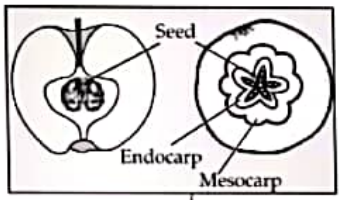
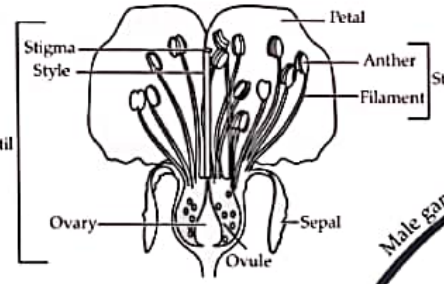
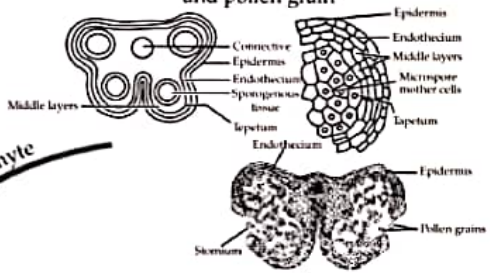
Sexual Reproduction in Flowering Plants

Seed dispersal help the species to colonize in other areas and many fruits have mechanisms for dispersal of seeds.





Stamen, Microsporangium and pollen grain

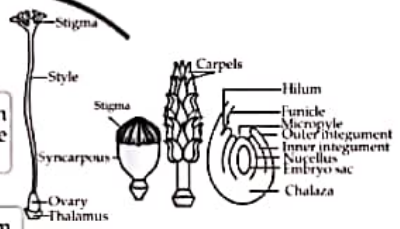


Flower Structure

Pre-fertilisation events

Male gametophyte

Female gametophyte



Pistil, megasporangium, embryosac

Pollination

Types

Autogamy: pollen transfer from the anther to the stigma of the same flower

Geitonogamy : pollen transfer from the anther to the stigma of anothe flower of the same plant.

Xenogamy : pollen transfer from anther to the stigma of a different plant.

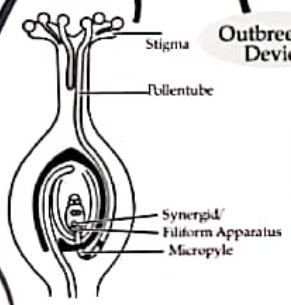
Agencies

- Abiotic
  - Wind (Anemophily) *e.g.* grasses;
  - Water (Hydrophile) *e.g.* Vallisneria, Hydrilla.
- Biotic
  - Insects (Entomophily) *e.g.* Yucca
  - Birds (Ornithophily) *e.g.* Daylilies

Outbreeding Devices

- Devices for promoting cross pollination
  - Self–incompatibility
  - Arrangement of anther and stigma at different positions.
  - Production of unisexual flowers (Decliny)
- Pollen release and stigma receptivity not synchronised.

Pollen-pistil interaction



It is a dynamic process involving pollen recognition followed by pollen tube growth.

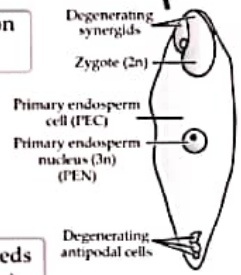
Artificial Hybridisation

It is one of the major approaches of crop improvement by using desired pollen grains for pollination.

Achieved by

- Emasculation
- Bagging

Double fertilization

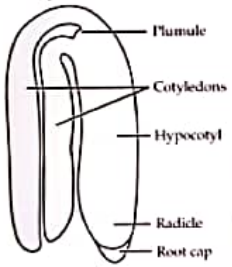


Syngamy + Triple fusion =Double fertilization.

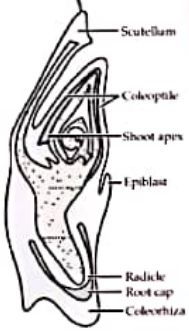
Post- Fertilization Events

Development of seed

- Dicot embryo



- L.S. of Monocot embryo.



- Albuminous seeds (Endospermic)
- Non-albuminous seeds (Non-endospermic)

Development of embryo

Development of endosperm

Formation of fruit

- False fruit
  - When parts other than ovary contribute to the fruit formation. *e.g.*: Apple
- True fruit
  - When fruit develops from ovary *e.g.*: Mango

It provides nutrition to growing embryo

- Consumed completely in seed *e.g.*; pea, groundnut,
- Persist in some seed *e.g.*; castor , coconut .

Special modes

- Development of fruit without fertilization
  - Parthenocarpy
  - Polyembryony
    - Occurrence of more than one embryo in a seed
  - Apomixis
    - Production of seed without fertilization

Significance of seed dispersal and fruit formation

Trace the Mind Map

- First Level
- Second Level
- Third Level

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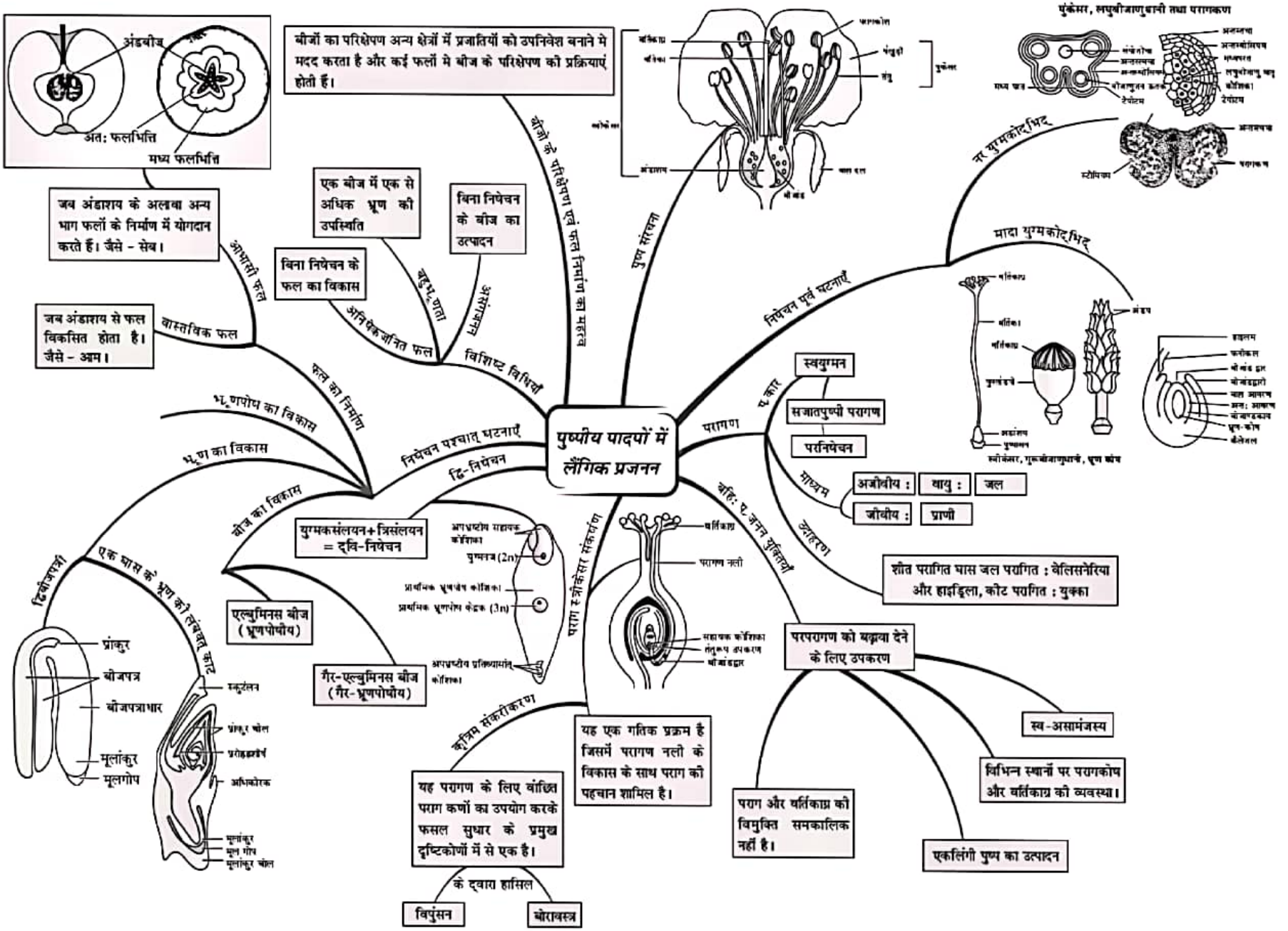
अध्याय - 2 पुष्पीय पादपों में लैंगिक प्रजनन



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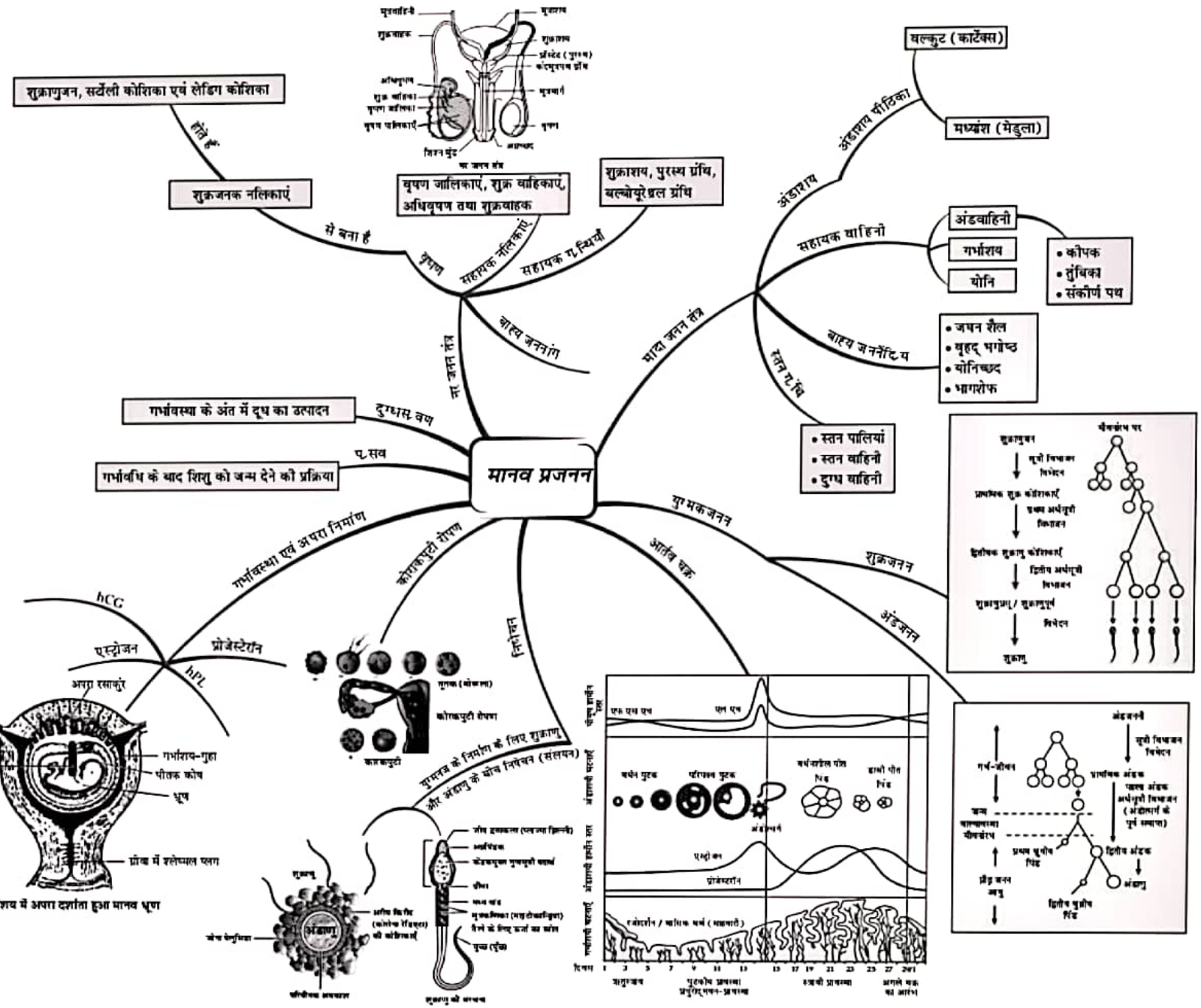
अध्याय - 3 मानव प्रजनन



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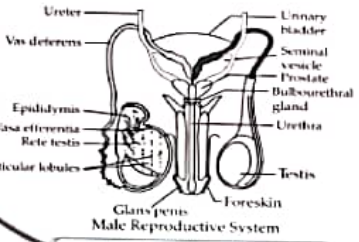
Human Reproduction

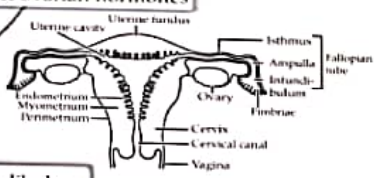
Male Reproductive System

- **Testes**
  - Seminiferous tubules (consist of)
    - **Spermatogonia :** forms sperms through meiotic divisions.
    - **Sertoli cells :** provide nutrition to germ cells.
    - **Leydig cells :** synthesise & secrete androgens
  - Testicular lobules (is made up of)
- **Accessory Ducts**
  - They store and transport the sperms from testis to urethra
  - Rete testis, Vasa efferentia, Epididymis & Vas deferens
- **Accessory glands**
  - Seminal vesicle, Prostate, Bulbourethral gland
  - Secretes: Seminal plasma (fructose, calcium & enzymes), Bulbo-urethral gland also lubricates the penis
- **External Genitalia** — penis, urethra, and scrotum.



