Ref . NCERT)

•The steps are repeated upto 30 cycles and -1 billion copies are produced.

• Taq polymerase is thermo-stable DNA polymerase isolated from bacterium ***Thermus aquaticus*** which remain active during high temperature.

> Insertion of Recombinant DNA into the Host cell/organism

• Vector carrying foreign DNA is then inserted into recipient cell by making it competent The transformants are then selected using selectable marker like ampicillin-resistance gene or gene of B-galactosidase enzyme.

> **Obtaining Foreign Gene Product**

• The transformed cells are cultured in large scale to express foreign protein ca**lled Recombinant proteins.**

> Downstream processing

• All The process to which a product is subjected to, before being marketed as a finished product called downstream processing. **It include:**

(i) Separation of the products from the reactor

(ii)Purification of the product.

(iii) Formulation of the product with suitable preservatives.

(iv) Quality control testing and clinical trials in case of drugs.

> Bioreactors: Raw materials are biologically converted into specific products.

•**Capacity**: (100-1000) litres

A bioreactor has the following components:

- An agitator system
- An oxygen delivery system
- Foam control system
- Temperature control system
- pH control system
- Sampling ports to withdraw cultures periodically

#Practice Figure 11.7 (a) & (b) Ref. NCERT

PRACTICE QUESTIONS

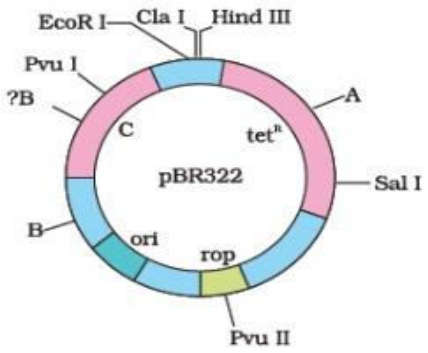
Q.1: **Assertion**: Enzyme chitinase is used for isolation of DNA from yeast cells, but not in case of plant cells.
Reason: fungal cell wall is made of Titan and plant cell wall is made up of Cellulose.

(a) both assertion and reason are true, and the reason is correct explanation of the assertion.
(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is falls.
(d) Both assertion and reason are false.

Q.2: **Assertion**: special methods are necessary to incorporate the alien or recombinant DNA into the host cells.
Reason: DNA is a hydrophobic molecule.

(a) Both assertion and reason are true, and the reason is correct explanation of the assertion.
(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Q.3: (i) Name the selectable marker in the cloning vector pBR322 ? Mention the role they play.
(ii) Why is the coding sequence of an enzyme B-galactosidase is a preferred selectable marker in comparison to the ones named above.
Q.4 Why does the **insertional inactivation** method to detect recombinant DNA be preferred to **antibiotic resistance** procedure?
Q.5: (i) Why Must a cell be made 'competent' in biotechnology experiments?How does calcium ion helps in doing so?
(ii) State the role of 'biolistic gun' in biotechnology experiments?
Q.6: What is Biotechnology? Briefly explain the Principles of Biotechnology?
Q.7: What are the properties of a good vector?
Q.8: Name the regions A, B, and C in the given cloning vector along with their roles:



Q.9: What is a polymerase chain reaction? What are the steps involved? Mention its applications.
Q.10: Mention any three vector-less methods that are used to introduce recombinant DNA into a competent host cell.
Q.11: Name the enzymes which are considered as molecular scissors in biotechnology.Mention two classes of these enzymes along with the role they perform.
Q.12: Write brief note on the following:
(i) Selectable marker
(ii) Insertional inactivation
(iii) Downstream Process
(iv) Palindromic sequence
Q.13: In the given process of separation and isolation of DNA fragments, some of the steps are missing, Complete the missing steps –
(a) Digestion of DNA fragments using restriction endonucleases
(b) ——————————————
(c) Staining with ethidium bromide
(d) ——————————————
(e) Elution
(f) ——————————————-
Q.14: What is Bioreactor? What are the advantages of Stirred tank Bioreactor over sparged stirredBioreactor . Show diagrammatically a simple Stirred tank Bioreactor?
Q.15: write the three critical research areas of biotechnology.
Q.16: (i) Explain the basis on which the gel electrophoresis technique works.
(ii)Write any two ways the products obtained through this technique can be utilised.
Q.17: Name and explain the technique used for separating DNA fragments and making them available for biotechnology experiments.
Q.18: (i) Draw schematic diagrams of segments of a vector and foreign DNA with the sequence of nucleotides recognised by **EcoRI.**
(ii**)** Draw the vector DNA segment and foreign DNA segments after the action of **EcoRI** and label the sticky end produced.

