SACRED HEART COLLEGE, CHALAKUDY

(AFFILIATED TO UNIVERSITY OF CALICUT)

THRISSUR, KERALA - 680307

AQAR 2021-22

CRITERION I

1.1.1 - The Institution ensures effective curriculum delivery through a well planned and documented process



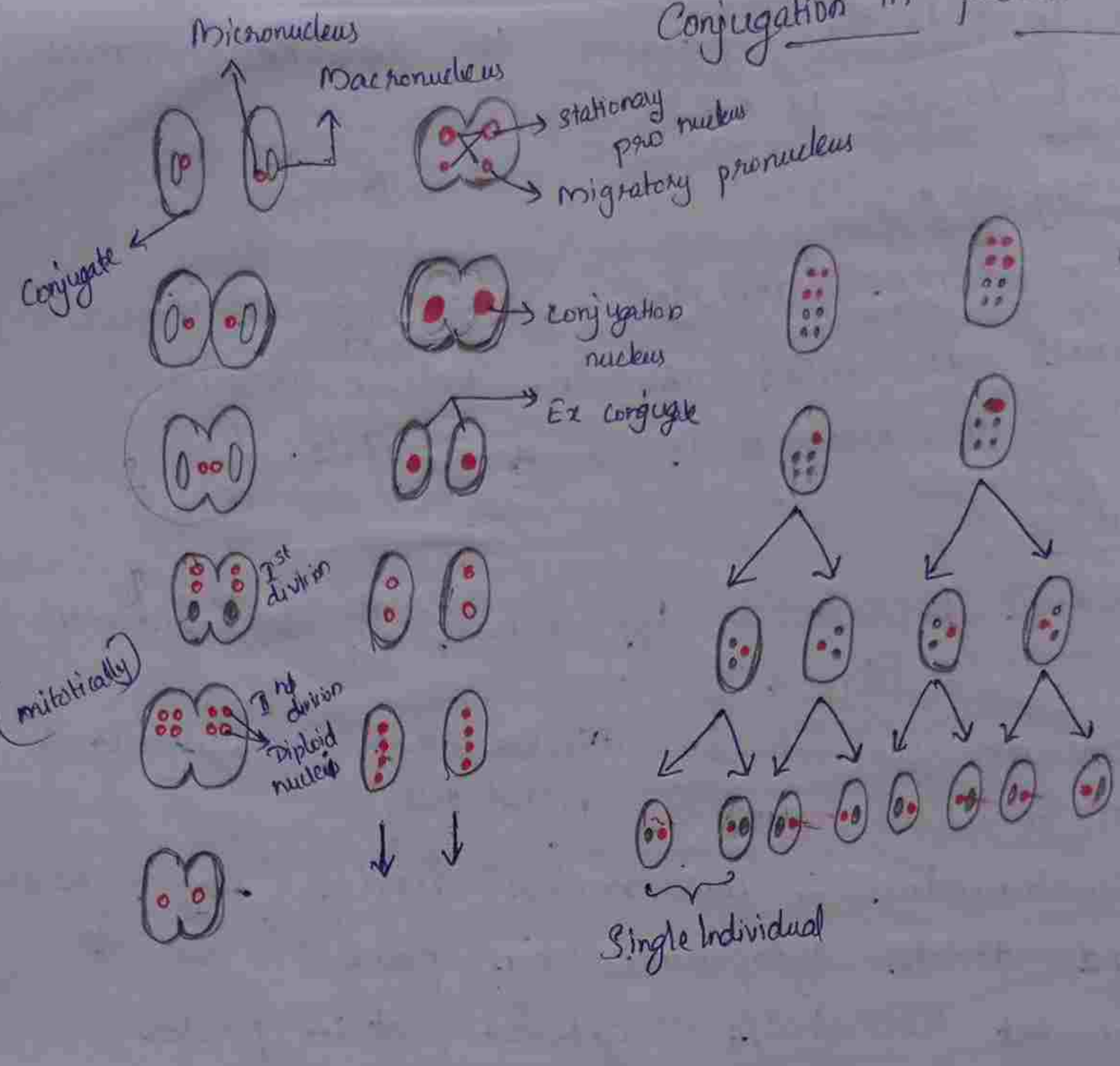
Submitted to

National Assessment and Accreditation Council

Student Notes

Department of Zoology

Conjugation in Paramecium



Paramecia Two paramecium involved in conjugation called as Conjugate.

Larger :- Stationary pro nucleus :- active

Small :- migratory pro nucleus :- movable

↓

It fuss to the Stationary in neighbo

Conjugate and fuse

and form Conjugate

Significance of conjugation

Demerits of binary fission :-

① Senility [old age] and decay in their race

② lose physiological efficiency and reduced in size

③ Degenerate in their Oraganization and enter into a state

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Merist of Conjugation

① Rejuvanate the senescent organisms.

② Reorganization leading to renewed vigour (All activities get renew)

③ Creation of new hereditory combination.

Two paramecia exchange their genetalia

Two conjugate close together by their ventral side

They lie together. Macronucleus degenerate

Micronucleus under division form four nuclei

and only two of them are alive. and it

become division and form two :- one is bage

and another is small. and the migratory

pronucleus fuse with with stationary pronucleus

of other conjugate and form conjugate nucleus.

Thus it forms Ex conjugate. That ex conjugate

divides, thrice and later forms 4 micro and

macro nuclei and then one micronucleus become

alive other three are dissapears and that

one micronucleus along with 4 macronucleus

divides along with parent and form 2 macronucles

and one micronucleus. Then form 4 set of it.

Each of its formed Single Individuals consist

of one micronucleus and one macronucleus.