Female Reproductive System

- **Ovaries**
  - Ovarian stroma
    - Cortex → Produces ovum & ovarian hormones
    - Medulla
- **Accessory Ducts**
  - Oviduct
    - Infundibulum
    - Ampulla
    - Isthmus
    - Uterine part
  - Uterus
  - Vagina
- **External Genitalia**
  - Mons pubis
  - Labia majora
  - Labia minor
  - Hymen
  - Clitoris
- **Mammary Glands**
  - Mammary duct
  - Lactiferous duct
  - Mammary lobes → Alveoli cells secrete milk
- **Lactation** — Production of milk towards the end of pregnancy



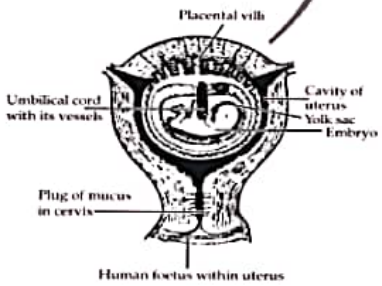
Parturition

- Oxytocin Hormone
- Process of giving birth to young ones after gestation period

Pregnancy and placenta formation

- Transports substances and gases to and from the embryo.
- Produces hormones hCG, hPL, estrogens, progestogens, relaxin

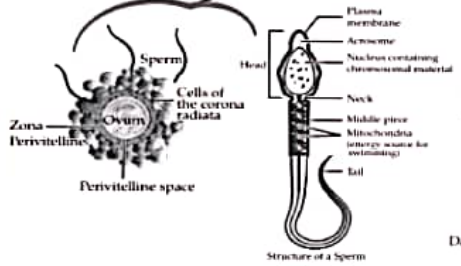
(Placenta function)



Blastocyst implantation

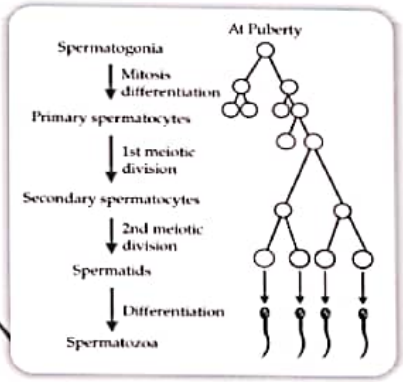
Fertilization

Fusion between sperm and ova to form zygote

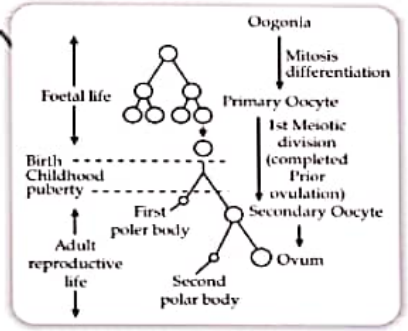


Gametogenesis

- **Hormones** — GnRH, LH, FSH, Androgens
- **Spermatogenesis**

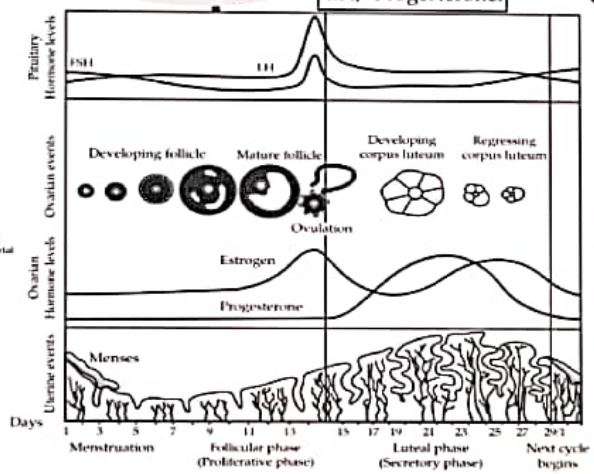


- **Oogenesis**



Menstrual Cycle

- **Hormones** — FSH, Estrogen, LH, Progesterone.



Trace the Mind Map

- First Level
- Second Level
- Third Level

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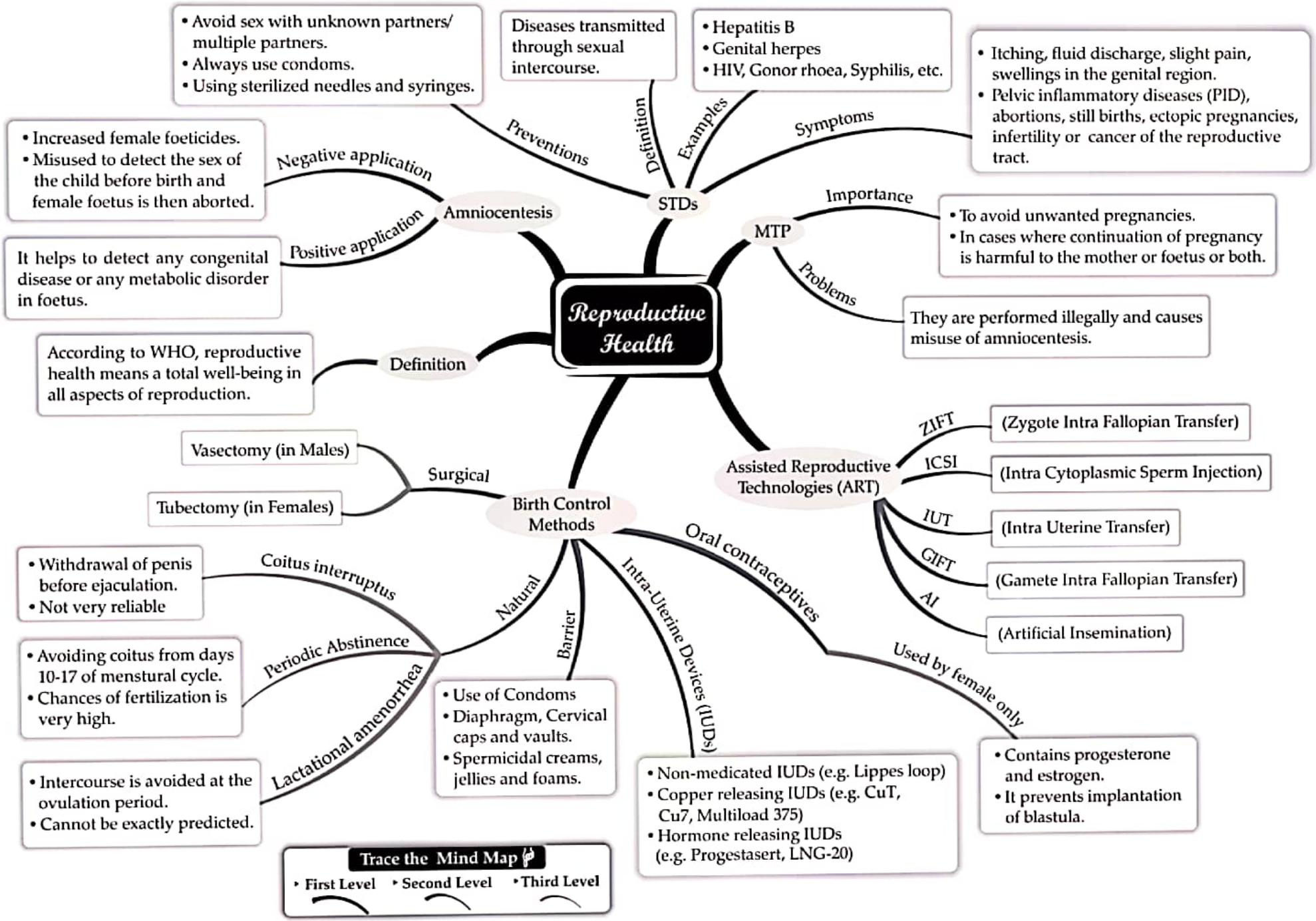

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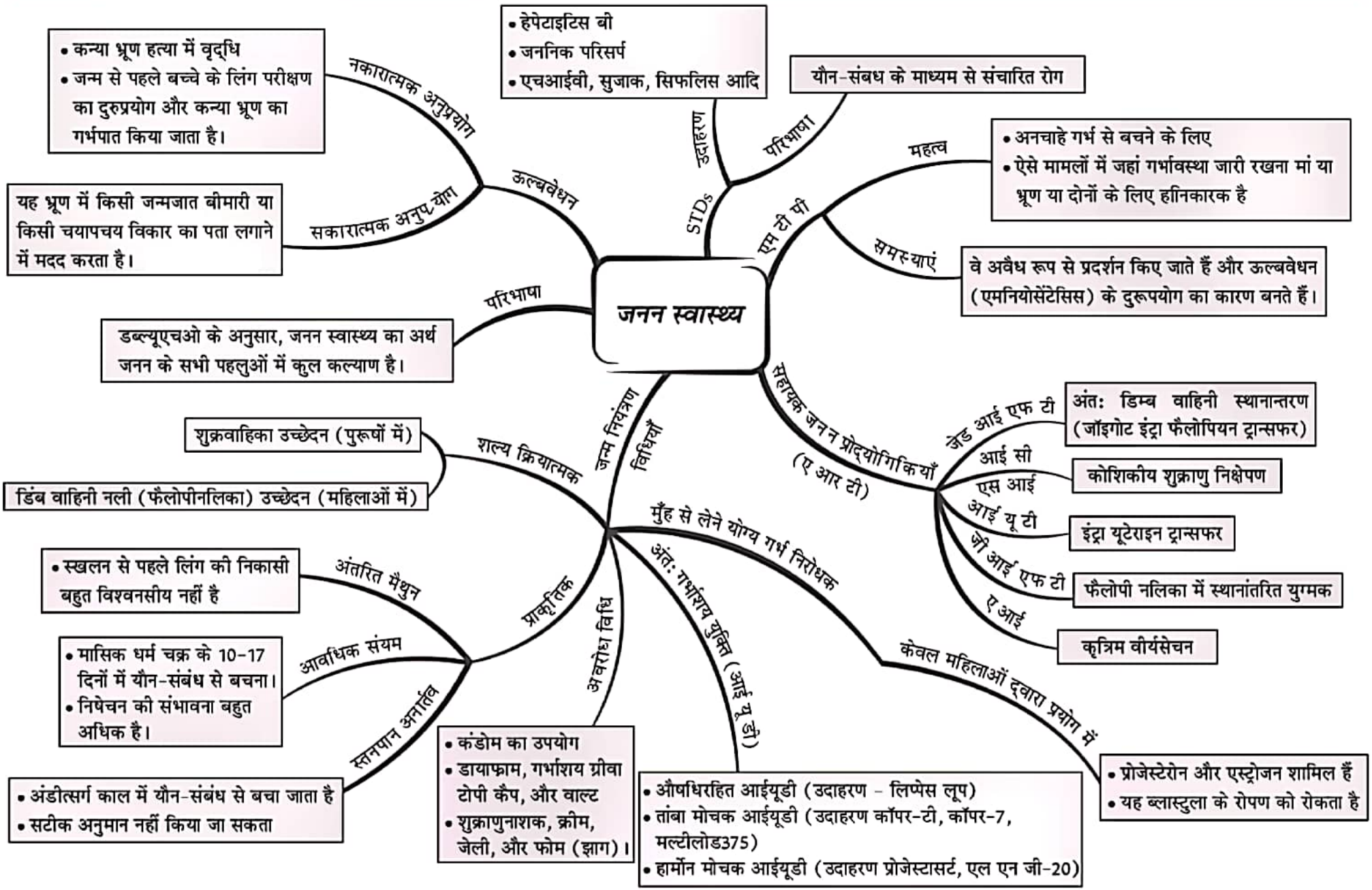
अध्याय - 4 जनन स्वास्थ्य



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Principles of Inheritance and Variation

Genetic Disorders

Mendelian Disorders

It is caused by alteration or mutation in the single gene.
Autosomal dominant: E.g. Muscular dystrophy.
Autosomal recessive: E.g. Sickle cell anaemia, Albinism
Sex linked: E.g. Haemophilia.

Chromosomal Disorders

It is caused due to absence or excess or abnormal arrangement of one or more chromosomes.
Example, Down's syndrome (trisomy of 21).
Klinefelter's Syndrome (XXY in male).
Turner's syndrome (XO in female).