Chapter-12 : BIOTECHNOLOGY & ITS APPLICATION

Revised Syllabus: Application of biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, biopiracy and patents.

Biotechnology is making Genetically modified organisms-microbes, plants, animals for industrial production of Bio-Pharmaceuticals and other useful products.

Applications –

i) Diagnostic & therapeutic
ii) Genetically modified crops
iii) Waste treatment
iv) Energy production
v) Food processing
vi) Bioremediation
vii) Application in agriculture

Genetically modified organisms(GMO)-Plants, bacteria, fungi, animals.whose genes are altered by manipulation.

•Transgenic crops(GMO) -Crops contain or express one or more useful foreign genes.

Advantages -i) More tolerant to stresses (heat, cold, draught).

ii) Pest resistants GM crops, reduce the use of Chemical pesticides. Eg-BT-Cotton

iii) Reduced post harvest losses. Eg- Flavr savr tomato

iv) Enhance nutritional value of food. eg.- Golden Rice (Vitamin A enriched).

v) Increased efficiency of mineral use.

•PEST RESISTANT PLANTS

Bt- cotton -- BT stands for

Bacillus thuringiensis (Soil Bacteria). Bacterium produces proteins (Crystal Protein-cry I AC, cry II AB). A crystalliane insecticidal protein that kills the insects.Hence cry-Genes have been introduced in plants to produce crystal proteinsas Protoxin (inactive toxin), which is converted to toxins in alkaline medium (i.e. in the gut of insects) and cause death of the insect larva.

• **Protection of plants against nematodes** –Nematode ***Meloidogyne incognita*** infects tobacco plants & reduces yield. Specific genes (DNA) from nematodes introduced into the plants using ***Agrobacterium tumifecians*** (soil bacteria). Genes produce sense and antisense complementary RNA. Act as dsRNA and initiates **RNAi (RNA interference)** and silences the specific mRNA. Complementary RNA neutralizes the specific RNA of nematodes by a process called RNA Interference and parasite cannot live in transgenic host.

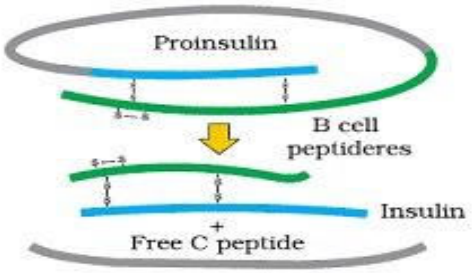
•In medicine- genetically engineered insulin—

rDNA technology was applied in therapeutic application by generating genetically engineered insulin for human.

In 1983, Eli Lilly, an American company prepared 2 DNA sequences coding for chains A & B.

Human insulin consists of two short Polypeptide chains A & B being linked by disulphide bridges.In human, Insulin secreted as Prohormone containing C peptides that is removed during maturation.

In rDNA technique, insulin could be generated by preparing two separate DNA sequences of A & B chain which are incorporated into plasmids of ***E. coli*** to produce insulin chains.



•Gene therapy

Molecular diagnosis --

Gene therapy involves correction of the gene defects in child or embryo.

Adenosine deaminase deficiency (ADA) is a kind of immune-disorder caused by deletion of gene coding for ADA.

•It can be cured by bone marrow transplantation or enzyme replacement therapy.

• A functional ADA-cDNA(through Retrovirus) is introduced in lymphocyte culture for genetic infusion and transferred to the patient body for normal functioning.

• **Early & accurate detection of diseases** substituting conventional diagnostic tecniques may be done by following methods:

PCR (Polymerase chain reaction): Short stretches of pathogenic genome is amplified for detection of suspected AIDS, Cancer or genetic disorder.

ELISA (Enzyme Linked Immunosorbent Assay) used to detect AIDS based on detection of antibodies produced against antigen of pathogen.

•Transgenic Animals

Animals with manipulated genes or a foreign gene to be expressed are called as transgenic animals.

They are useful for

1.Study of disease– to know how genes contribute to development of disease.

2. **Biological products**–To use proteins for treatment of disease, such as human protein (alpha – 1-antitrypsin) used to treat emphysema.

3. To verify vaccine and

4. Chemical safety testing

5.Normal physiology and development

Ethical Issues:

•Biopiracy -- Some organizations and multinational companies exploit or patent bioresources of other nations without proper authorization. Indian patent bill is there to prevent such unauthorized exploitation.

•Biopatent- A patent is the right granted by a government to an inventor to prevent others from making commercial use of his invention (for Biological entities).

•GEAC- (Genetic Engineering Approval Committee), which will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.

PRACTICE QUESTIONS

Biotechnology and its applications

One mark questions

Q.1

Assertion: retroviruses are used efficiently as vectors in rDNA technology experiments.