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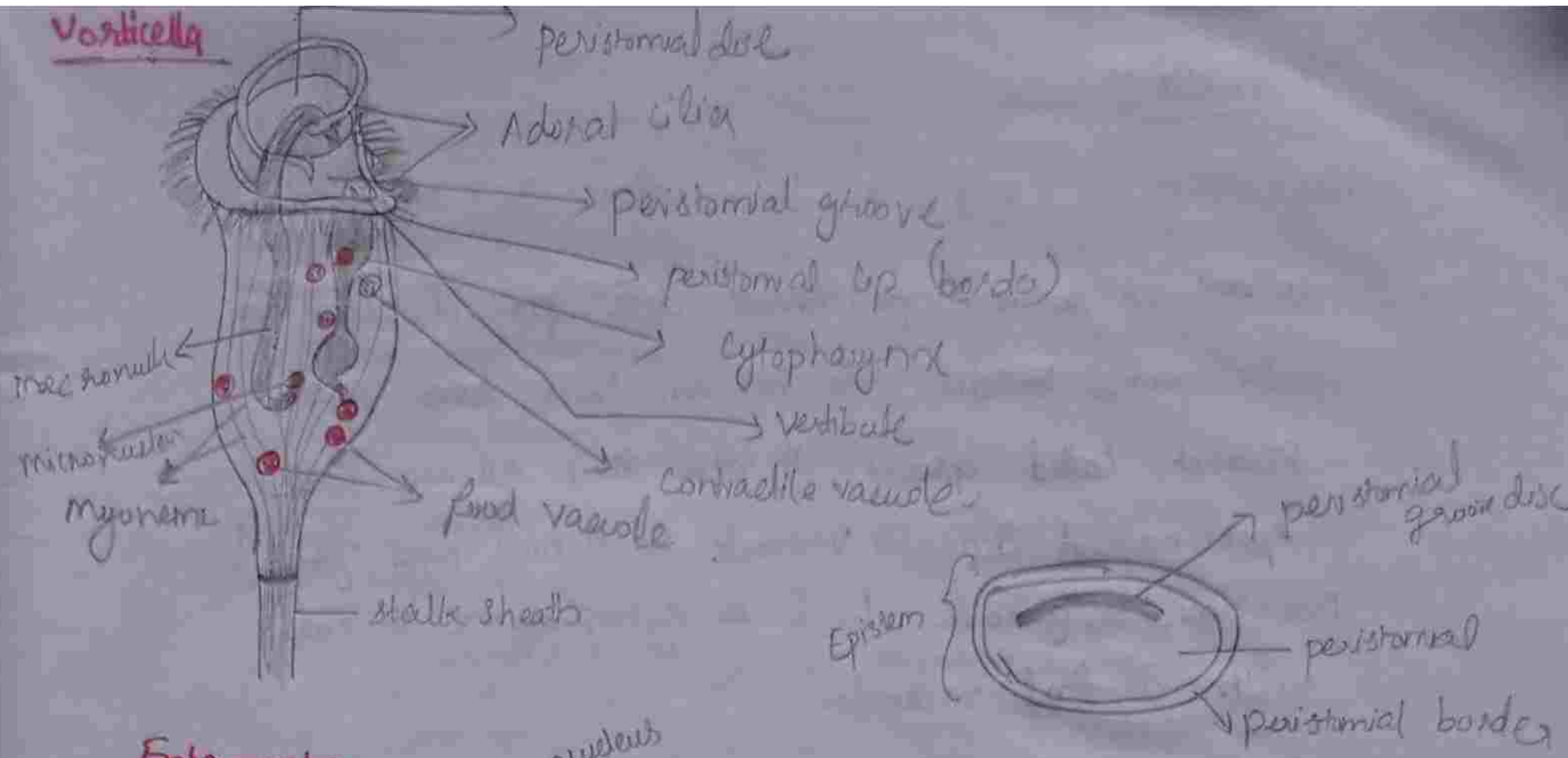
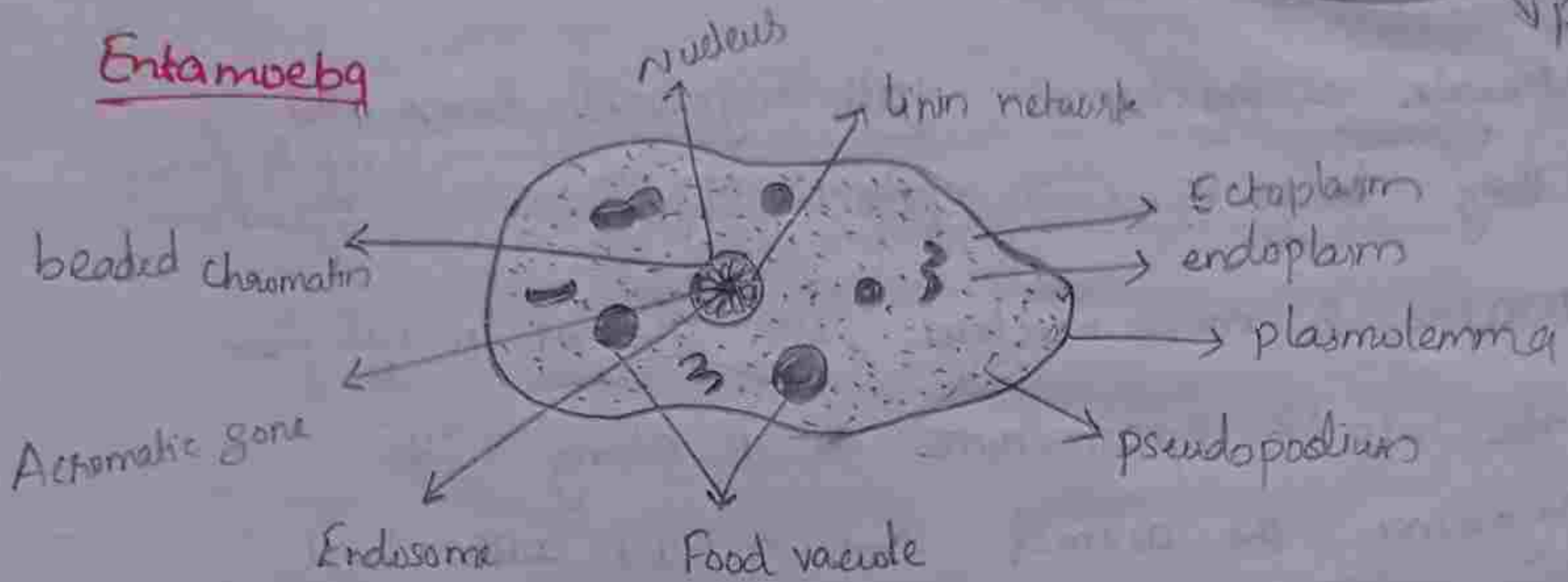
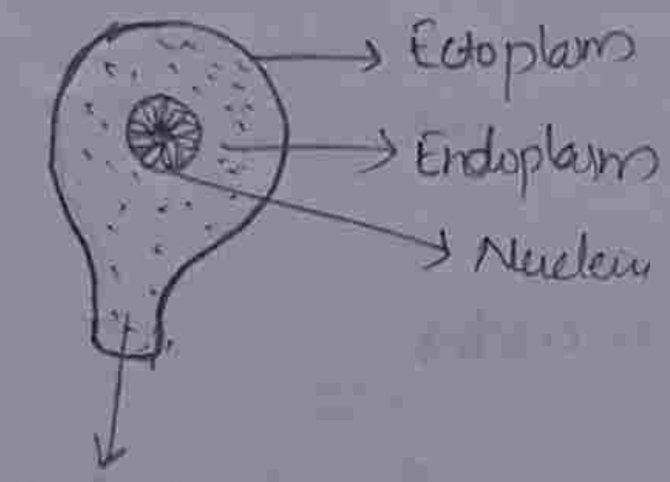
Vorticella