Gregor Mendel

Studied 7 Pairs of contrasting characters of pea plant

S.No.	Characters	Contrasting Traits
1.	Stern height	Tall/dwarf
2.	Flower colour	Violet/white
3.	Flower position	Axial/terminal
4.	Pod shape	Inflated/constricted
5.	Pod colour	Green/yellow
6.	Seed shape	Round/ wrinkled
7.	Seed colour	Yellow/green

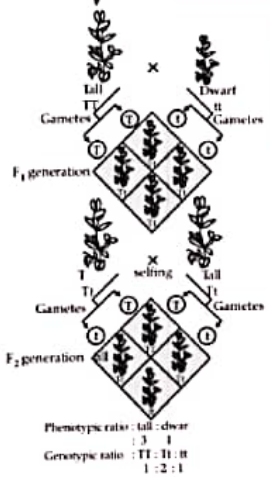
Proposed three laws

Law of Dominance

In heterozygous condition only one member of apai r expressesitseffectinthehybridandis called asdominantwhilethemanifestationof the other is masked and is known as recessive

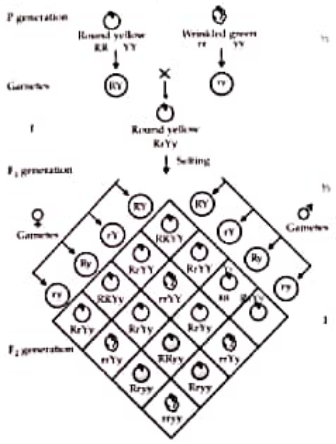
Law of Segregation

During gamete formation, the factors (alleles) of a character pair present in parents segregate from each other such thatagametereceivesonlyoneofthe two factors.



Law of Independent assortment

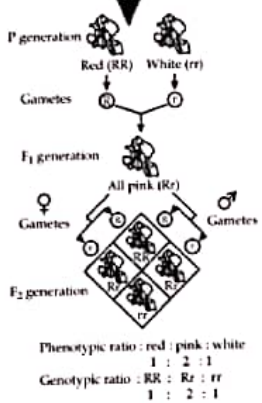
When two pairs of traits are combined in a hybrid, segregation of one pair of characteristics is independent of the other pair of characters.



Non-Mendelian Inheritance

Incomplete Dominance

The heterozygous offspring shows intermediate character between two parental characteristics.
Phenotypic ratio and Genotypic ratio are same.E.g., Flower colour in ***Antirrhinum sp.*** and ***Mirabilis jalapa.***



Co-Dominance

Two alleles of a gene are equally dominant and express themselves even when they are together.
E.g. ABO blood grouping in human.

Multiple Alleles

A gene exists in more than two allelic forms
E.g., ABO blood grouping

Pleiotropy

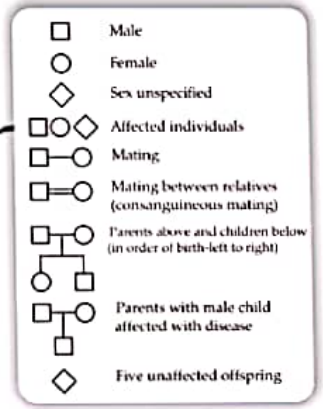
Ability of a gene to have multiple phenotypic effects as it influences a number of characters simultaneously.

Pedigree Analysis

Definition

Record of occurrence of a trait in several generations of a family.

Symbol used



Importance

Pedigree study is utilized to trace the inheritance of a specific trait, abnormality or disease.

Mutation

Definition

Sudden heritable change in DNA sequence, which results in changes in the genotype and the phenotype of an organism.
Leads to variation in DNA.

Frameshift Mutation

Loss /deletions or gain /insertion/ duplication of a DNA segment.

Point Mutation

Change in a single base pair of DNA. E.g. sickle cell anaemia.

Sex Determination

- ZZ—ZW mechanism Example, Birds
- XX—XO mechanism Example, grasshopper
- XX–XY mechanism Example, Human being

Chromosomal Theory of inheritance

- Proposed by Walter Sutton and Theodore Boveri in 1902.
- Thomas Hunt Morgan formulated chromosomal theory
- of inheritance using fruit flies (*Drosophila melanogaster*).
- Morgan coined the term Linkage.

It States

- Chromosomes are immortal.
- Two identical chromosomes form a homologous pair.
- They segregate at the time of gamete formation.
- Independent pairs segregate independently of each other.
- Chromosomes are mutable.

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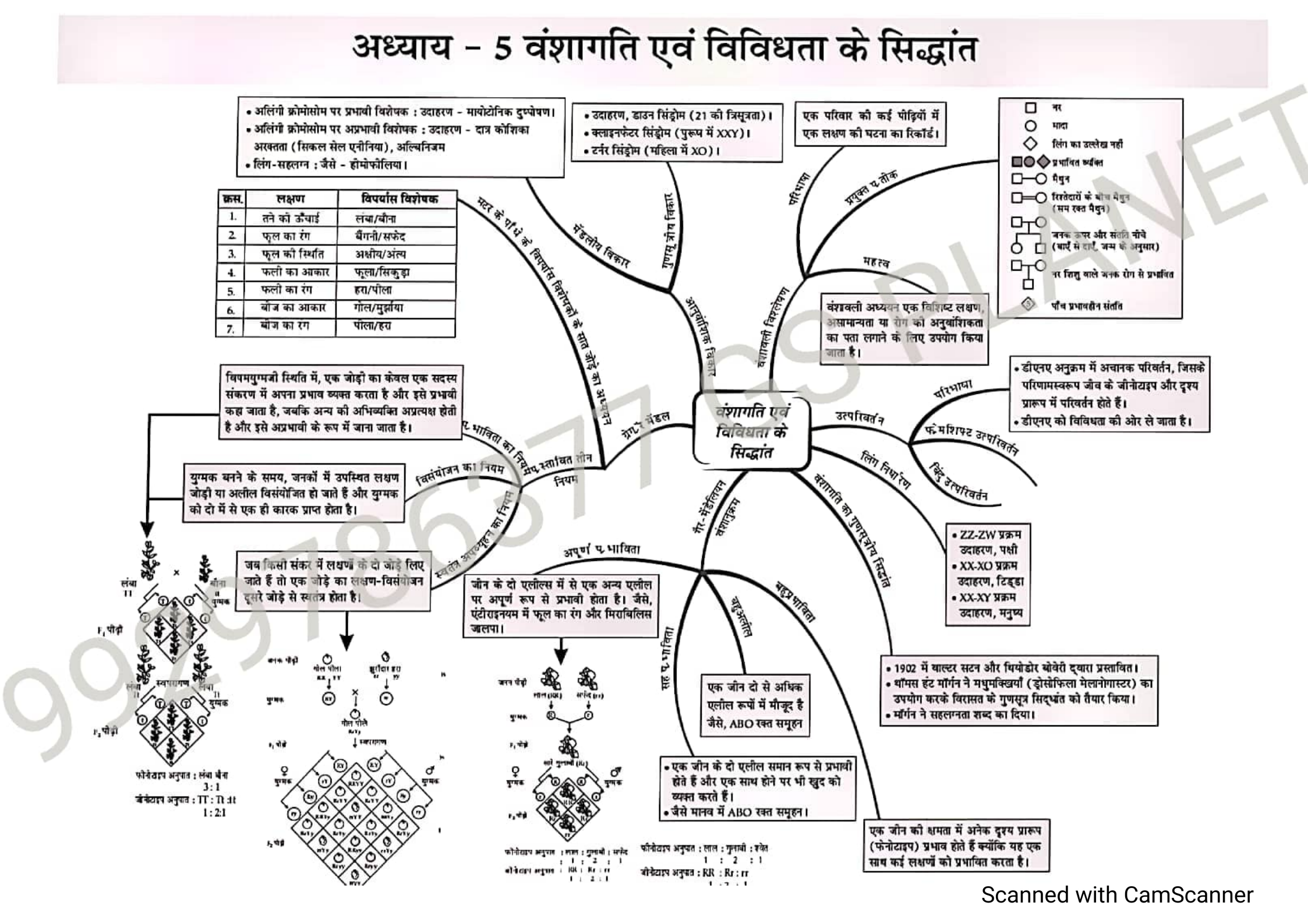

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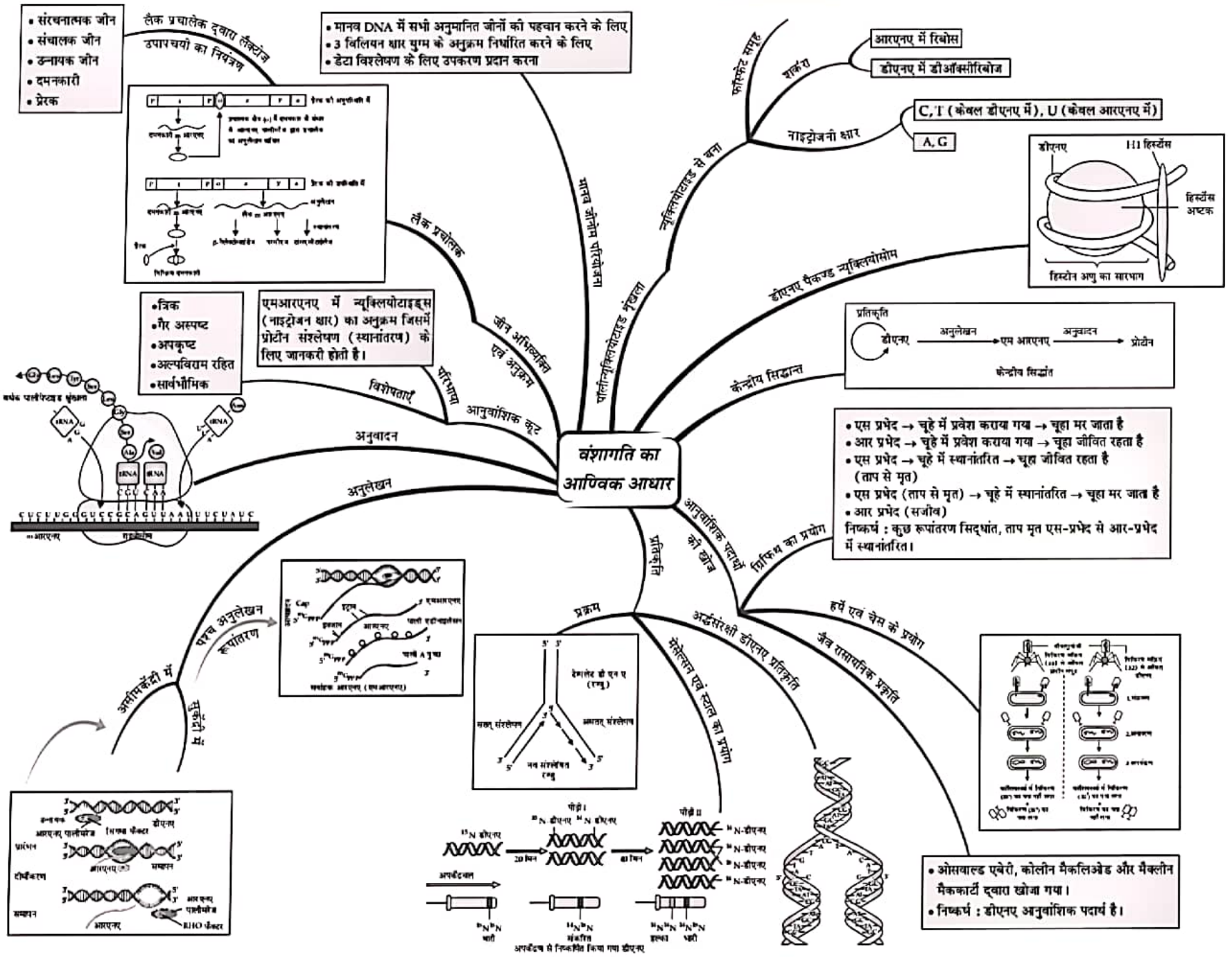
अध्याय - 6 वंशागति का आण्विक आधार



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Molecular Basis of Inheritance

Human Genome Project

- To identify all the estimated genes in human DNA
- To determine the sequences of the 3 billion base pairs
- To provide tools for data analysis

Polynucleotide Chain

Made of Nucleotide

- Phosphate group
- Sugar
  - Ribose in RNA
  - Deoxyribose in DNA
- Nitrogenous Base
  - C, T (only in DNA), U (Only in RNA)
  - A, G

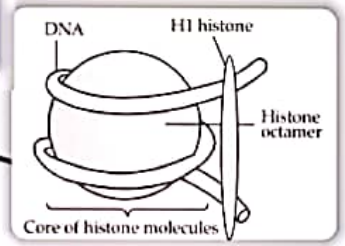
Linked to the 5'- and 3'- carbon deoxyribose

Double Helix

Salient Features

- Two polynucleotide chains.
- They have anti-parallel polarity.
- 2 H-bond : A=T, 3 H-bond : G≡C.
- Two chains coiled in a right -handed fashion
- Plane of one base pair stacks over the other

DNA packaged nucleosome



Central Dogma

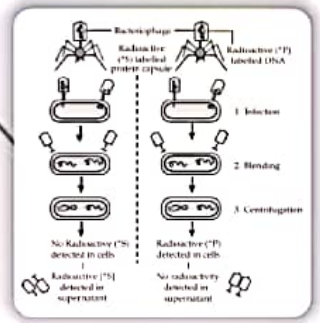
DNA —transcription→ mRNA —translation→ Protein

Search for genetic material

Griffith exp

- S-strain → Inject into mice → Mice die
- R-strain → Inject into mice → Mice live
- S-strain (Heat killed) → Inject into mice → Mice live
- S-strain (Heat killed) + R-strain (live) → Inject into mice → Mice die
- Conclusion: Some 'transforming principle', transferred from heat-killed S-strain to R-strain.