Reason: ***Agrobacterium tumefaciens*** is the most commonly used vector for transformation of plant cells.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Q.2:

Assertion:The insulin produced using recombinant DNA technology is more advantageous than the insulin extracted from pancreas of slaughtered cattle and pigs.

Reason:Insulin obtained from animal source causes allergy.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Q.3:

Assertion: ' **cry'** is the gene which codes for Bt-toxin.

Reason: **CRY** is the protein coded by **'cry'** genes.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Q.4:

Assertion:Golden rice is a transgenic variety of rice Which is nutritionally very advantageous.

Reason:This variety is rich in Vitamin A.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Two marks questions

Q.1: why does BT toxin not kill the bacterium that produces it, but kill the insects that ingest it?

Q. 2: list any four advantages of genetically modified plants?

Q.3: What does 'cry' genes in ***Bacillus thuringiensis*** code for ? State its importance in cotton crop.Also mention the name of cry genes that control cotton bollworm and corn borer respectively.

Q.4: : What is Gene therapy? Name the first clinical case in which it was used.

Q.5: why is proinsulin so called? How is insulin different from it.

Q.6: expand the following and mention one application of each:

(a) PCR
(b) ELISA

Q.7: what is biopiracy? State the initiative taken by the Indian Parliament against it.

Q.8: mention any four benefits derived from transgenic animals.

Q. 9:Describe the responsibility of **GEAC**, set up by the Indian government.

Q.10: (a) name the first transgenic cow developed.
(b) Explain the improvement in the quality of the product produced by it.

Three marks questions

Q.1: how has **RNAi** technique helped to prevent the infestation of roots in tobacco plants by a nematode ***Meloidogyne incognita***?

OR

Name the host plant and its part that ***Meloidogyne incognita*** infects. Explain the role of ***Agrobacterium*** in the production of dsRNA in the host plant.

Q.2: what is meant by **ADA deficiency**? How is Gene therapy a solution to this problem? Why is it not a permanent cure?

Q.3: (a) Why are transgenic animals so called?
(b) Explain the role of transgenic animals in
(i) Vaccine safety and (ii) biological products with the help of an example each.

Q.4: Name the organism that is the source of thermal stable DNA polymerase. Mention its role in genetic engineering.

Q.5: How did **Eli Lilly** synthesise the human insulin? Mention one difference between this insulin and the one produced by the human pancreas.

Chapter 13: Organism and Populations

Revised Syllabus: Organisms and environment: Habitat and niche, population and ecological adaptations; population interactions - mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution.

*Biome: biome is a large regional unit constituting of a major vegetation zone and associated fauna . Annual variation in the intensity, duration of temperature and precipitation for the formation of major biomes like :Desert, Grassland, Tropical forest,Temperate forest,Coniferous forest,Arctic & Alpine Tundra.

Fig 13.1 NCERT BOOK

*Niche : The ecological niche of an organism represent the range of conditions that it can tolerate the resourses,it utilises and its functional role in the ecological system.Each species occupies a distinct niche and no two species occupy the same niche.

* Eurythermal : Organisms that can tolerate wide range of temperature.

Stenothermal : Organisms that live in a narrow range of temperature.

*Euryhaline : Organisms that can tolerate wide range of salinity.

Stenohaline: Organisms that live in narrow range of salinity.

*Homeostasis: is the ability of an organism to maintain the constancy of its internal environment (constant body temperature).

* Regulate: Some Organisms that have the ability to maintain their constant body temperature and Osmotic concentration.Ex.All birds and mammals.

* Conform : The Organisms that can not maintain their constant body temperature with respect to their surrounding environment.Ex.

Plants & 99%animals .

*The smaller Organisms have larger surface area relative to their volume,and to tend to lose body heat at a faster pace.Hence small bodied animals are rarely found in the polar regions.

*Migration: is the ability of an organism to move away temporarily from the stressful habitat to a more hospitable habitat.Ex. Every winter the Keolado National Park Bharatpur in Rajasthan is host the migratory birds coming from Siberia &cold northern regions.

*Suspend : involve suspension of metabolic activities of Organisms during unfavourable conditions.It includes:

Hibernation (winter sleep) .Ex .Polar bear

Aestivation (summer sleep) .Ex.

Snails & Fishes

Diapause(stage of suspended development) .Ex.Zooplankton

*Adaptations:

Adaptations is the process of adjustment which enables the organism to survive and reproduce in its habitat.

Three types of adaptations:

1.Physiological Adaptation: Ex.Kangaroo rat in north American desert capable of meeting all its water requirements through fat oxidation and concentrated urine.

2.Morphological adaptations: ex.Presence of thick cuticle on leaf surface of desert plants .