Entamoeba



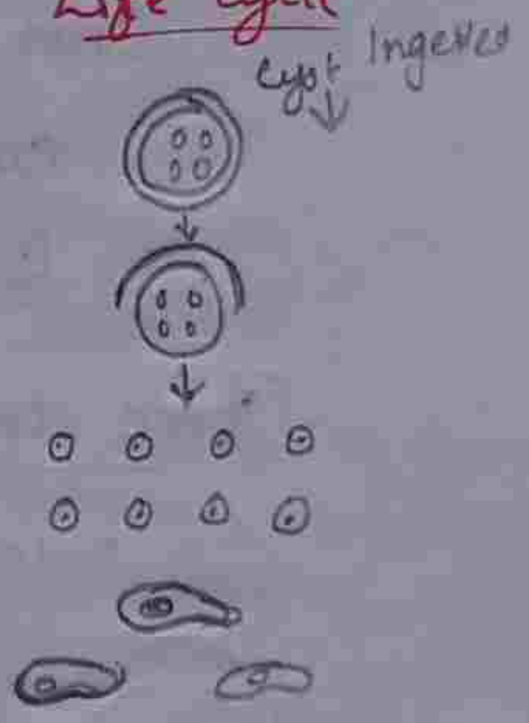
Magna Form



[Lobopodium]

Minuta

Life cycle



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Vorticella

Anterior position :- Bell so it is called Bell animal

In anterior position peristomial disc present along that peristomial border. In between there space present called groove. It sides there all are called epistome. A depression vestibule & funnel shaped cytopharynx peristomial groove leads to cytophaynx it ends with a food vacuole.

Contractile elements :- Myonemes [all myonemes forms and they body is with pellicle (Thin) unite & forms Spasmoneme]

(Single layer) Macro & micro nucleus, are present in cytoplasm

In the help of Spasmoneme it along with Myonemes the animal can retract it bell when disturbed

Cilia is distributed in peristomial region

Cilia is also seened in vestibule and phaynx for food & feeding

Three concentric rows

outer one and two inner circles

Reproduction is binary fission and also conjugation

Contractile vacuole :- osmoregulation

Fresh water form

sessile

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Entamoeba

Phylum Rhizopoda

4 species :- Entamoeba histolytica host :- man
also seen monkey
pig dog

E. coli

E. invadens

E. gingivalis

E. histolytica

active feeding (large irregular)

Trophozoite form → (vegetative form)

(feeding, & growing Vegetative form)

↓

magna & minuta form

harmful form
seen in intestinal wall
Cause Amoebic disentary
oval shape

harmless
seen in lumen of the Intestine
extended (psuedopodia)

precystic form (Transitory period) intestinal lumen

cystic form

intestinal lumen

precystic form develop double layered form

Minuta form :- enter into the wall of intestinal become magna & divide

Entamoeba

granules are :- ectoplasm

endoplasm :- heavy

Center of nucleus chromatic region called Endosome Caryosome

enveloped clear Achromatic zone

From endosome to Achromatic nuclear envelop region present chirin network (Spiral like structure) food vacuoles and no. of other vacuole present

↓

Contain RBC, tissue debrise, digestive enzyme

Anterior region extended by pseudoplasm

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opposite region :- posterior
It can retract & extends its pseudopodium when it requires.

In early stages magna contain glycogen and chromatin bars and when it matures it disappears

Minuta

No food vacuole

Cyst enters to lumen minuta form move to ewall become magna. Sometimes it enters to lumen again (presystic stage) and become double layer. Then it enters to encystic form. Two mitotic division first form binucleatic cyst and become tetranucleate cysts. In moisture contains it be alive easily Tetranucleate stage released to the soil. It break off dead. looses it cyst the nucleus divided into and form 8 nucleated cyst. cytoplasm around each nucleus and cyst wall breaks young amoebula (Trophozoite) it enter into nucleus

Chronic :- anaemia
muscles weight lose
Cachexia
Amoebic granuloma

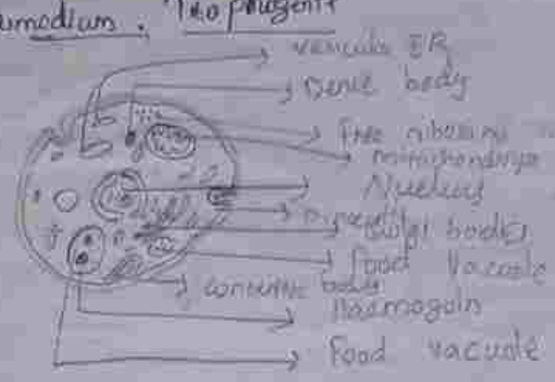
loss apetite
inflated abdomen
gripping pain
headach
flowy stool
Severe case :- Cavities develop in
cramping

Acute dysentery

Intestinal adhesion
perforation
metastatic

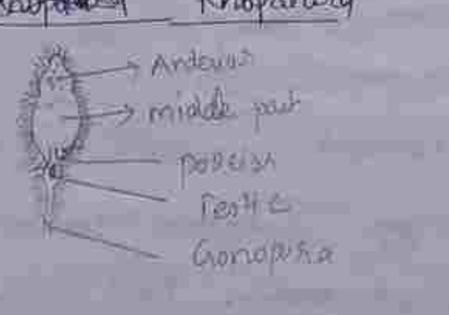
Secondary Infection (invasive)