Hershey and Chase exp.

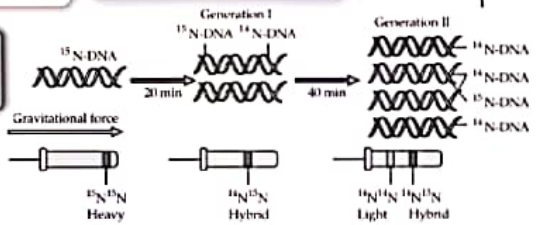


Biochemical Nature

- Discovered by Oswald Avery, Colin MacLeod and Maclyn McCarty.
- Conclusion: DNA is the hereditary material.

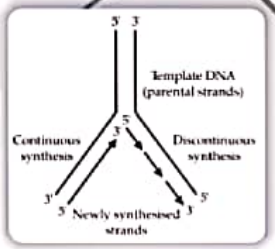
Semi-Conservative DNA Replication

Meselson and Stahl experiment



Replication

Process



Types of RNA

- mRNA (messenger RNA) : Protein synthesis.
- rRNA (ribosomal RNA) : Structural & catalytic role during translation.
- tRNA (transfer RNA or sRNA or soluble RNA) : Brings amino acids for protein synthesis and reads the genetic code.

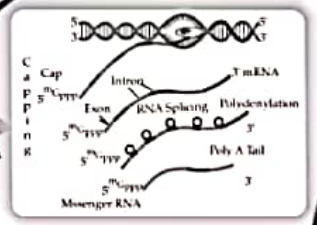
Transcription

The process of copying genetic information from one strand of the DNA into RNA.

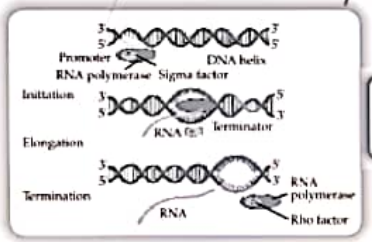
Units

- A promoter.
- The structural gene.
- A terminator.

Post transcriptional modification



In Prokaryotes



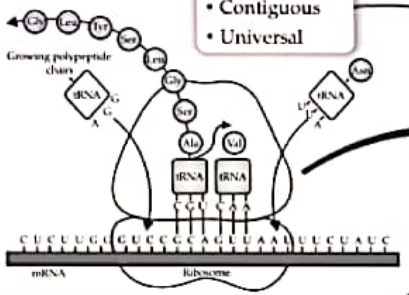
In Eukaryotes

Translation

Sequence of nucleotides (nitrogen bases) in mRNA that contains information for protein synthesis (translation).

Features

- Triplet
- Unambiguous
- Degenerate
- Contiguous
- Universal



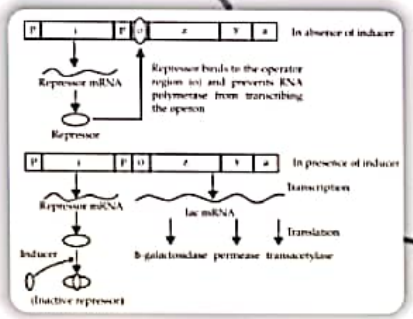
Genetic Code

Gene expression and regulation

Lac operon

The operon controlling lactose metabolism

- Structural gene
- Operator gene
- Promoter gene
- Repressor
- Inducer



Trace the Mind Map

- First Level
- Second Level
- Third Level

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Evolution

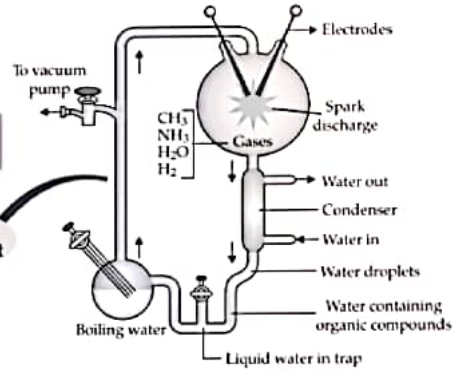
Origin of Life

Theories

- **Biogenesis**
  - Life originates from pre-existing life.
- **Spontaneous generation (Abiogenesis)**
  - Life came out of decaying and rotting matter
- **Cosmic theory/Panspermia**
  - The units of life (spores) were transferred to earth.
- **Special creation theory**
  - Living and non living things was created God.
- **Chemical evolution theory**
  - Life originated from non-living inorganic & organic molecules

- The universe originated about 20 billion years ago, by a thermonuclear
- The earth was formed about 4.5 billion years ago.

Origin of Life-Urey and Miller's Experiment



Human Evolution

Human ancestors	Origin period
Dryopithecus	20-25 mya
Ramapithecus	14-15 mya
Australopithecus	3-4 mya
Homo habilis	2 mya
Homo erectus (java man)	1.5 mya
Homo sapiens neander-thalesis (primitive man)	1,00,000-40,000 years ago
Homo sapiens sapiens (modern man)	75,000-10,000 years ago

Hardy Weinberg

Factors affecting

- Gene Migration
- Genetic drift
- Mutation
- Genetic recombination
- Natural Selection

Theory of Mutation

- Proposed by Hugo de Vries
- Single step large mutation.
- Mutation caused speciation

Theories of Biological Evidences

Lamarckism

- Theory of Inheritance of Acquired Characters.
- Evolution by use of organs : E.g. Long neck of giraffe.
- Evolution by disuse : Eg .Disappearance of limbs in snakes.

Darwinism

- Natural Selection
- Heritable minor variations.
- Over production by organisms.
- Limited natural resources.
- Struggle for existence.
- Survival of the fittest.

Evidences

Palaeontological Evidence

- By study of fossils
- Fossils help to study phylogeny, connecting link and about extinct animals.

Morphological & Anatomical

Homologous Organs

- Human hand, Whale's flippers, Bat's wing, and Cheetah's foot.
- Thorns of *Bougainvillea* and tendrils of *Cucurbita*.

Analogous Organs

- Wings of insects and wings of birds.
- Eyes of Octopus and mammals
- Flipper of Penguins and Dolphins.
- Sweet potato (modified root) and Potato (modified stem).

Bio Geographical

Adaptive Radiation

Darwin Finches

Marsupial Radiation

Placental Mammals

E.g., Placental wolf and Tasmanian wolf-marsupial.

Bio-Chemical

Similarities in proteins and genes.

Embryological

Similarities in embryo development.

Natural Selection

- White winged moth *Biston betularia* than dark winged/ melanised *Biscarbonaria*.
- By anthropogenic action

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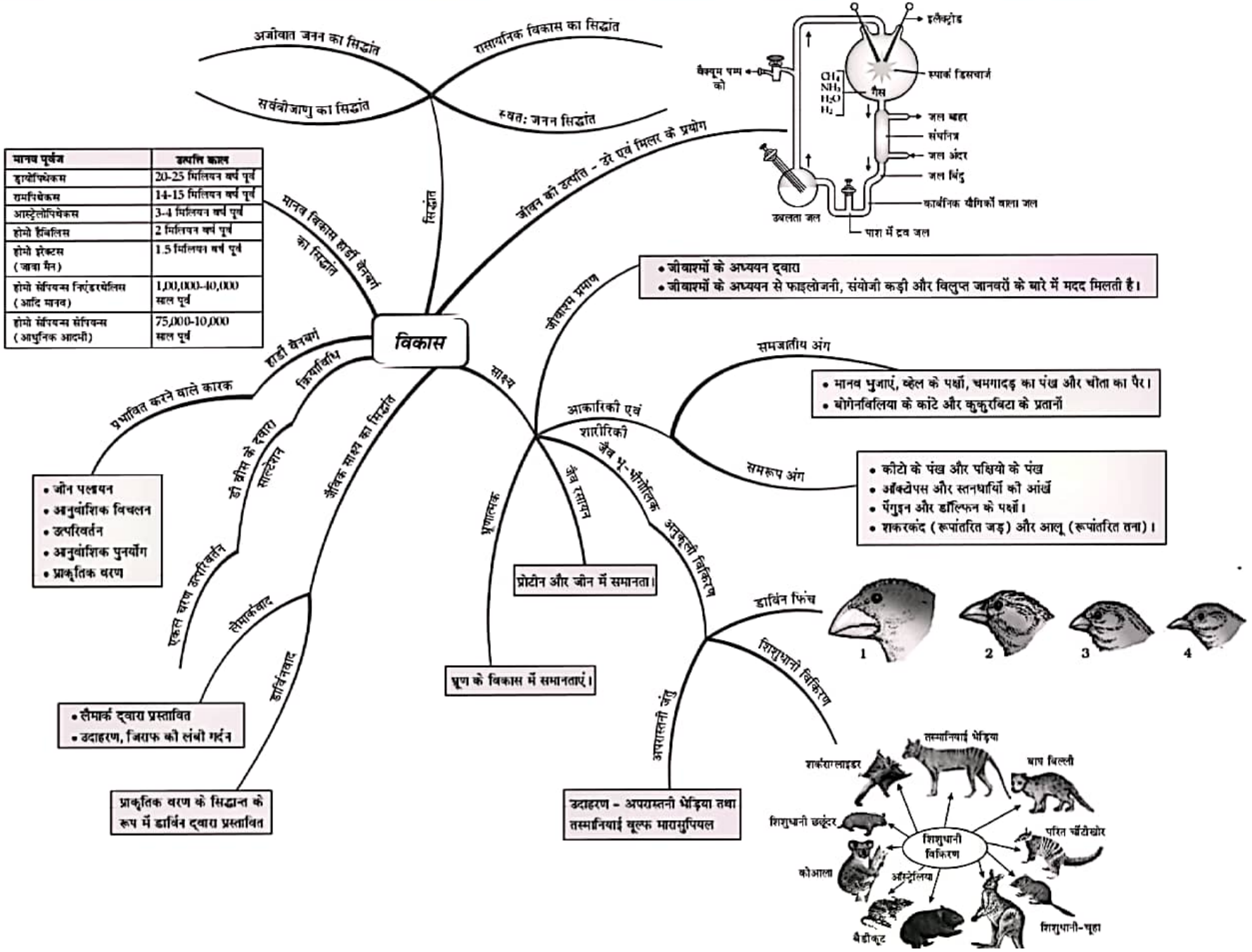
अध्याय - 7 विकास



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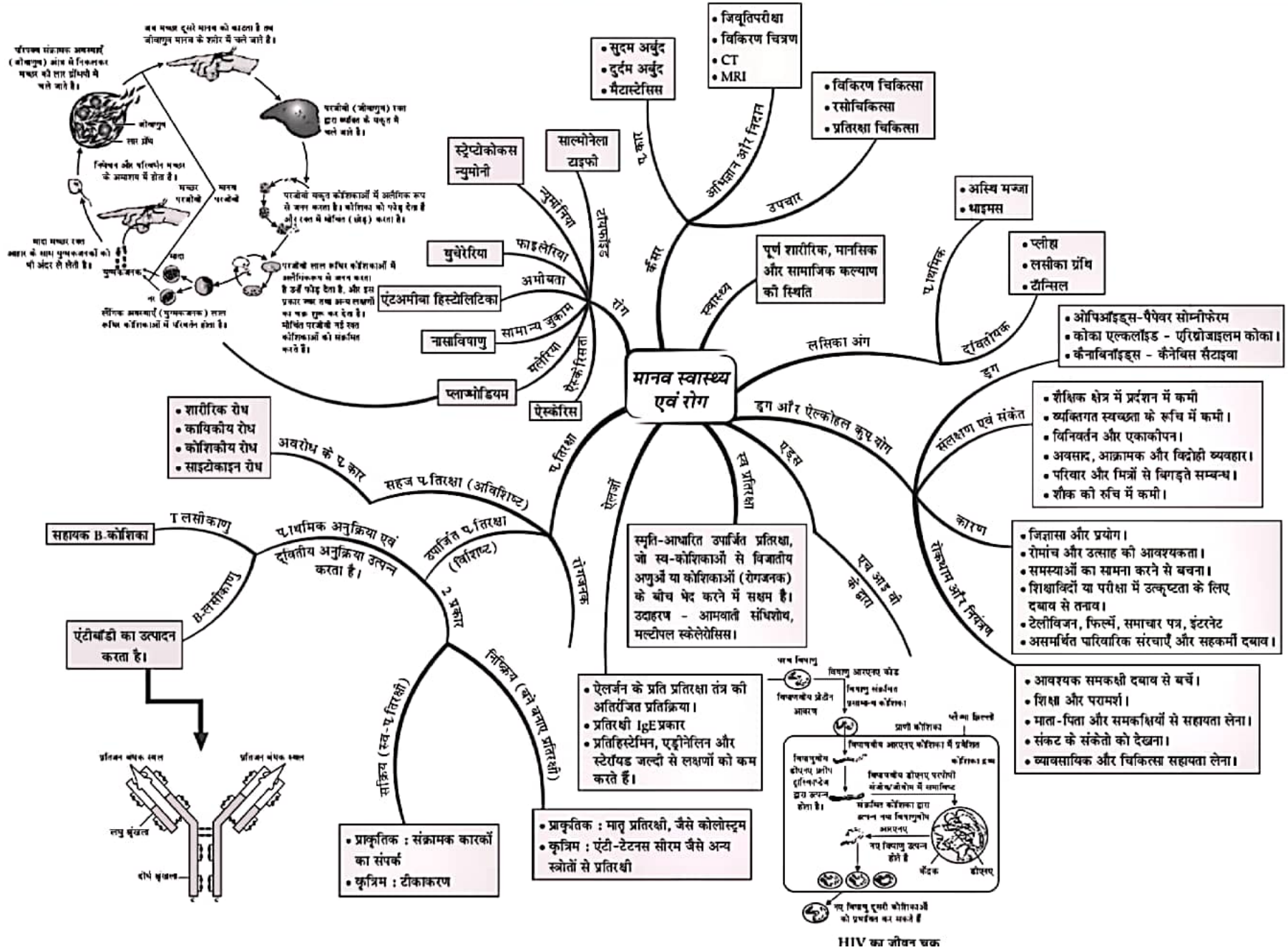
अध्याय - 8 मानव स्वास्थ्य एवं रोग