3.Behavioural adaptations: ex.Desert lizard basking in the sun to absorb heat ,to maintain its body temperature.

*Allen's rule : Mammals from colder climates have shorter Ears and Limbs to minimise heat loss.
*Another ex.of physiological adaptations: Some Organisms have
this type of adaptation which allow them to respond quickly to an unfavourable situation.If you had ever been to any high altitudes like Rohtang pass& Mansrover in Tibet.You must experienced what is called altitude sickness.
Symptoms: Nausea ,fatigue ,heart palpitations.
It is due to low atmospheric pressure of high altitudes that the body does not get enough oxygen.
After sometime we get acclimatised by producing : producing more RBC , Reducing oxygen binding capacity and increasing breathing rate.
*Population has certain attributes:
Birth rate and death rate per capita ,Sex ratio and age distribution .Ex.
If 4 individuals in a lab . population of 40 fruitflies died during a specified time interval ,a week ,the death rate in population during that period is 4/40=0.1 individual per fruitfly per week.
*Age pyramids : Graphic representation of different age group found in human population with pre - reproductive group at base ,reproductive group in middle and post - reproductive group at the top is called Age - Pyarmid .Fig.13.4 NCERT BOOK
Expanding population : shows more no. of individuals in pre - reproductive age group.
Stable population: has almost equal no.of individuals in the pre - reproductive and reproductive age group ,converging at the post reproductive age group.
Declining population: has lesser no.of individuals in the pre- reproductive age group and greater no.of individuals in the reproductive age group.
*Population density: designated as N .Number of individuals per unit area ,Not only no.but Biomass also more meaningful for population .
The Tiger census in our National parks and tiger reserves is often based on pug marks and fecal pellets of Tigers.
*Population Growth : population density fluctuates due to -
1.Natality (B) - no.of births
2.Mortality (D) - no.of deaths
3.Immigration (I)-no.of individuals of same species have to come into habitat from elswhere .
4.Emigration (E) - no.of individuals of population who left habitat and gone elsewhere.
If N is population density at time t ,then its density at time t+1 is
$N_{t+1}=N_t + [\{B+ I\} - \{D+ E \}]$
N will increase if [B+ I] is more than [D+ E].
*Population Growth Models :
1.Exponential growth :
When resources are unlimited in habitats ,then population grows in an exponential or geomatric fashion.
If population size N ,
Birth rate per capita b ,Death rate per capita as d ,
Then increase or decrease in N during unit time period t (dN/dt)
will be :
$dN/dt= (b- d)\times N$

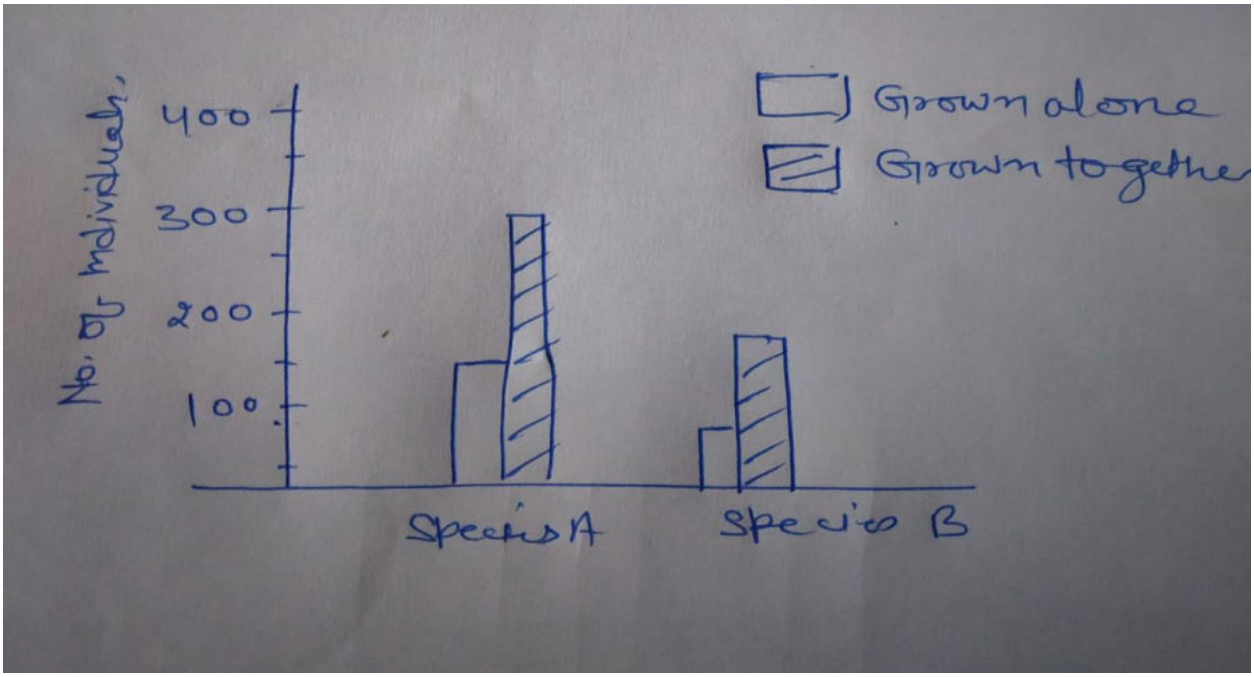
Let (b - d) = r
Then dN /dt = rN
Here" r" is intrinsic rate of natural increase .
When we plot a graph between N and in relation to time t ,results J - shaped curve is obtained .We can derive integral form of Exponential growth equation as
Nt= N0 e rt
Where Nt = population density after time t .
N0 = population density at time zero .
r= intrinsic rate of natural increase
e= the base of natural logarithms (2.71828).
Fig.13.6 NCERT BOOK Population growth curve :
A .when responses are not limiting the growth ,plot is exponential.
B.when response are limiting the growth,plot is logistic.
K. is carrying capacity.
2. Logistic Growth (Sigmoid growth curve):
A population growing in a habitat with limited resources show initially a lag phase ,followed by the phases of increase and decrease and finally the population density reaches the carrying capacity.A plot of N in relation to time (t) results in a S or sigmoid curve.This type of population growth is called Verhuslst - Pearl Logistic Growth as given in equation form:
dN/ dt= r N { K-N/K }
Where N= population density at a time t .
r= intrinsic rate of natural increase K= carrying capacity
*Population and Interactions :
Table 13.1NCERT BOOK
Interspecific interactions arise from interaction of population of two different species.