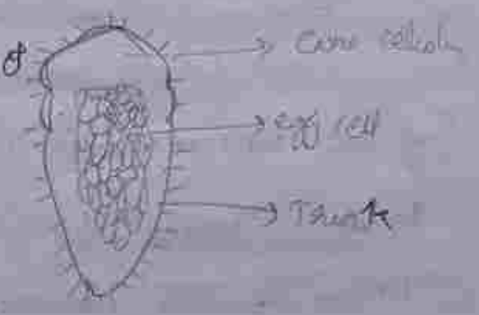
Plasmodium : Trophozoite

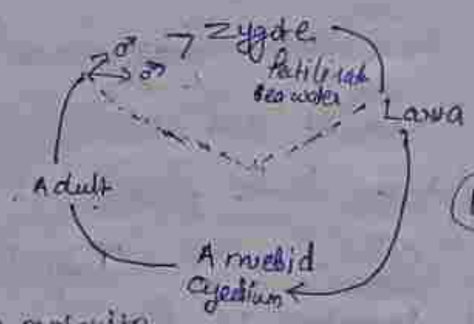


12-15 day P. vivax
12 days P. falciparum (death) (malignant tertian malaria ....
Incubation period 12-15 days P. ovale (mild tertian malaria
25-30 day P. malaria (quartan malaria

Rhopalurg Rhopalurg







Primary :- Female Anopheles mosquito

Feeding & growing form of plasmodium

There is a uninuckeus. plasmodium also called uninucleate amoeboid protozoan. mitochondrion, ribosome etc are seen in plasmodium. food vacuole contain haemozoin it is the digestive part of haemoglobin

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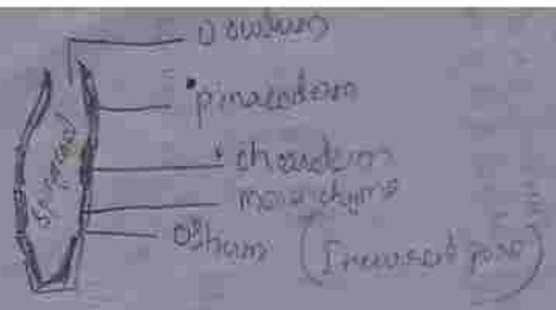
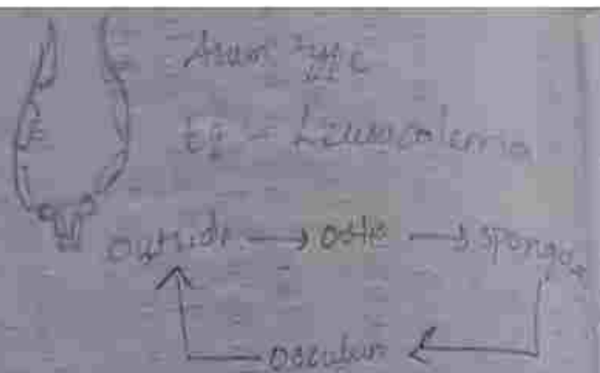






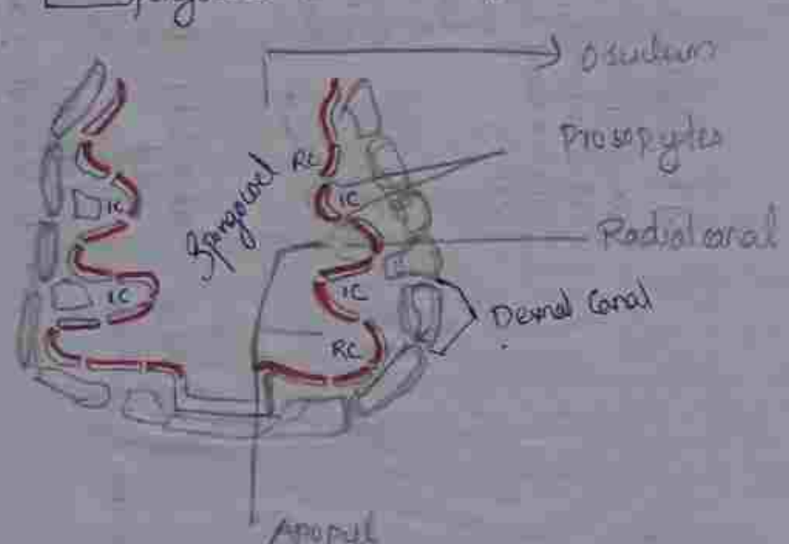
Sycon :- Simple type

Eg :- Sycon

outside → ostia → Radial canal

osculum ↑ ↓

spongocoel ← Apopyle



Sycon - complex

Outside → Dermal ostia → Incurrent canal → prosophyle ↓ Radial canal → Apopyle → spongocoel → Osculum → Outside

Leuconoid type

Canal System

In Some complex sponges Rhagenoid type Ascon, Sycon, Leucon, & Rhagon :- canal systems.

In Simple sponges :- Ascon

Shape is like a vase

inside it cavity can be seen called spongocoel

layers :- inner layer, outer layer & middle layer

to enter into the body through ostium

water goes out from the body to outside through osculum

Small finger shape structure that the outpushing body wall called Radial canal.

* In Sycon type perforations on organs. only freely hanging radial canal opens to - Apopyle.

* In the case of Sykon type of canal system when cortex starts to form. between 2 radial canal is to closed by cortex. Then another canal cavity form. The space to is lost by the formation of cortex cortex is perforated by dermal ostia. from IC to RC. through prosopyle. Then RC to spongocoel through Apopyle. From spongocoel to outside through Osculum (Sponges becoming solid) only the RC is covered by choanocytes.

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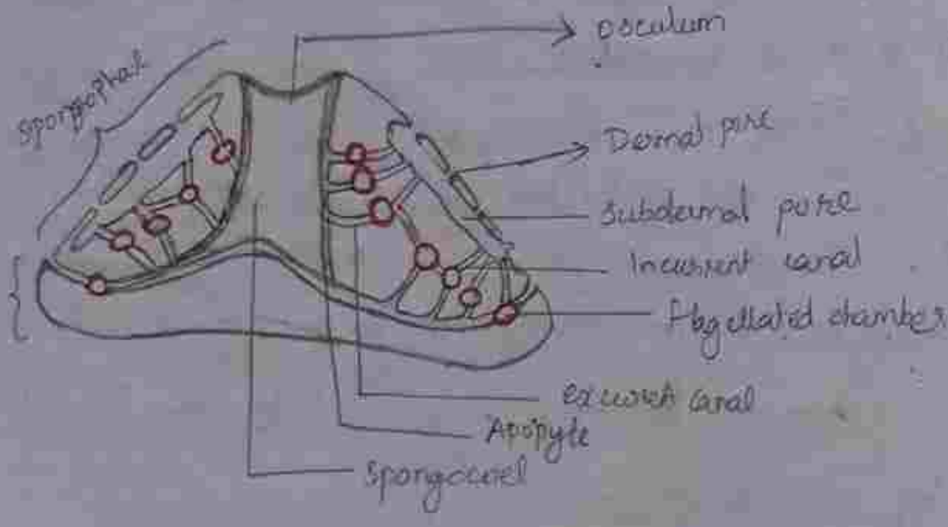
The Rc further folded into small ... tube known as flagellated chamber. There foldings covered by Choanocytes. Between two flagellated chambers there occurs excurrent canal. Apopyl