HIV का जीवन चक्र



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Human Health and Diseases

Diseases

Pneumonia
- *Streptococcus Pneumonia*
- *Salmonella typhi*

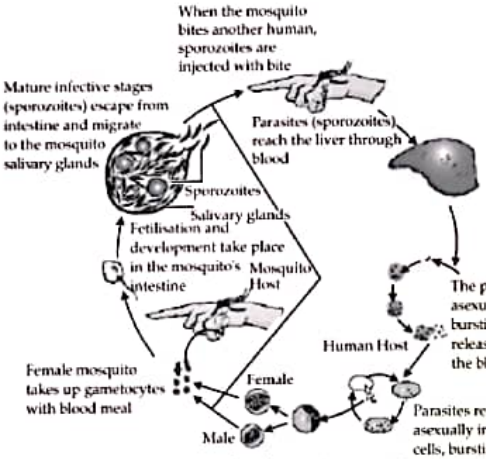
Typhoid

Filariasis
- *Wuchereria*

Amoebiasis
- *Entoamoeba histolytica*

Common cold
- Rhino virus

Malaria
- *Plasmodium*



Ascariasis
- *Ascaris*

Cancer
- Benign tumor
- Malignant
- Metastasis

Types

Detection & Diagnosis
- Biopsy
- Radiography
- CT
- MRI

Treatment
- Radiation therapy
- Chemotherapy
- Immunotherapy

Health

State of complete physical, mental and social well-being

Lymphoid organs

Primary
- Bone marrow
- Thymus

Secondary
- Spleen
- Lymph node
- Tonsils

Drugs and Alcohol abuse

Drugs
- Opioids- *Papavar somniferum*
- Coca alkaloid- *Erythroxylum coca.*
- Cannabinoids- *Cannabis sativa*

Symptoms and signs
- Drop in academic performance
- Lack of interest in personal hygiene.
- Withdrawal and isolation.
- Depression, aggressive and rebellious behavior.
- Deteriorating relationship between family and friends.
- Loss of interest in hobbies.

Causes
- Curiosity and Experimentation.
- Need for adventure and excitement.
- Escape from facing problems.
- Stress from pressure to excel in academics or examination.
- Television, movies, newspapers, internet
- Unsupportive family structures and Peer pressure.

Prevention / Control
- Avoid undue peer pressure.
- Education and counselling.
- Seeking help from parents and peers.
- Looking for danger signs.
- Seeking professional and medical help.

Immunity

- Physical
- Physiological
- Cellular
- Cytokine

Types of barriers

Innate (Non-specific)

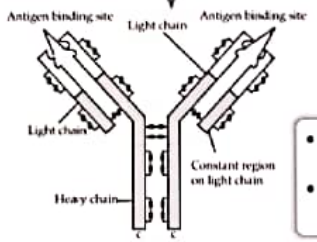
Acquired (Specific)

Produces primary & Secondary response

2 Types

T-Lymphocytes
Helper B Cells

B-Lymphocytes
Produces Antibodies



Active (Own antibodies)
- Natural: exposure to infectious agent
- Artificial: immunization

Ready made antibodies / Passive
- Natural: maternal antibodies *e.g.*, colostrum
- Artificial: antibodies from other sources like anti-tetanus serum

Allergy

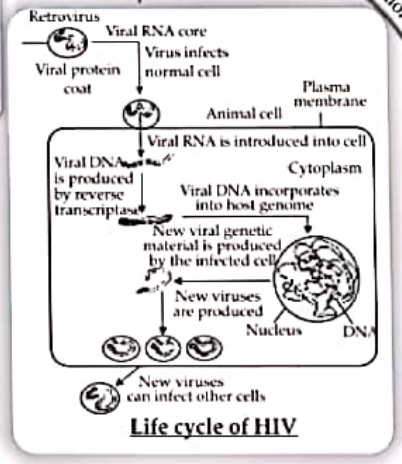
- Exaggerated response of the immune system to allergens.
- Antibodies IgE type.
- Anti-histamine, adrenaline and steroids quickly reduce the symptoms.

Auto Immunity

Memory based acquired immunity, which is able to distinguish foreign molecules or cells (pathogen) from self-cells.E.g. Rheumatoid arthritis, Multiple sclerosis

AIDS

Caused by HIV



Life cycle of HIV

Identification

ELISA [Enzyme Linked Immuno Sorbent Assay] test.

Trace the Mind Map
- First Level
- Second Level
- Third Level

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अध्याय - 10 मानव कल्याण में सूक्ष्मजीव

मानव कल्याण में सूक्ष्मजीव

जैव उर्वरक के रूप में सूक्ष्मजीव

- जीवाणु
  - राइजोबियम (सहजीवी जीवाणु)
  - ऐजोस्पाइरिलम और ऐजोबैक्टर (मुक्तावस्था जीवाणु)
- कवक
  - माइकोराइजा - पौधों के साथ ग्लोमस का संगठन
- साइनोबैक्टीरिया
  - सहजीविता : एजोला में ऐनाबीना
  - मुक्त जीवन : नॉसटॉक, ओसिलेटोरिया और नील हरित शैवाल

औद्योगिक उत्पादों में सूक्ष्मजीव

- एंटीबायोटिक पैनीसीलिन
  - पैनीसीलियम नोटेटम
  - सैक्रोमाइसेस सेरेविसी
- कार्बनिक अम्ल
  - एस्परजिलस नाइगर (एक कवक) : साइट्रिक अम्ल
  - एसिटोबैक्टर एसिटाई (एक जीवाणु) : एसिटिक अम्ल
  - क्लोस्ट्रीडियम ब्यूटायलियम (एक जीवाणु) : ब्यूटिरिक अम्ल
  - लैक्टोबैसिलस (एक जीवाणु) : लैक्टिक अम्ल
- एंजाइम
  - लाइपेज
  - पेक्टिनेजिज और प्रोटीऐजिज (बोतल वाले रस को साफ करने के लिए)
  - स्ट्रेप्टोकाइनेज (स्ट्रेप्टोकोकस - थक्का स्फोटन के लिए प्रयुक्त)
- जैवसक्रिय अणु
  - स्टैटिन - मॉनस्कस परप्यूरीअस का उपयोग रक्त-कोलेस्ट्रॉल कम करने वाले कारकों के रूप में किया जाता है
  - साइक्लोस्पोरिन ए - ट्राइकोडर्मा पॉलोस्पोरम एक प्रतिरक्षा निरोधक दवाओं के रूप में

घरेलु उत्पादों में सूक्ष्मजीव

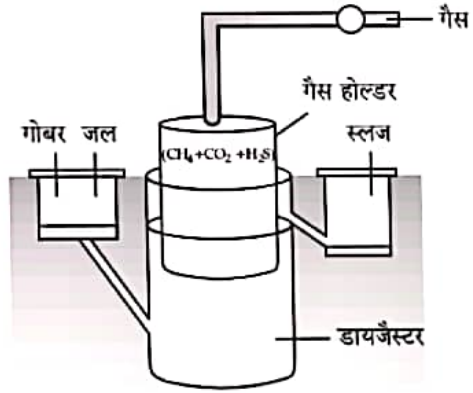
- दही
  - लैक्टोबैसिलस या एलएबी
- ब्रेड
  - सैकरोमाइसीज सैरीवीसी
- टोडी
- स्विस चीज
  - प्रोपिओनिबैक्टीरियम शारमैनाई

वाहितमल उपचार में सूक्ष्मजीव

- प्राथमिक वाहितमल उपचार
  - मोटे ठोस पदार्थों को हटाना शामिल है
- द्वितीयक वाहितमल उपचार
  - सुक्ष्माणुओं की क्रिया शामिल है

बायोगैस के उत्पादन में सूक्ष्मजीव

- शामिल बैक्टीरिया मीथेनोबैक्टीरियम है



संयंत्र का एक प्रारूप बायोगैस

जैव नियंत्रण कारक के रूप में सूक्ष्मजीव

- बेसिलस थुरिजिएंसिस : बटरफ्लाई कैटरपिलर का नियंत्रण
- ट्राइकोडर्मा sp.
- बैक्यूलोवायरेसिस (esp. न्यूक्लिओपॉलीहीड्रोसिसवायरस जीनस) कीट और संधिपाद को नियंत्रित करता है

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Microbes in Human Welfare

Microbes in Industrial Products

- Antibiotic: *Penicillium notatum* — Penicillin
- Organic acids:
  - *Aspergillus niger* (a fungus): Citric acid
  - *Acetobacter aceti* (a bacterium): Acetic acid
  - *Clostridium butylicum* (a bacterium): Butyric acid
  - *Lactobacillus* (a bacterium): Lactic acid
- Enzymes:
  - Lipases
  - Pectinases and Proteases (To clarify bottles juices)
  - Streptikinase (*Streptococcus*- used as clot buster)
- Fermented beverages: *Saccharomyces cerevisiae*
- Bioactive molecules:
  - Statins- *Monascus purpureus*- used as blood-cholesterol lowering agents
  - Cyclosporine A- *Trichoderma polysporum*- used as an immunosuppressive drugs.

Microbes as bio-fertilizers

- Bacteria: *Rhizobium* (symbiotic bacteria); *Azospirillum* and *Azotobacter* (free living bacteria).
- Fungi: Mycorrhiza- association of *Glomus* with plants
- Cyanobacteria:
  - Symbiosis: *Anabaena* in *Azolla*
  - Free living: *Nostoc*, *Oscillatoria* and blue green algae

Microbes in household

- Curd: *Lactobacillus* Or LAB
- Bread: *Saccharomyces cerevisiae*
- Toddy
- Swiss Cheese: *Propionibacterium sharmanii*

Microbes in Sewage Treatment

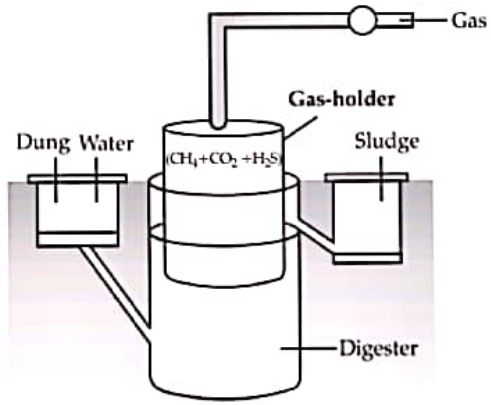
- Primary Sewage treatment: Involves removal of coarse solid materials
- Secondary Sewage treatment: Involves the action of microbes

Microbes as biocontrol agents

- *Bacillus thuringiensis:* Control butterfly caterpillar
- *Tichoderma* sp.
- Baculoviruses (esp. genus *Nucleopolyhedrovirus*): Controls insect and arthropods

Microbes in Production of Biogas

Bacteria involved is *Methanobacterium*



A typical blogas plant

Trace the Mind Map

First Level · Second Level · Third Level

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Biotechnology : Principles and Processes

Principles of Genetic engineering

rDNA
Gene cloning
Gene transfer

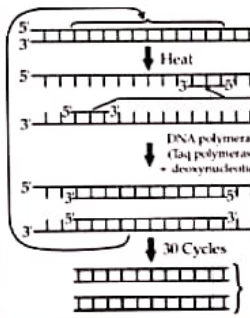
It is the integration of natural scienceandorganisms,cells, parts thereof, and molecular analogues for product and services.

Processes of rDNA Technology

Selection of recombinants:
(a) By antibiotic resistance method.
(b) By Insertional inactivation method

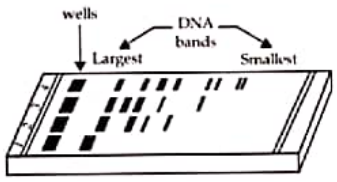
Inserting of DNA into host cells. Host cells are made competent to take up DNA

Amplification of gene by PCR



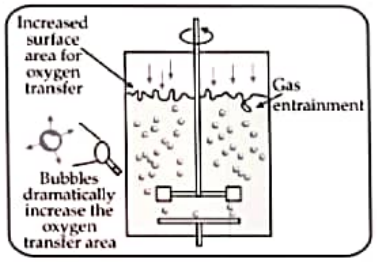
Isolation of DNA

Cut DNA fragments are separated by Gel electrophoresis.