+ = Sign.for beneficial interaction.
- = Sign for detrimental
0 = neutral interaction

1.Predation : Interaction between species involving killing and consumption of prey is called predation.
Predator help in maintaining species diversity in a community as ,by reducing the intensity of competition among competing prey species .In American Pacific coast the starfish Pisaster is important predator,in experimental field ,when all starfish were removed,more than 10 species of invertebrates became extinct within a year ,because of interspecific competition.
Plants unlike animals,they cannot run away from their predators so plants have evolved variety of morphological and chemicals defence as thorn in Cactus ,Acacia and in Calotropis produced highly poisonous Cardiac glycosides,Animals sick when they are eaten ,inhibit feeding or digestion,disrupt its reproduction or even kill it.
2.Competition :
It occur when closely related species compete for the same resources that are limiting. But this is not entirely true. Totally unrelated species today also compete for the same resources.Ex. In South American lake visiting flamingos and resident fishes compete for their common food the zoo plankton in the lake. Secondly resources need not be a limiting for competition to occur.

In interference competition: competition is best defind process in which fitness of one species is significantly lower in presence of another species.Ex.Abingdon tortoise in Galapagos islands became extinct within decade after Goats were introduced on the island due to greater browsing efficiency of the goats.
Competitive release: A species whose distribution is restricted to small geographical area because of the presence of a competitively superior species is found to expand its distributional range dramatically when the competing species is experimentally removed.Ex.
Connell' elegant field experiments showed on rocky sea coasts of Scotland ,larger & superior Barnacle Balanus dominates the intertidal area and excludes smaller Barnacle Chathamalus from that zone .
Gause ' s Competitive Exclusion Principles: Two closely related species competing for the same resources cannot coexist indefinitely and the competitively inferior one will be e eliminated eventually.
3.Parasitism :
Parasitism is a kind of relationship between two species in which one derives its food from the host.
Brood parasitism: is seen in birds in which the parasite bird lay its egg in the nest of its host and lets the host incubate them .ex .Koel laying its eggs in Crow 's nest.
4.Commenlism : This is the interaction in which one species benefits and the other is neither harmed nor benefitted.Ex. clown fish living among tentacles of sea animal, pilot fish Remora accompanies shark, egret and grazing cattle
5.Amenlism : interaction between two different species in which one species is harmed and the other is is neither benefited nor harmed .Example penicillium whose toxin kill many bacteria is neither benefited nor harmed .
6. Mutualism: this interaction confer benefits on both the interacting species.Ex.
Mycorrhizae are association between fungi and roots of higher plants .Fungi help plants in absorption nutrients from soil while plants in turn provide the fungi with energy yielding carbohydrates.
Plants - Animals interaction often involve co - evolution of the mutualists .The evolution of the flower and its pollinators species are tightly linked with one another.ex.
Fig species can be pollinated by its partners wasp species and no other species.female wasp uses the fruit not only as an egg laying site but uses the developing seeds within fruit for nourishing its larvae .
In Orchids shows there is relationship with pollinators insects Bees & Bumblebees .The Mediterranean orchid Ophrys employs sexual deceit to get pollination done by a species of bee.One petal of its flower bear an uncanny resemblance to the female of the bee in size,colour and marking .The male bee is attracted to what it perceives as a female,pseudocopulates with the flower ,and in that process pollinates the flower.
Important Questions :
1 mark questions
Q1.What is Allen's rule?
Ans. Mammals living in colder region have a short ears and limbs to minimise heat loss.
Q2. "Cuckoo bird lays egg in the nest of crow"which type of interaction is shown in this relation?
Ans . Brood parasitism