① Eurypylous (tube passes apopyl)
② Aphodal ← Apopyle extends into tube
③ diplodal both apopyl (In addition to Aphodal prosopyle present in tube)





outside → ostia → Sub dermal spaces → Incurrent canals → Prosopyle → Flagellated chamber → excurrent canal → Apopyles → Spongocoel → Osculum



Leucosolenia

Class :- Calcispongiae

Nutrition :- planktons....
Canal system :- Asconoid
Cavity , ostia,
Vase shaped .
Fully porous type
Horizontal tubes
From horizontal, Vertical tube arises.
It has pinacoderm & Choanoderm
Spicules present :- Calcareous they embedded in mesohyl
Storage food materials in Amoeboid cell totipotential cells.
Asexual reproduction by budding
Sexual reproduction by larval form parenchymula
Internal cross fertilization (hermaphrodites)
It has the power of regeneration.

Euplectella

[Lives on below seafloor]



Class :- Hyalospongiae
Scientific Name :- Euplectella aspergillum

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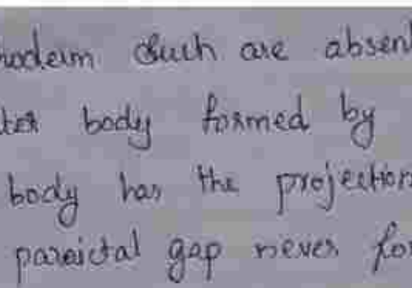
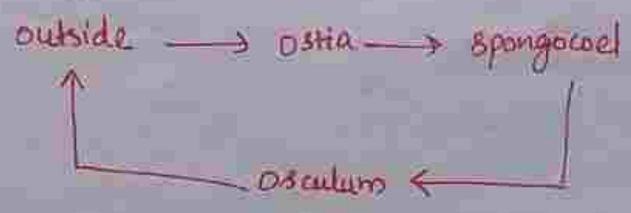
pinachoderm. Such are absent.
The entire body formed by lattice network of Siliceous spicule
The body has the projection of spicule.
The parietal gap never form canal System
Canal System :- Syson type
Osculum covered by oscular sieve
Usually it is Euplectella are spongicola venusta.
Single Siliday
Root spicules attached the body by Root tuft
They grow about 1-3 m
Reproduction is not known.

Spongilla



It is Seened in pounds, lakes etc.
colonial forms, greens in colour It harvest an algae called Zoochorella. It feeds on algae
Base also has a perforation.
* Asexual reproduction is by formation of gemmule
Sexual reproduction :- By larval forms It is peculiar to the fw class :- Demospongiae
Canal System :- Rhagon
Spongi Fibres

Asconoid type
Simplest type. cavity :- Spongocoel
Important feature :- (i) Simple wall (ii) complete & continous lining epithelium of choanocytes
The outer epithelium :- pinacoderm. composed of pinacocytes
The inner epithelium :- choanoderm :- Composed of choanocytes
They are radially symmetrical, vase like body
Sponges open through narrow opening Osculum
Middle epithelium :- mesenchyme
↓
Skeletal spicules
Amoebocytes embedded in gelatinous matrix
perforated numerous microscopic pores incurrent pores or Ostia
eg :- olynthus



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Animal Diversity : Non chordata - I

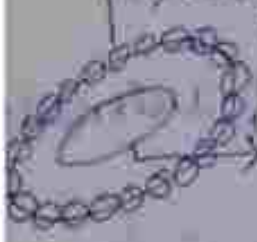
concepts of classification of animals

classification based on no: of cell tissue or organ system level of organisat^{n} development of germ germ layer, devpt of symmetry, devpt of coelom, segmentat^{n} in somite homology of analogy organs and their Origin. devpt of mouth and digestive tract.

* Kingdom Animalia is ÷ into 2 sub kingdom Mesozoa and Metazoa

Sub kingdom Mesozoa:

lower level of cellular grade of Organisat^{n}.



Middle animals fewer cells 100 – 200

phylum Orthonectida

phylum Rhombozoa (Dicyemida)