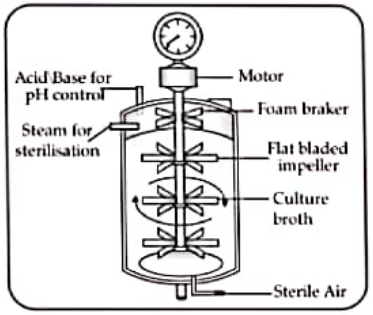


Cutting of DNA at specific locations by restriction enzymes.

Obtaining foreign gene product by bioreactors.



Stirred-tank bioreactor

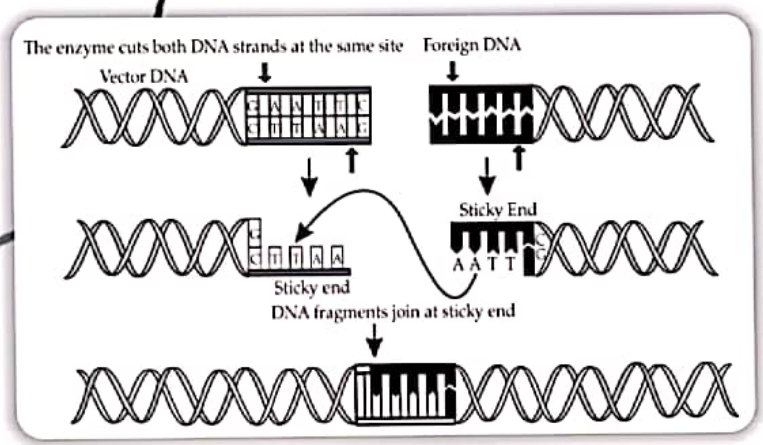


Sparged stirred-tank bioreactor

Tools of rDNA Technology

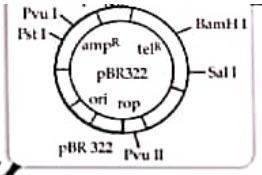
Restriction Enzymes

Exonucleases:They remove nucleotides from the ends of the DNA.
Endonucleases : They cut at specific positions within the DNA.



Cloning vector

pBR322



HasOri
Has Selectable Markers
Has fewer cloning sites
Examples:
Agrobacterium tumifaciens
Retroviruses

Competent host

Host is made competent by:

Biolistics

Cell are bombarded with high velocity micro particles of gold or tungsten coated with DNA

Micro injection

rDNA is directly injected into the nucleus of an animal cell

pathogen vector

Disarmed

Vectors like*Agrobacterium* when infects the cell transfertherecombinant DNA into the host

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अध्याय = 11 जैव प्रौद्योगिकी : सिद्धांत एवं प्रक्रम

जैव प्रौद्योगिकी : सिद्धांत एवं प्रक्रम

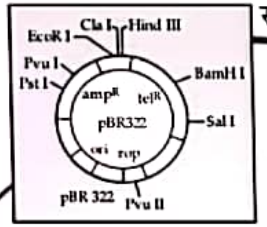
यह प्राकृतिक विज्ञान और जीवों, कोशिकाओं, उसके अंगो और उत्पाद और सेवाओं के लिए आण्विक अनुरूपों का एकीकरण है।

जैव प्रौद्योगिकी के सिद्धांत

- आरडीएनए
- जीन क्लोनिंग
- जीन स्थानांतरण

आरडीएनए तकनीक के साधन

क्लोनिंग संवाहक



संवाहक की विशेषताएं

- Ori है
- वरण योग्य चिन्हक हैं
- कुछ क्लोनिंग स्थल हैं

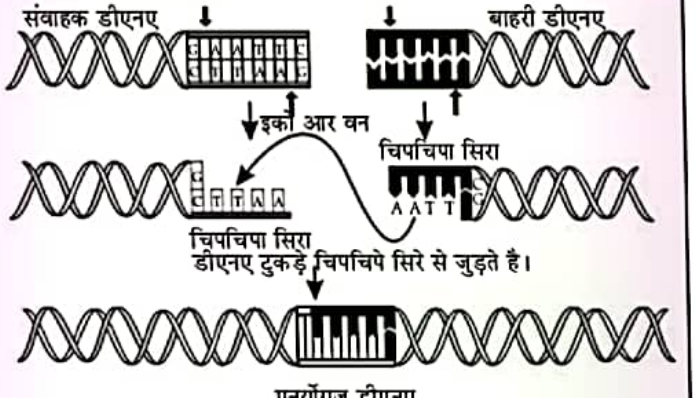
सक्षम परपोषी आतिथेयpBR322

मेजबान सक्षम बनाया जाता है

- **बायोलिस्टिक** — कोशिका पर डीएनए के साथ लेपित सोने या टंगस्टन के उच्च-वेग सूक्ष्म कणों के साथ बमबारी की जाती है
- **सूक्ष्म अंत-क्षेपण** — rDNA को सीधे जंतु कोशिका के केन्द्रक में इंजेक्ट किया जाता है।
- **निर्बल रोगजनक संवाहक** — एग्रोबैक्टीरियम जैसे संवाहक जब कोशिका को संक्रमित करते हैं तो पुनर्योगज डीएनए को पोषी में स्थानांतरित कर देते हैं।

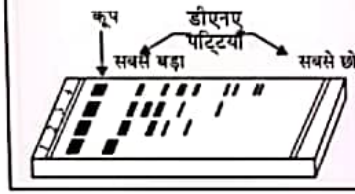
प्रतिबंधन एंजाइम

एंजाइम दोनों डीएनए लड़ियों को एक ही स्थान पर काटता है।



डीएनए को विशिष्ट स्थलों पर प्रतिबंधन काटना

जेल इलेक्ट्रोफोरेसिस द्वारा डीएनए खण्डों को अलग-अलग करना



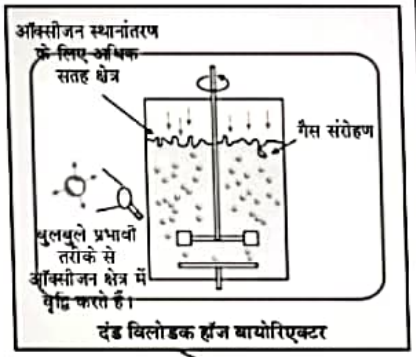
आनुवंशिक पदार्थ (डीएनए) का पृथक्करण

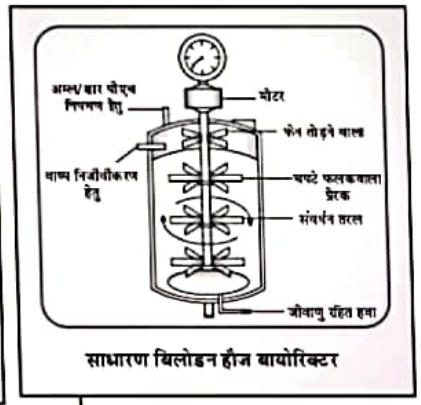
होस्ट कोशिकाओं में डीएनए का निवेशन। होस्ट कोशिकाओं को डीएनए लेने के लिए सक्षम बनाया जाता है।

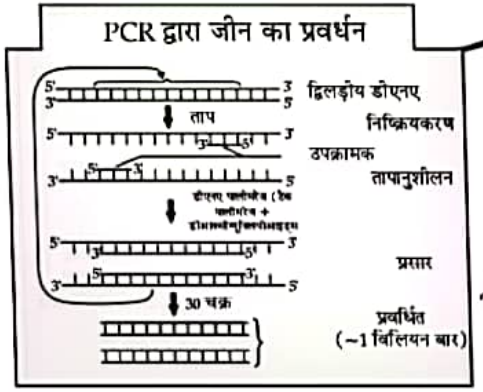
आरडीएनए तकनीक के प्रक्रम

पुनर्योगज का चयन :
(a) प्रतिजैविक प्रतिरोध विधि द्वारा।
(b) निवेशी निष्क्रियता विधि द्वारा।

बायोरिक्टर द्वारा विजातीय जीन उत्पाद प्राप्त करना।







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Biotechnology and its Applications

Transgenic animals

Definition

- Animals that have their DNA manipulated to possess or express an extra gene.
- E.g. Transgenic rats, rabbits, pigs, sheep, Rosie cow and fish.

Advantages

- To study normal physiology and development.
- To study the contribution of genes in the development of a disease.
- Biological products.
- Vaccine safety testing.
- Chemical safety testing.

GEAC

- Genetic Engineering Approval Committee
- Make decisions about the validity of GM research.
- Safety of GM-organisms for public services.

Biopiracy and biopatent

- **Biopiracy :** Use of bio-resources by multinational companies and other organizations without proper authorization from the countries and people concerned is biopiracy.
- **Biopatent :** Patents granted for biological entities and for products derived from them are called biopatents.E.g. Basmati Rice.

In Agriculture

Advantages of GM Crops

- Makes crops more tolerant to abiotic stresses
- Reduces resilience on chemical pesticides.
- Helps to reduce post-harvest losses.
- Increases efficiency of mineral usage by plants.
- Enhances nutritional value of food. E.g. Golden rice.

Pest resistance in Cotton plant

- *Bacillus thuringiensis* contain Bt toxin, which is in inactive form.
- It becomes active toxin in the alkaline pH of insect gut.
- The activated toxin binds to the surface of midgut epithelial cells of insect and creates pores.
- This causes cell swelling and lysis and eventually death of the insect.
- The toxin is coded by a gene named cry. E.g., The proteins encoded by the genes *cryIAc* and *cryIIAb* control the cotton bollworms.

Pest resistance in Tobacco plant

RNA interference (RNAi) strategy is used to prevent the infestation of tobacco plants by Nematode *(Meloidogyne incognitia)*.

Molecular diagnosis

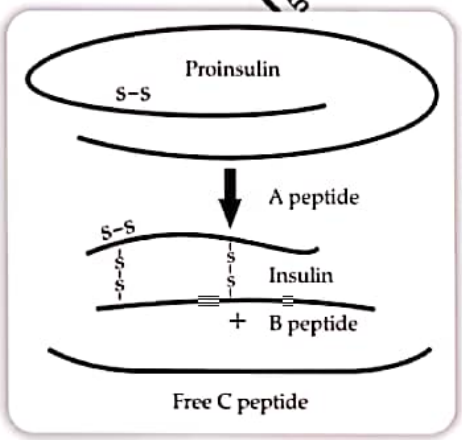
- Recombinant DNA technology
- Polymerase Chain Reaction.
- Enzyme Linked Immuno-sorbent Assay (ELISA).

Gene Therapy

- Technique for correcting a defective gene through gene manipulation.
- First clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency.

In Medicine

Genetically Engineered insulin



Trace the Mind Map

First Level · Second Level · Third Level

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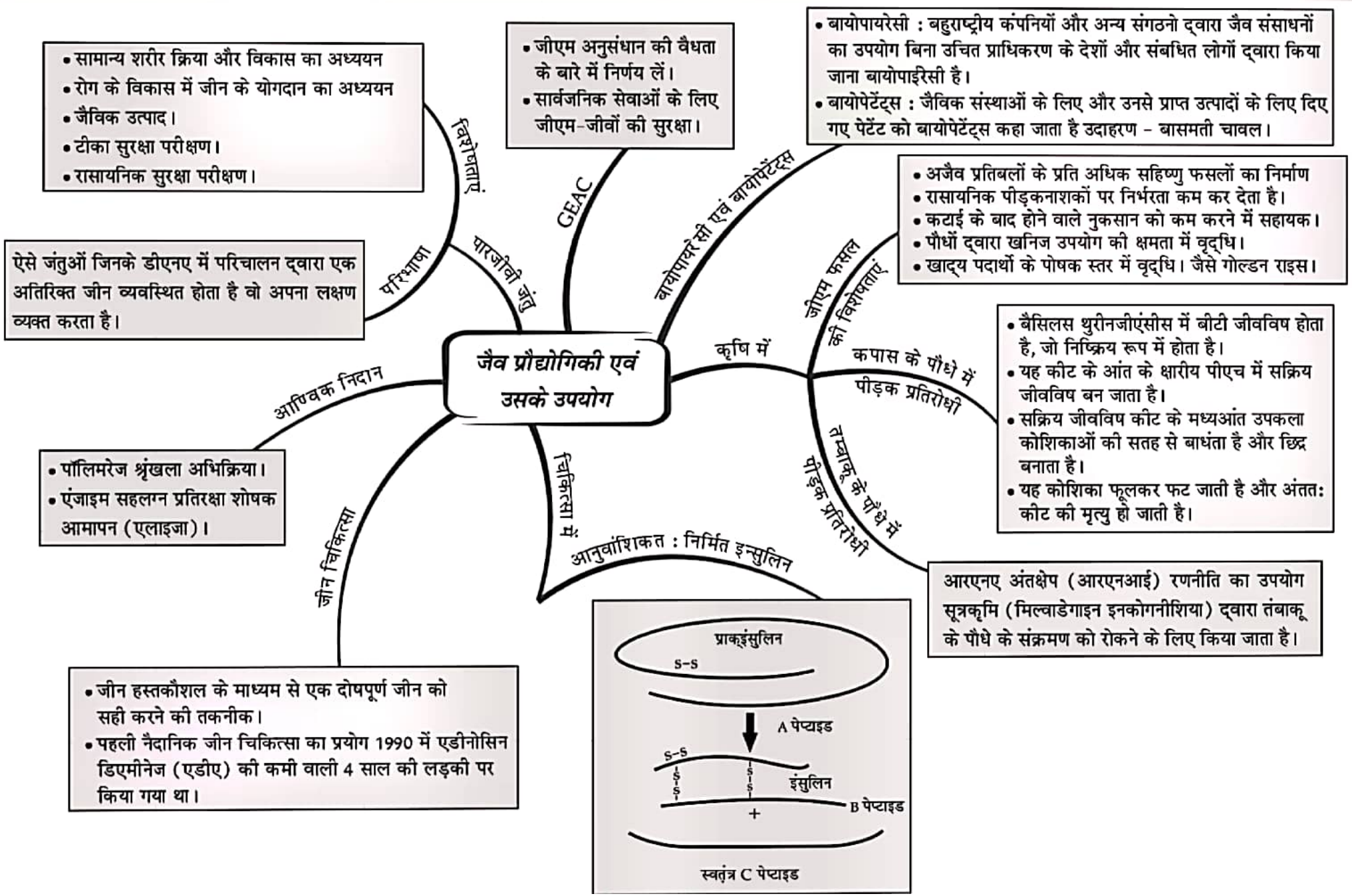
अध्याय - 12 जैव प्रौद्योगिकी एवं उसके उपयोग