Q3. Why are calotropis plants not browsed by herbivores?
Ans. Because calotropis plants produces a highly poisonous glycoside that is a cardiac poison and thus directly kill the Predator.
Q4. What does ecological niche of an organism represent?
Ans. The ecological niche of an organism represent the range of condition that it can tolerate, the resources it utilizes,and its functional role in the ecological systems.
*Assertions type questions :
In each of the following questions two statements are given ,one is assertion (A) and other is Reason(R).For the (A) and (R) statements mark the correct answer as-
(a) if both A and R true and R is the correct explanation of A.
(b) If both A and R are true and R is not the correct explanation of A.
(c)If A is true but R is false .
(d)If both A and R are false.
Q5.Assertion: Inter specific competition is the only potant force in organic evolution.
Reason : Unexceptionally two closely related species competing for the same resources cannot coexist indefinitely.
A. B. C. D
Ans .D
Q6.Read the following and answer any four questions from 17(i) to17 (v) given below:
Two insect species were used in the laboratory experiment. For one treatment , both species were grown by themselves in separate chamber on a suitable food source. For second treatment the two species were grown together in the same chamber on the same type of amount of food as in the first treatment. The given graph shown the result (the number of individual of each species in the two treatment) the end of the experiment.



(i) The two species A&B should be classified as
a)Competitors b)mutualist
c) predators of pathogen d)commensals

Ans : b
(ii) Which of the following is correct regarding the experiment result?
a) species A grown more it is grown alone
b) species B grand more if it is grown alone
c) species B grown more than the species A.
d) both species A&B grown more when they are grown together.
Ans.d
(iii)which of the following could be another example of the given interaction?
a) interaction between algae and fungus
b) interaction between sea anemone and clown fish
c) Interaction between tick bird with rhinoceros
d) interaction between crocodile with bird
Ans.a
(iv) the association between two species A& B is a type of association where
a) both species are harmed
b) both species are benefited
c) one species is harmed and other is benefited
d) one species is harmed and other is unaffected
Ans .b
(v) Assertion: interaction between two species A& B represent Commenlism.
Reason: interaction between species A& B result negative effects on growth and survival of both the Population

a) Both assertion and reason are true, and reson is the correct explanation of assertion.
b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
c) Assertion is true but reason is false.
d) Both assertion and reason are false.

Ans.d
Q7. Why do people suffer from altitude sickness after reaching the the higher altitude reason? How does their body get acclimatised After couple of days?
Ans. If a person moves to higher altitude without taking rest, he will Suffer from altitude sickness which occur due to low atmospheric pressure,the body does not get enough oxygen .
Symptoms of altitude sickness are nausea , fatigue and heart palpitations. Body compensates low oxygen availability during rest by increasing RBC production, decreasing the binding capacity of hemoglobin with oxygen and increasing breathing rate.
Q8..Some Organisms suspend their metabolic activities to survive in unfavourable conditions.Explain with examples?
Ans .Polar bear hibernate during winter.
Snails and Fishes undergo aestivation during summer.
Zooplanktons suspend their metabolic activities and enter into the state of diapauses.
Seeds of higher plants undergo the stste of dormancy.
Q9..Why very small animals are rarely found in polar regions?