Sub kingdom Metazoa : Multicellular grade of organisation

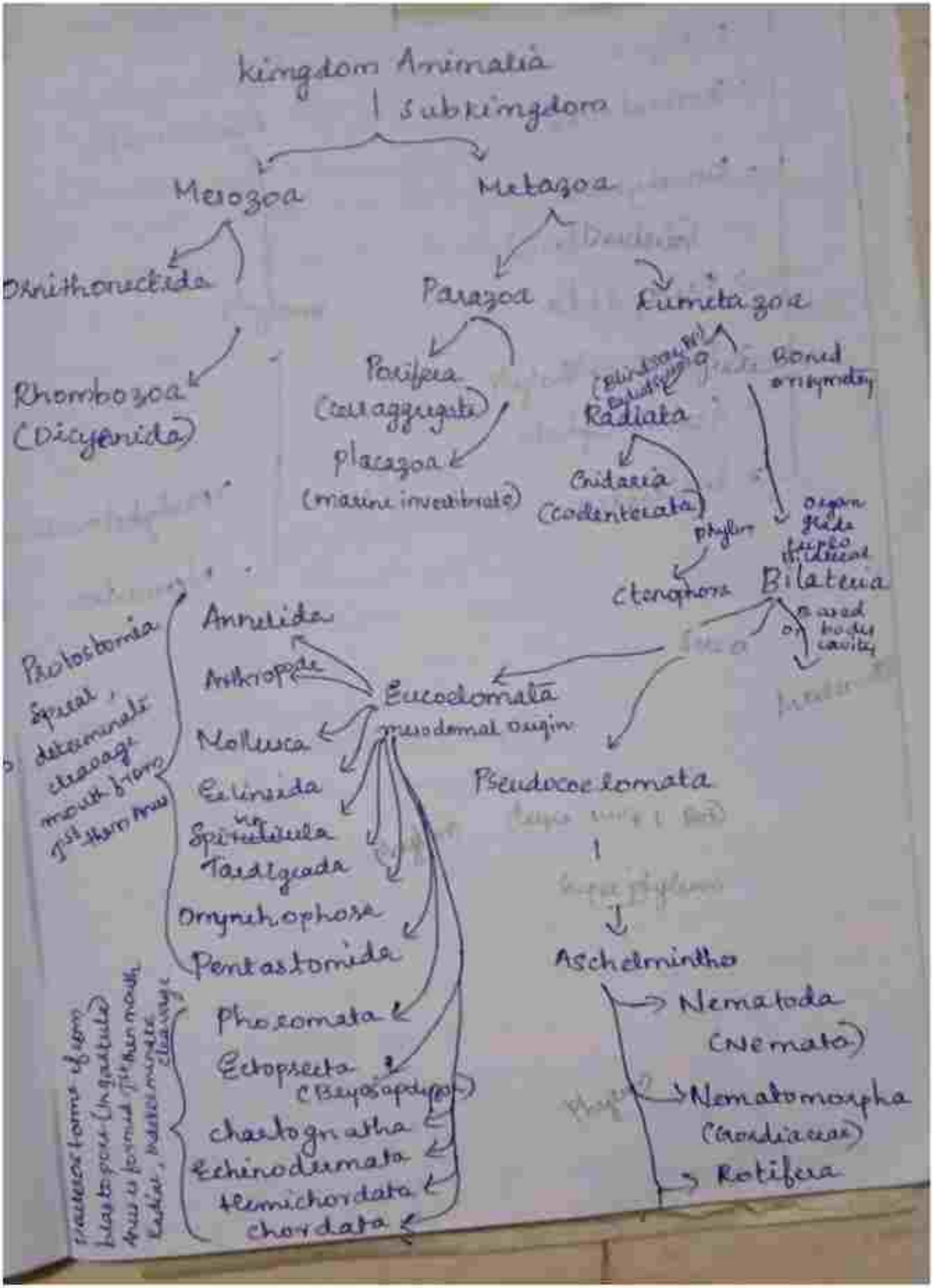
↓

Division parazoa : near animals cellular

Division Eumetazoa : multicellular, tissue, organ, organ system level true animals

↓

Grade (Based on symmetry)


Kingdom Animalia
Subkingdom
Mesozoa
Metazoa
Orthonectida
Parazoa
Eumetazoa
Rhombozoa
(Dicyemida)
Porifera
(cell aggregate)
placozoa
(marine invertebrate)
Radiata
Bond
Cnidaria
(Coelenterata)
Ctenophora
Bilateria
Protostomia
Annelida
Arthropoda
Mollusca
Echinozoa
Sipuncula
Tardigrada
Onychophora
Pentastomida
Deuterostomia
Phoronata
Ectoprocta
(Bryozoa)
Chaetognatha
Echinodermata
Hemichordata
Chordata
Eucoelomata
Pseudocoelomata
Aschelmintha
Nematoda
(Nemata)
Nematomorpha
(Gordiacea)
Rotifera

Difference b/w Parazoa and Eumetazoa

Parazoa are more complex than protists and mesozoans and less complex than Eumetazoan they are least specialized of all metazoans. They are asymmetrical organisms of the cellular grade of organisation without nerve cell and muscle cell, true tissues, organs and organ systems.

Eumetazoa is large of complex metazoans. They exhibit high degree of structural differentiat^{n} and functional specializat^{n}. Eumetazoans characteristically have connective, epithelial, muscular and nervous tissue. Muscular and nervous tissue enable them to move about. In eumetazoans tissues, organs, and organ system are arranged along definite body axes.

Difference b/w Eumetazoa and Mesozoa

Eumetazoa is large group of complex metazoans. Some of them have tissue grade of organisat^{n} with similarly modified cells organized into different kinds of tissues for specific funct^{n}. Others have organ grade of construct^{n} with tissues, organs and organ systems. They have

connective, epithelial, muscular and nervous tissues

Mesozoa is a group of long, worm-like, parasitic organisms. They are apparently intermediate b/w simple and unicellular Protists and complex and multicellular metazoans in the level of their organisation. Nerve cells, muscle cells, skeletal material and tissues are absent.

Difference b/w Acoelomata and Pseudocoelomata

Acoelomata includes the triploblastic animals without a coelomic body cavity. the space b/w the body wall and the alimentary canal is filled with a loose mesodermal tissue called parenchyma or mesenchyma. They exhibit the "blind-sac" type of body plan. They include 2 phyla platyhelminthes and Nemertea

Pseudocoelomates are bilaterally symmetrical and triploblastic animals in which the body cavity is a fluid-filled false coelom, known as pseudocoel. They exhibit "tube-within-tube" type of body plan. They include Aschelminth phyla Nematoda,

Nematomorpha, Rotifera, Gastrotricha, Kinorhyncha, Priapulida, Entoprocta, Acanthocephala and Loricifera

Difference b/w Acoelomata and Eucoelomata

Acoelomates include the triploblastic animals without a coelomic body cavity. They include 2 phyla namely platyhelminthes and Nemertea.

Eucoelomates are primarily bilaterally symmetrical and triploblastic animals with a coelomic body cavity. They include the phyla Annelida, Arthropoda, Mollusca, Echinodermata, Hemichordata, chordata, Echiurida, Sipuncula, Tardigrada, Onychophora, Pentastomida, Phoronida, Ectoprocta, chaetognatha, etc....

Difference b/w Pseudocoelomata and Eucoelomata

Pseudocoelomates are bilaterally symmetrical and triploblastic animals in which body cavity is fluid filled false coelom. They include Aschelminth phyla Nematoda, Nematomorpha, Rotifera, Gastrotricha, kinorhyncha, priapulida, Entoprocta, Acanthocephala and loricifera

Eucoelomata are primarily bilaterally

Symmetrical and triploblastic animals with a coelomic body cavity. They include phyla Annelida, Arthropoda, Mollusca, Echinodermata Hemichordata, chordata, Echiurida, Sipuncula, Tardigrada, Onychophora, pentastomida, Phoronida, Ectoprocta, chaetognatha, etc...

Difference b/w blind sac and tube-within-tube

Blind sac plan is found in cnidaria, ctenophora and acoelomate bilateria, such as platyhelminthes and Nemertea. In this case, body is sac-like with a central digestive cavity that opens out only by mouth. cells are structurally and functionally modified for different functions, and are organized into tissues in some and into tissues, organs and organ systems in others. Among cells, division of labour and nervous co-ordinat^{n} are characteristic.