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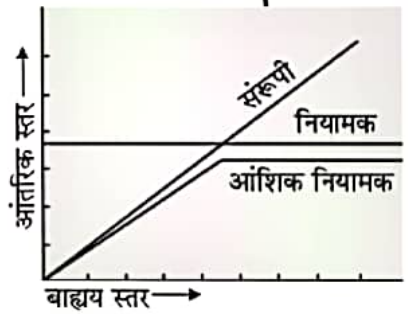
अध्याय - 13 जीव एवं समष्टियाँ

जीव एवं समष्टियाँ

जीव और इसका पर्यावरण

- प्रमुख अजैव कारक
  - तापमान
  - जल
  - प्रकाश
  - मृदा
- अजीवीय कारकों के प्रति अनुक्रियाएँ
  - नियमन करना
  - संरूपण
  - प्रवास करना
  - निलंबित करना
- जैविक अनुक्रिया



- अनुकूलन

जीव के आकारिकीय, कार्यिकीय और व्यवहारिक परिवर्तनों की विशेषता जो जीवों को अपने निवास स्थान में जीवित और पुनः जनन करने में सक्षम बनाती है।

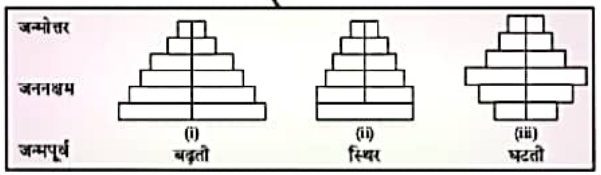
- कंगारू चूहा का मरुस्थल में अनुकूलन
  - आंतरिक वसा के ऑक्सीकरण द्वारा पानी की आवश्यकता को पूरा करना
  - सांद्रित मूत्र का उत्पादन
- पादप का मरुस्थल में अनुकूलन
  - पत्ती पर मोटी उपत्वचा
  - प्रकाश-संश्लेषी (सीएएम)
  - कोई पत्ती नहीं
- स्तनधारियों में अनुकूलन
  - एलन का नियम
  - वसा की मोटी परत (सील में)
- मरुस्थल की व्यावहारिक अनुकूलन
  - ऊष्मा अवशोषित करती है
  - छाया में चली जाती है
- उच्च तुंगता में अनुकूलन
  - लोग तुंगता बीमारी से पीड़ित होते हैं
  - जलवायु-अनुकूलन के कारण राहत मिलती है साँस लेने की दर में वृद्धि, RBCs उत्पादन में वृद्धि।

समष्टियों की पारस्परिक क्रिया

जाति अ	जाति ब	पारस्परिक क्रिया का नाम
+	+	सहोपकारिता
−	−	स्पर्धा
+	−	परभक्षण
+	−	परजीविता
+	0	सहभोजिता (कमन्सेलिज्म)
−	0	अंतरजातीय परजीविता (एमेन्सेलिज्म)

समष्टि

- समष्टि गुण
  - समष्टि का आमाप
  - जन्म दर
  - मृत्यु दर
  - लिंगानुपात
  - आयु पिरेमिड



- समष्टि वृद्धि
  - समष्टि घनत्व
    - जन्मदर
    - मृत्यु-दर
    - आप्रवासन
    - उत्प्रवासन
  - समष्टि घनत्व समीकरण

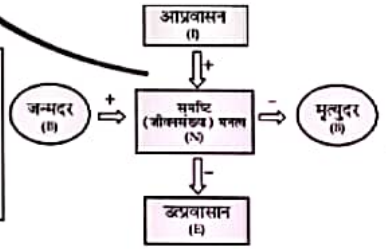
$$N_{t+1}=N_t+[(B+I)-(D+E)]$$

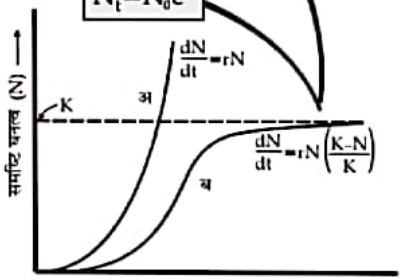
  - वृद्धि मॉडल
    - संभार तंत्र वृद्धि

$$\frac{dN}{dt}=rN\left(\frac{K-N}{K}\right)$$

    - चरघातांकी वृद्धि

$$N_t=N_0e^{rt}$$





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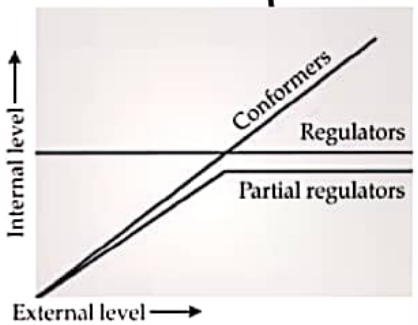
Organisms and Populations

Organisms and its Environment

- Biotic Factor
  - Includes pathogens, parasites, predators and competitors.
- Major abiotic factors
  - Temperature
  - Water
  - Light
  - Soil
- Response to abiotic factors
  - Organismic response
    - Regulate
    - Conform
    - Migrate
    - Suspend



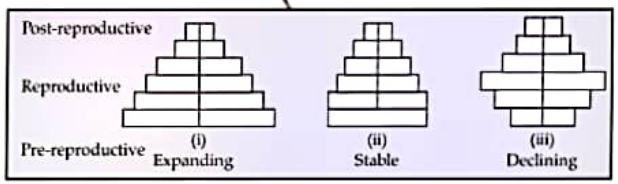
- Adaptations
  - Attribute of organism's morphological, physiological and behavioural changes that enables the organisms to survive and reproduce in its habitat.
  - Adaptation of kangaroo rat in desert
    - Meeting water requirement by fat oxidation
    - Produce concentrated urine
  - Adaptation of plants in desert
    - Thick cuticle on leaf
    - CAM
    - No leaves
  - Adaptation in Mammals
    - Allen's rule : colder region mammals have shorter ears and limbs.
    - Thick layer of fat (as in seal)
  - Behavioural Adaptations in Lizards
    - Desert lizards absorb heat, move into shade
    - Some species burrow into the soil
  - Biochemical Adaptations in humans
    - People suffer from mountain sickness
    - Relief occur due to acclimatization: Increased breathing rate, Increased RBCs production.

Population Interaction

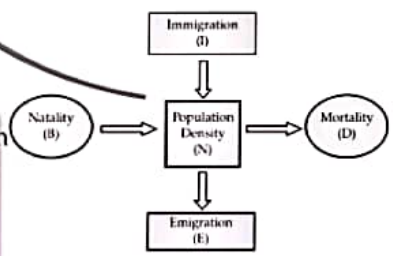
Species A	Species B	Name of Interaction
+	+	Mutualism
−	−	Competition
+	−	Predation
+	−	Parasitism
+	0	Commensalism
−	0	Ammensalism

Population

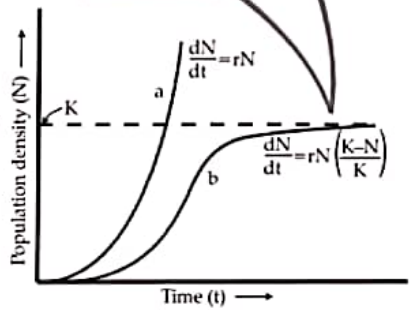
- Population Attributes
  - Population Size
  - Natality rate
  - Mortality rate
  - Sex Ratio
  - Age Pyramids



- Population Growth
  - Population Density
    - Natality
    - Mortality
    - Immigration
    - Emigration



  - Popn. density eqn.
    - $N_{t+1} = N_t + [(B+I) - (D+E)]$
  - Growth Models
    - Verhulst-Pearl Logistic Growth
      - $\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$
    - Exponential Growth
      - $N_t = N_0 e^{rt}$



Trace the Mind Map

First Level · Second Level · Third Level

Scanned with CamScanner

Ecosystem

Ecosystem Services

- Purify air and water.
- Mitigate droughts and flood.
- Cycle nutrients.
- Generates fertile soil.
- Provide wildlife habitat.
- Maintain biodiversity.
- Pollinate crops.
- Provide storage site for carbon
- Provide aesthetic, cultural and spiritual values.

Structure and function Ecosystem

Comprises: Autotrophs, Herbivores and carnivores

Biotic

Abiotic: Pond, lake, river, estuary

Distribution of different species at different levels

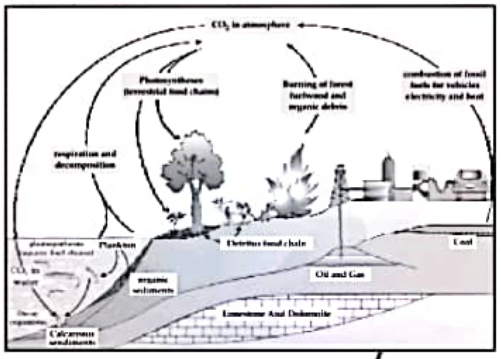
Stratification

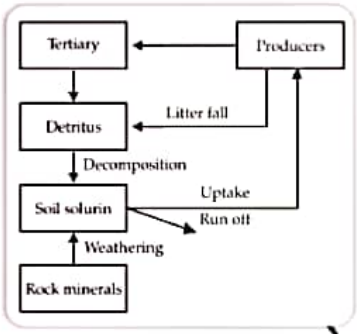
- (i) Tall emergent trees
- (ii) Canopy trees
- (iii) Understoreys trees
- (iv) Shrubs
- (v) Herbs
- (vi) Grasses

(i)–(iii): Top most layers; (v)–(vi): Bottom layers

Functional Components of Ecosystem

Nutrient Cycling





Phosphorus Cycle

Carbon Cycle

Gaseous Cycle
- Reservoir exists in the atmosphere.
- Nitrogen cycle, carbon cycle etc.

Sedimentary Cycle
- Reservoir is located in Earth's crust.
- Sulphur and phosphorus cycle.

Nutrient Cycling

Energy Flow

Food chain shows energy pathways. Energy passes from producer (plants) to Plant-eaters, to Animal-eaters and to tertiary consumer.

Ecological Pyramid

Pyramid of No.
- Upright e.g. in grassland
- Inverted e.g. in tree ecosystem

Pyramid of Biomass
- Upright e.g. in grassland
- Inverted e.g. in pond

Pyramid of energy

Always upright because energy is lost as heat at each step

Tropic Level

Different Trophic Levels

Tertiary Consumer/ Fourth Trophic level (Top Carnivore).eg, Man,Tiger

Secondary Consumer/ Third trophic level (Carnivore) eg, Birds, Fishes,wolf

Primary Consumer/ Second trophic level (Herbivore), eg, Zooplankton, grasshopper, cow

Primary Consumer / First Trophic level(Plants). eg.Phytoplankton, grass, trees

Specific place occupied by an organism in the food chain in an ecosystem.

Food chain

Grazing food chain

Begins with producers, present at the first trophic level.

Detritus food chain

Begins with detritus such as dead bodies of animals or fallen leaves.

Ten percent Law

During transfer of energy from one trophic level to another, only about 10% is stored at higher levels; remaining 90% is lost in respiration (heat).

Different trophic levels in an ecosystem

Productivity

The rate of biomass production is called productivity.

Primary: NPP= GPP-R

Depends on
- Plant species of that particular area.
- Environmental factors.
- Availability of nutrients.
- Photosynthetic capacity of plants.

Secondary: Rate of formation of new organic matter by consumers

Process of Decomposition

- Fragmentation
- Leaching
- Catabolism
- Humification
- Mineralisation

Depends on
- Availability of oxygen
- Chemical composition of detritus.
- Temperature
- Soil moisture

Ecological Succession

Two Types

Primary
Takes place in areas where no living organisms ever existed. E.g. newly cooled lava, bare rock, newly created pond or reservoir.