Ans . Small animals have larger surface area relative to their volume,so they tend to lose body heat very fast when it is cold outside.To survive they have to expand much energy to generate body heat through metabolism.Thus polar regions are not suitable for such animals.
Q10..Why do Clown fish and Sea anemone pair up? What is this relationship called?
Ans : Clown fish lives within the stinging tentacles of Sea anemone and gets protection from its predators.The Sea anemone is neither benefited nor harmed by the interaction with the fish.This relationship is called Commenlism.
3 marks questions :
Q11.What is Gause's principle of competitive exclusion and competitive release?
Ans . Principle of competitive exclusion of Gause(1934) state that two closely related species competing for the same resources cannot coexist indefinitely and the competitively inferior one will be eliminated eventually. This may be true you if resources are limiting.
Competitive release: A species whose distribution is restricted to a small geographical area because of the presence of a competitively superior species , is found to expand it's distributional range dramatically when the competing species is experimentally removed .
Q12. (a)"Analysis of age pyramids for human population can provide important inputs for long term planning strategies ".Explain?
(b) Sketch three different age pyramids for human population and mention the one which is ideal for human population and why?
Ans : (a)For human population, the age pyramids generally show age distribution of males and females in a combined diagram. The shape of the pyramids reflect the growth status of the population whether it is growing, stable or declining.With
Increasing population, the strategies should be planned to allocate resources in such a manner that each one gets equal opportunities for the livelihood, this can be done by creating more jobs opportunities, infrastructural facilities to educate children and by investing more on medicinal facilities and transport facilities.
(b)Fig.13.4 NCERT.BOOK
Pyramid" stable" is ideal for human population because it will be helpful for planning future welfare strategies. It will also help in better survival of human population.
Q13. Name the type of interaction seen in each of the following examples:
(a) Disappearance of smaller Barnacles when Balanus dominated in the coast of Scotland.
(b) Wasp pollinating fig's inflorescence.
(c) Clownfish living among the tentacles of sea anemone.
(d) Mycorrhizae living on the roots of higher plants.
(e) Orchids growing on a branch of of mango tree.
Ans.(a) competition
(b) mutualism
(c) Commenlism
(d) mutualism
(e) Commenlism

Chapter 15: Biodiversity and conservation

Revised Syllabus: Biodiversity - Concept, patterns, importance; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, Sacred Groves, biosphere reserves, national parks, wildlife, sanctuaries and Ramsar sites.

Biodiversity term was coined by Edward Wilson. Biodiversity refers to the sum total of diversity that exists at genetic, species and ecosystem level of biological organisation.

IUCN : International union for conservation of nature and natural resources

Global species diversity : according to IUCN the total number of plant and animal species is over 1.5 million.

India has 1,42,000 known species of plants and animals.

Levels of biodiversity:-there are three interrelated levels of biodiversity.

1) Genetic diversity : The measure of variety in genetic information contained in the organisms. It helps in speciation.

2)) Species diversity: Varities in the number and richness of the species of a reason.

3) Ecological diversity : Variety in the types of ecosystem.

Patterns of biodiversity: biodiversity is not uniform throughout the world, it depends on latitude gradients and species – area relationship.

Latitudinal gradients :-*Biodiversity increases when we move from pole to equator.

- Tropical areas have more species than temperate or polar areas.
- Columbia located near the equator has nearly 1400 species of birds while New York has 105 species and Greenland near poles has only 56 species.
- Forests in tropical areas like Equador has 10 times as many species then forests of temperate region..
- Reasons for greater biological diversity in tropical areas:
    a) Tropical latitudes have remained relatively undisturbed for millions of years.

b)Tropical environments are less seasonal and arrelatively more constant it and predictable which results in more niche speciation and more species diversity

c) Tropical areas have greater solar energy exposure resulting higher productivity and greater diversity
    (1) Species- area relationship
        - German naturalist and geographer Alexander von Humboldt observed that within a reagion , species richness increased with increasing explored area but up to a limit.
        - The relationship between species richness and area for a wide variety of taxa (like vascular plants, birds ,bats and freshwater fishes)appears as a rectangular hyperbola.

- Only a logarithmic scale the relationship is a straight line described by by the following equation:

  Log S = log C + Z log A

  Where S = Species richness
  A = Area
  Z = Slope of the line (regression coefficient)
  C= Y-intercept
- The value of Z lies in the range of 0.1 to 0.2 to regardless of taxonomic group or the region.
- The species area relationship among very large areas like the entire continents has much steeper slope of the line (Z values of the range of 0.6 to 1.2)
- Refer to NCERT Figure No.. 15.2 page no. 262

Importance of Species diversity to the Ecosystem

- According to Ecologists communities with more speciesmore stable than those with lesser species.
- Characteristics of a stable community
  a. Productivity should not very too much from year to year
  b. It should be resistant to occasional natural and man-made disturbances.
  c. It should be resistant to invasions by alien species
- Rivet popper hypothesis proposed by Paul Ehrlich explains the importance of biodiversity for survival of species..

- According to rivet popper hypothesis the ecosystem is assumed to be an airplane and the species to be the rivets joining all parts together, if every passenger pops a rivet to take home with time as more revets are removed the plane becomes weak and fatal to the life of other species.