Tube-within-a-tube plan is found in pseudocoelomates and eucoelomates. In this case, the whole body is tubular, with a body cavity within a body wall, placed within

CLASSIFICATION OF THE LIVING WORLD

Two kingdom classification

Since, the time of Aristotle, divided the living world into a kingdom namely Plantae based on external form and shape, locomotor power, mode of nutrition, etc....

~~Plants have no definite form and shape~~

Short comings of 2-kingdom classification

does not provide an appropriate taxonomic position for some organisms, which have characters of both plants and animals.

Euglena have neither plant character nor animal character. So, they do not deserve a place either in plant or in animal kingdom

Diatoms are included in plant kingdom and protozoans in animal kingdom.

Bacteria and cyanobacteria are prokaryotes still, they are placed in plant kingdom.

Fungi are placed in plant kingdom; since

some of them is chlorophyes bearing and photosynthetic, most of them have a chitinous cell wall

* Slime moulds lack cell wall and ingest particulate matter during vegetative phase but develop spores during reproductive phase thus they are animal-like in the vegetative phase and plant-like in the reproductive phase. so, their inclusion either in animal or in plant kingdom is arbitrary

Five-kingdom classification

In 1969 R.H Whittaker proposed the five kingdom classification, elevating fungi to the status of an independent kingdom and provide seperate kingdom for bacteria and cyanobacteria. The five kingdoms are Monera, Protista, fungi, plantae and Animalia

Five kingdom classification is based on:-

* cellular complexity * Mode of nutrition
* Body complexity * Phylogenetic relation

Monera comprises acellular prokaryotes such as eubacteria and cyanobacteria.

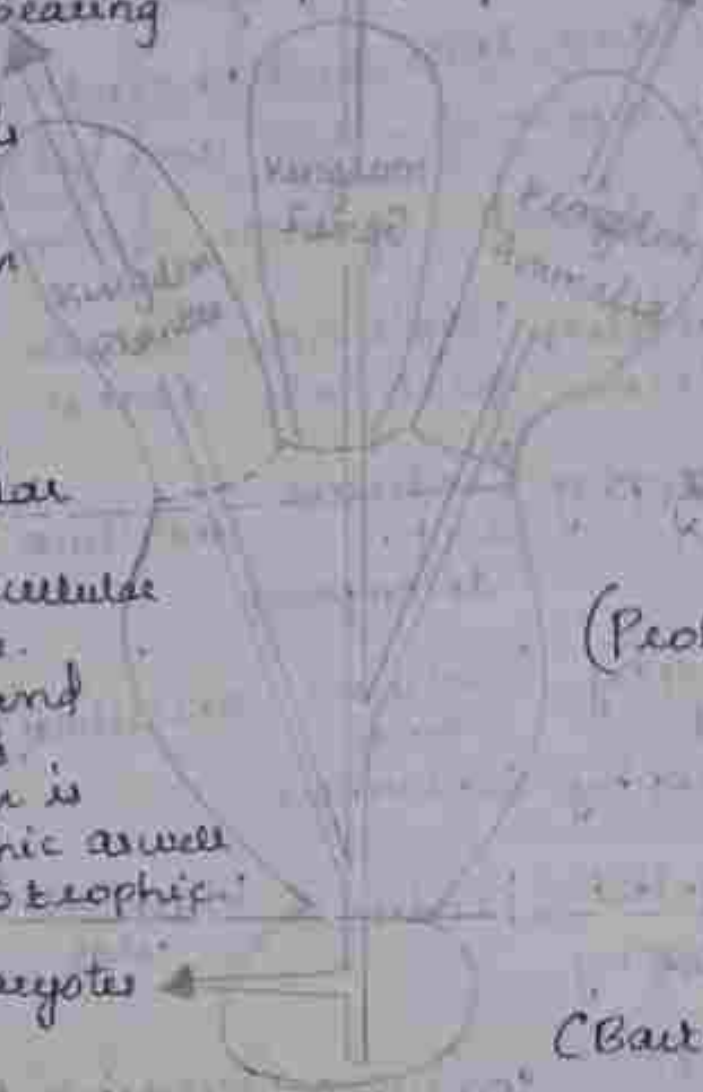
Protista comprises protophytes and protozoans. Protophyte are plant-like and phototrophic. Protozoans are animal-like and heterotrophic. Fungi were the first to arise from Protista.

Kingdoms	Main mode of nutrition	Major ecological role	cellular status	complexity of organism
Monera	Autotrophy	Producers and decomposers	unicellular	Prokaryotes
Protista	Phototrophy and heterotrophy	Producers and Consumers	unicellular	Eukaryotes
Plantae	Photosynthetic autotrophy	Producers	Multicellular	Eukaryotes
Animalia	Holozoic heterotrophy	consumers	Multicellular	Eukaryotes
Fungi	Saprophytic heterotrophy	Decomposers	Multicellular	Eukaryotes

Eukaryotes chlorophyll lacking Reducers & decomposer Nutrit^{n} is saprotrophic

Eukaryotic Multicellular chlorophyll bearing Producers Nutrition is Phototrophic (350 million years ago)

Eukaryotes consumers Nutrition is holozoic heterotrophy (evolved 1 billion yrs ago)



Complex, multicellular

Simple, unicellular eukaryotes. Produces and consumers. Nutrition is Phototrophic as well as heterotrophic

(Protophyta and Protozoans)

Prokaryotes

(Bacteria and cyanobacteria)

Ancestral stock

simple, unicellular Prokaryotes. produces and reducers. Nutrition is autotrophic.

Merits of five kingdom classification

It reveals the course of evolution of early organisms into plants and animals.

In five kingdom classification plant and animal kingdom are more homogeneous than in two-kingdom classification

The inclusion of Prokaryotes is an independent kingdom (monera) Seperating them from higher plants is justifiable, because they differ from other organisms morphologically and Physiologically

The inclusion of all unicellular organism in the kingdom protista could avoid the arbitrary inclusion of some of them (eg; Euglena, clamydomonas) etc.. either in the plant kingdom or in animal kingdom

The evolution elevation fungi to the rank of an independent kingdom is fully justifiable, because they differ widely from plants with which they were formerly grouped in the plant kingdom.