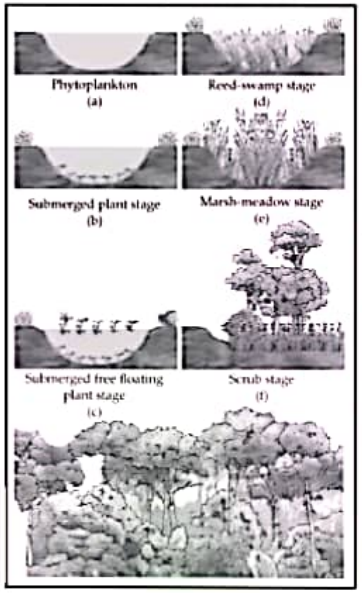
Secondary
Takes place in areas which have lost all life forms due to destructions and floods. E.g. abandoned farm lands, burned or cut forests, lands that have been flooded

Succession in plants

Hydrach Succession
Takes place in water areas. The successional series progress from hydric to the mesic conditions

Xerarch succession
Takes place in dry areas. The series progress from xeric to mesic conditions

Primary succession



Trace the Mind Map

- First Level
- Second Level
- Third Level

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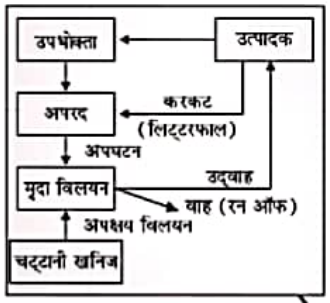
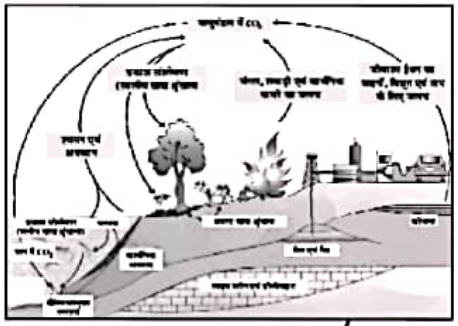
अध्याय – 14 पारितंत्र (पारिस्थितिक तंत्र)





- वायु और जल को शुद्ध बनाना।
- सूखे और बाढ़ को घटाना।
- पोषकों को चक्रित करना।
- भूमि को उर्वर बनाना।
- जंगली जीवों को आवास उपलब्ध कराना।
- जैव विविधता को बनाए रखना।
- फसलों को परागण करने में सहायता करना।
- कार्बन के लिए भंडारण स्थल उपलब्ध कराना।
- सौंदर्यात्मक, सांस्कृतिक और आध्यात्मिक मूल्य प्रदान करना।

फास्फोरस चक्र | कार्बन चक्र | पोषक चक्रण

पारितंत्र सेवाएं

संरचनात्मक एवं क्रियात्मक पारितंत्र

समर्थित है

सजीव — स्वपोषक, शाकाहारी और मांसाहारी

निर्जीव — झील, तालाब, नदी, ज्वारनदमुख

विभिन्न स्तरों पर विभिन्न प्रजातियों का वितरण

स्तर विन्यास

- (i) उभरते हुए लंबे पेड़
- (ii) कैनोपी के पेड़
- (iii) अंडर स्टोरी पेड़

} सबसे ऊपरी परतें

- (iv) झाड़ियाँ
- (v) जड़ी बूटी
- (vi) घास

} नीचे की परतें

पारितंत्र

पारिस्थितिक तंत्र के क्रियात्मक घटक

पोषक चक्रण

उत्पादकता

प्राथमिक — NPP = GPP - R

द्वितीयक — उपभोक्ताओं द्वारा नए कार्बनिक पदार्थों के निर्माण की दर

ऊर्जा प्रवाह

अपघटन की प्रक्रिया

- चरण खंडन
- निक्षालन
- अपचयन
- ह्यूमस भवन (बनना)
- खनिजी भवन

एक खाद्य श्रृंखला ऊर्जा मार्ग प्रदर्शित करती है। ऊर्जा उत्पादक (पौधों से पौधे-खाने वालों, पशु-भक्षण करने वालों और तृतीयक उपभोक्ता तक पहुंचती है।

दस प्रतिशत नियम

एक ट्रॉफिक स्तर से दूसरे में ऊर्जा के हस्तांतरण के दौरान, केवल 10 प्रतिशत उच्च स्तर पर संग्रहीत किया जाता है, शेष 90 प्रतिशत श्वसन (ऊष्मा) में ह्रास हो जाता है।

पोषी स्तर

खाद्य श्रृंखला

चारण खाद्य श्रृंखला — उत्पादकों के साथ शुरू होता है, पहले पोषी स्तर पर मौजूद है

अपरद खाद्य श्रृंखला — पशुओं या मृत पत्तियों के शवों जैसे अपरद से शुरू होता है।

पारिस्थितिक पिरेमिड

संख्या का पिरेमिड
- सीधा, उदाहरण घास के मैदान में
- उल्टा, उदाहरण पेड़ पारिस्थितिक तंत्र में

जैवमात्रा का पिरेमिड
- सीधा, उदाहरण घास के मैदान में
- उल्टा, उदाहरण तालाब में

ऊर्जा का पिरेमिड — हमेशा सीधा क्योंकि प्रत्येक चरण पर ऊष्मा के रूप में ऊर्जा का ह्रास होता है

एक पारिस्थितिकी तंत्र में खाद्य श्रृंखला में एक जीव द्वारा अधिग्रहित विशिष्ट स्थान।

पारिस्थितिक अनुक्रमण

दो प्रकार

प्राथमिक — उन क्षेत्रों में शुरू होता है जहां कोई जीवित जीव कभी मौजूद नहीं था। जैसे नया ठंडा लावा, नग्न चट्टान, नव विकसित तालाब या जलाशय।

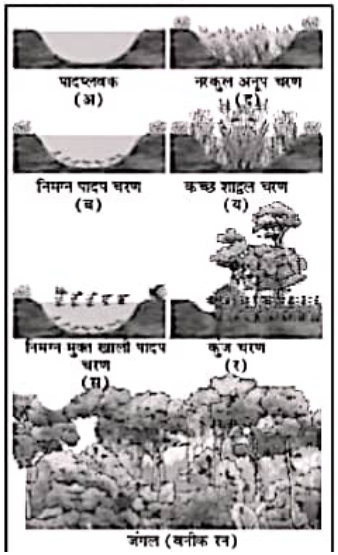
द्वितीयक — उन क्षेत्रों में शुरू होता है जो विनाश और बाढ़ के कारण सभी जीवन रूपों को खो चुके हैं। छोड़े गए कृषि भूमि, जले या कटे वन, बाढ़ प्रभावित भूमि।

पादपों में अनुक्रमण

जलोभी अनुक्रमण — जलमग्न क्षेत्रों में होता है। यह श्रेणी जल से समोदिक परिस्थितियों के ओर अग्रसरित होती है।

शुष्कतोभी अनुक्रमण — शुष्क क्षेत्रों में होता है। यह श्रेणी शुष्कता से समोदिक परिस्थितियों को ओर अग्रसरित होती है।

प्राथमिक अनुक्रमण



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अध्याय - 15 जैव-विविधता एवं संरक्षण

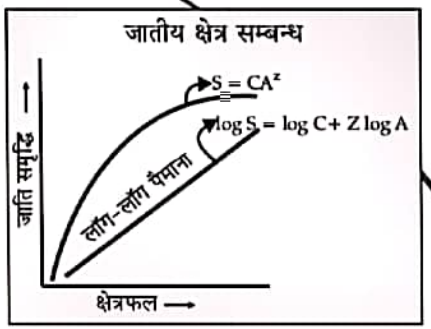
जैव-विविधता एवं संरक्षण

जैव-विविधता का स्तर

- आनुवांशिक विविधता
  - आनुवांशिक स्तर पर एक ही प्रजाति द्वारा दर्शाई गई विविधता।
- जातीय विविधता
  - जाति स्तर पर विविधता
- पारिस्थितिकीय विविधता
  - पारिस्थितिकीय तंत्र के स्तर पर विविधता

जैव-विविधता के प्रतिरूप

- वैश्विक जातीय विविधता
- अक्षांशीय प्रवणता
  - प्रजातियों की विविधता भूमध्य रेखा से ध्रुवों की ओर घटती जाती है।
  - उष्णकटिबंधीय (23.5° N से 23.5S की अक्षांशीय सीमा) में समशीतोष्ण या ध्रुवीय क्षेत्रों की तुलना में अधिक प्रजातियां हैं।
- जातीय क्षेत्र सम्बन्ध



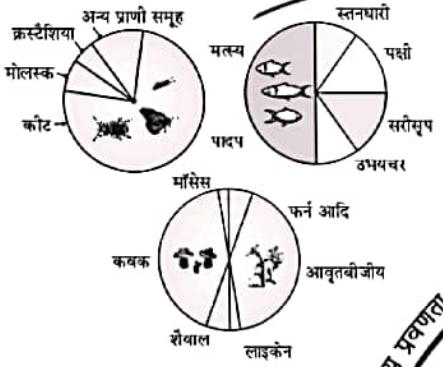
$\log S = \log C + Z \log A$

जैव-विविधता क्षति के कारण

- आवासीय क्षति और विखंडन
- अतिदोहन
- विदेशी जातियों का आक्रमण
- सहविलुप्तता

जैव-विविधता का संरक्षण

- कारण
  - संकीर्ण रूप से उपयोगी
    - 25% से अधिक औषधीय उत्पाद पौधों से प्राप्त होते हैं।
  - व्यापक रूप से उपयोगी
    - ऑक्सीजन प्रदान करता है
    - परागण
    - सौंदर्यात्मक लाभ
  - नैतिक रूप से उपयोगी
    - जैव विविधता की देखभाल के लिए नैतिक कर्तव्य।
- विधियाँ
  - स्वस्थाने (इन सीटू) संरक्षण
    - राष्ट्रीय उद्यान
    - अभ्यारण्य
    - बायोस्फीयर रिजर्व
    - पवित्र वन
    - हॉटस्पॉट्स
  - बाह्यस्थाने (एक्स सीटू) संरक्षण
    - प्राणि उद्यान
    - वनस्पति उद्यान
    - आनुवांशिक संसाधन केंद्र
    - जीन बैंक



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Biodiversity and Conservation

Biodiversity

Levels of biodiversity

- **Species diversity** — Diversity at the species level. E.g. - Western Ghats have greater amphibian species than Eastern Ghats.
- **Genetic diversity** — Diversity shown by a single species at genetic level. E.g.; *Rauwolfia vomitoria* shows genetic variation in chemical reserpine.
- **Ecological diversity** — Diversity at the ecosystem level

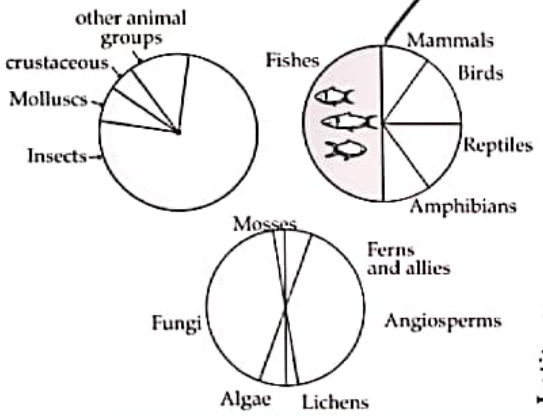
Definition

The diversity of biological organisation ranging from cellular macromolecules to biomes.

Importance of species diversity

- The communities with more species are more stable .
- A stable community not show too much variation in productivity from year to year.
- Rich biodiversity is essential for ecosystem health and survival of human race
- Tilman : Increased diversity contributed to higher productivity.

Global Species Diversity

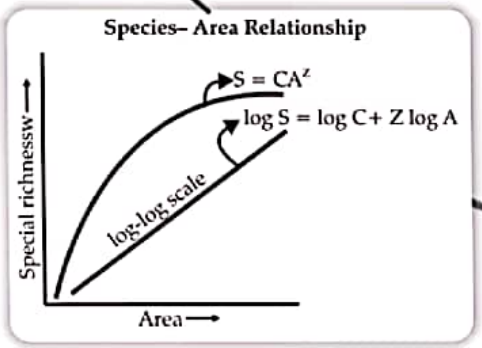


Patterns of biodiversity

Latitudinal gradients

- Species diversity decreases from the equator towards the poles.
- Tropics (latitudinal range of 23.5° N to 23.5° S) have more species than temperate or polar areas.

Species– Area Relationship



$\log S = \log C + Z \log A$

Causes of loss of biodiversity

- Habitat loss and fragmentation
- Over-exploitation
- Alien-species invasions
- Co-extinctions

Conservation of Biodiversity

Reasons

- **Narrow Utilitarian** — More than 25% of the drugs are derived from plants.
- **Broadly Utilitarian**
  - Provides oxygen
  - Pollination
  - Aesthetic pleasures
- **Ethical Utilitarian** — Moral duty to take care for biodiversity.

Methods

- **In-situ Conservation**
  - National Park
  - Sanctuary
  - Biosphere Reserves
  - Sacred Forests
  - Hotspots
- **Ex-situ Conservation**
  - Zoological Parks
  - Botanical gardens
  - Gene banks
  - Genetic resource centres

Trace the Mind Map — First Level · Second Level · Third Level

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