Causes of biodiversity losses (The Evil Quartlet)

1. Habitat loss and fragmentation : destruction of habitat is the primary cause of extinction of species. For example tropical rainforest is being destroyed faster. Amazonian rainforest is called the lungs of the planet is being cut for cultivating soybeans.
2. Over exploitation : many species extinctions are due to over exploitation by humans
3. Alien species invasions : when alien species are introduced in new habitat some of them turn invasive and cause decline or extinction of indigenous species ,example lantana and water hyacinth posed a threat to native species.
4. Co -extinctions : when is species becomes extinct the plant and animal species associated with it in an obligatory manner also become extinct.

Reasons for biodiversity conservation

1. Narrowly utilitarian : Humans drive a number of direct economic benefits from nature like food ,fibres ,firewood ,medicines etc.
2. Broadly utilitarian : These include the ecosystem services that nature provides , like production of oxygen through photosynthesis ,elimination of crops etc.
3. Ethical reasons : Every species has an intrinsic value even if it may not B of any current economic value to us. We have a moral duty to care for their well being and pass on our biological legacy in good order to future generations.

Conservation strategies

- Biodiversity can be conserved by protecting its whole ecosystem.
- For conservation of biodiversity there are two basi approaches :-
  (2) In- situ conservation
  (3) Ex- situ conservation

In- situ conservation (on site conservation)

This approach involves protection of species in their natural habitat

- Sacred Groves : Tracts of forests are set aside for worship. All the trees and wildlife within are given total protection by the local people. Example:- Khasi and Jaintia hills in Meghalaya. Aravalli hills of Rajasthan.
- Biodiversity Hot Spots : these are areas with high level of species richness , biodiversity and high degree of endemism. Out of 34 hotspots in world, 3 occurs in India i.e. Western Ghats and Sri Lanka, Indo- Burma (North- East India) and Himalayas.
- Protected areas : Ecological or Biogeographical areas where biological diversity with natural and cultural resources are protected. E.g. National parks , Sanctuaries and Biosphere reserves.
- Ramsar sites : Wetlands which are considered to be of international importance. The 26 Ramsar sites in India . e.g. Chilka lake, Sambhar lake etc.
- Ex-situ conservation (Off- site conservation)

Conservation and protection of selected rare plants or animals in places outside their natural habitat.

- Off site collections :Live collection of wild and domesticated species e.g. Botanical parks and Zoological parks.
- Gene banks : maintain stock of viable seeds live growing plants tissue culture and Frozen germplasmwith the whole range of genetic variability.
- Cryopreservation: preservation of seeds embryos at - 196 C° in liquid nitrogen.

International efforts for biodiversity conservation:

- World conservation union : provides leadership, approach and expertise in the area of conservation.
- The Earth Summit : historical convention on biological diversity held in 1992 at Rio de Janeiro Brazil.
- The world summit on sustainable development : Held in 2002 in Johannesburg ,South Africa to pledge to reduce biodiversity losses at global and local levels.

The biological diversity act 2002

The biological Act, 2002 is the Indian response to the conservation of biological diversity the main objectives of the Act are:

1. Conservation of biological diversity
2. Sustainable use of its
3. fair and equitable sharing of the benefits arising out of utilisation of genetic resources.

Important questions:--

One Mark Questions :-

Q.1. Write the importance of cryopreservation in conservation of biodiversity.

Q.2. Why is tropical environment able to support greater species diversity?

Q.3. What is a Hot spot ?

Q.4. What is Red Data Book ?

Q. 5. What is the expanded form of IUCN ?

Q. 6. Name the important components of biodiversity.

Q.7 . What is meant by alien species?

Q. 8. What are seed banks ?

Two mark Questions :-

Q.1.List any four techniques where the principle of Ex-situ conservation of biodiversity has been employed.

Q.2. List four causes of biodiversity loss.

Q.3. List the features that make a stable biological community.

Q.4. Explain any two levels of biodiversity?

Q.5. Why should biodiversity be conserved ? List any two ethical arguments in support.

Three mark Question :-Q.1. Compare narrowly utilitarian and broadly utilitarian approaches to conserve biodiversity with the help of suitable examples.

Q.2. Explain " rivet popper hypothesis ‘ . Name the ecologist who proposed it?

Q.3. Explain giving one example how co-,extinction is one of the causes of loss of biodiversity. List the three other causes also(without description).

Five marks Questions:-

Q.1. (a) Why is there a need to conserve biodiversity?

(b) Name and explain any two ways that are responsible for the loss of biodiversity.

Q.2. (a) What are the two types of desirable approaches to conserve biodiversity? Explain with examples bringing out the differences between the two types.

Q.3. What is the difference between In-situ and Ex-situ approaches of conservation of biodiversity.