De-Merits of five kingdom classification

kingdom monera and protista are not homogeneous group. but are heterogeneous with photosynthetic autotrophs and non-photosynthetic heterotrophs

The phylogenetic relations of some lower group are not fully reflected. for example ; green algae and some photosynthetic bacteria are quiet similar in that their source of photosynthetic hydrogen is not water. Still, they are placed in two different kingdom

Viruses, Viroids and prions have no place anywhere in any of the five kingdoms

Eight-kingdom classification

cavalier-smith proposed the eight-kingdom classification in 1993. The eight kingdom are Eubacteria, Archaebacteria, Archezoa, Protozoa, Chromista, fungi, plantae and Animalia.

Archezoa include the mitochondrial-lacking Protists, protozoa include the mitochondriate and non photosynthetic protists, and chromista includes the mitochondriate and phototrophic protists.

Eight-kingdom System
[Cavalier-Smith]

- Kingdom Eubacteria
- Kingdom Archaebacteria
- Kingdom Archezoa
- Kingdom protista
- Kingdom chromista
- Kingdom fungi
- Kingdom plantae
- Kingdom Animalia

Jun 8 GENETICS

> William Bateson - coined the term "Genetics"
> Genesis - means origin
> units of heredity are gene - earlier called factors by mendel
> Johann Gregor Mendel - Father of Genetics
> Mendel chose pea plant pisum sativum for following reasons
- usually self pollinating - asexual reproductive elements enclosed by petals
- obtainable in pure breeding varieties.
- grows easily in an experimental setup
- generation time is less
+ Stamens easily removed & pollen transferred from another plant
- hybrids were found to be fertile.
- contrasting character (7)
* flower colour * flower position
* seed colour * seed shape * pod shape
* pod color * stem length.

> 1864 - 1866 he published his work, but went unrecognized
1900 - De Vries & Correns rediscovered Mendel work

Terms used in genetics

- P - Parental generation - homozygous - pure line breeding - used for many generations
- F_1 - (First filial generation) progeny of parents
- F_2 - Progeny of F_1 after self fertilization
- Dominant - character that is expressed in the monohybrid generation
- Recessive - character that is expressed only in the homozygous condition
- Phenotype - physical appearance
- Genotype - genetic constitution of individual
- Hybrid - possible a individual with only one pair of contrasting characters
- Homozygous - when identical alleles are present at both genes loci for a particular character
- Heterozygous - when dissimilar alleles are present on the gene loci for a particular character

Mendel's monohybrid cross

Parent (P) Tall pea plant × small pea plant

(Dominant) (Recessive)

F_1 - All are tall pea plants with genotype Tt

Tallness × Tall pea

Tt × Tt

F_2: TT, Tt, Tt, tt

Tall, small

Phenotypic ratio 3:1 genotypic ratio 1:2:1

Long and vestigial winged Drosophila

— T is dominant

LL × ll

long, vestigial

gene

F_1 Ll

Ll × Ll

phenotypic ratio 3:1

genotypic ratio 1:2:1

F_2

Homozygous

Heterozygous

Laws of segregation | law of purity of gametes

- In a heterozygote the allele dominant & recessive remain together throughout without contamination or mixing with each other
- During gametogenesis they separate/segregate from each other
- each gamete will have either the dominant or the recessive allele
- During Anaphase I of meiosis homologous chromosomes get separated & each gamete receives only one member.

Chromatogenesis



duplication



meiosis I  separa 

meiosis II   chromatids

1 gamete passes only one allel.

Mendel's cross

round, yellow | round green | wrinkled, yellow

wrinkled, green

RRYY — (R)(Y)

wrinkled yellow

x

rryy (wrinkled green) F1

RrYy

(round green) — (R)(y)

F1 x → gametes

F1

gamet

P:

	RY	Ry	rY	ry
RY	RRYY round yellow	RRYy round yellow	RrYY round yellow	RrYy round yellow
Ry	RRYy round yellow	RRyy round green	RrYy round yellow	Rryy round green
rY	RrYY round yellow	RrYy round yellow	rrYY wrinkled yellow	rrYy wrinkled yellow
ry	RrYy round yellow	Rryy round green	rrYy wrinkled yellow	rryy wrinkled green

Biostatistics ... Today

Analysis of data:

a) Measures of central tendency: Mean, Median, mode, Standard error

once the data are presented in various ways, they have to be analysed for their characteristics. There are various statistical methods for data analysis. The important one are measures of central tendency & measures of dispersion.

central tendency: the word 'avarge' denotes a representative of a whole set of observation. It is a single figure which describes the entire series of observations with their varying size. It is a typical value occupying a central position where some observations are larger & some others are smaller than it. Avarage is a general term which describes the centre of series. It is the central part of the distribution & therefore they are also called the measures of central tendency.

Measures of central tendency: the most common central tendencies are

1. Mean or Arithemetic mean
2. Median

? median for grouped data : discrete series

Procedure :

1. Arrange the data in either ascending or descending order of magnitude.
2. A table is prepared showing the corresponding frequencies & cumulative frequencies.
3. Now median is calculated by the following formula

$M = \left(\frac{n+1}{2}\right)^{th}$ item

Income (Rs)	100	150	80	200	250	120	300
No. of Persons	34	26	16	20	6	30	8

Income	No. of persons	Cumulative frequency
80	16	16
100	24	40
120	30	70
150	26	96
200	20	116
250	6	122

$M = \text{size of } \left(\frac{n}{2}\right)^{th}$ item $+ \left(\frac{n}{2}+1\right)^{th}$ item

$= \frac{122}{2}^{th} + \frac{122}{2}+1$

$= 61^{st} + 62^{nd}$ item

$= \frac{(150+150)}{2}$

$= 150$

$M = L + \frac{\frac{n}{2} - C}{f} \times i$

(Continuous series)

The no. of runs scored by 11 players of cricket team is as follows

6 19 2 11 50 30 21 0 52 34 27

Find the median :

0 5 11 19 21 27 30 36 42 50 52

$\frac{n+1}{2} = \frac{11+1}{2} = 6^{th}$

Ex 1

? compute the median wage from the following 10 persons wearing wages in rupees

75, 205, 315, 34, 340, 1025, 521, 791, 695, 234

→ 34, 75, 205, 315, 340, 521, 695, 791, 1025, 234

$\frac{n}{2} = \frac{10}{2} = 5$ $\quad \frac{n}{2}+1 = 6^{th}$

$\frac{340+521}{2} = 430.5$

marks	no of students	cumulative frequency
11-20	12	12
21-30	38	50
31-40	125	175
41-50	89	264
51-60	45	309
61-70	31	340
71-80	30	370

$$M = L + \frac{\frac{n}{2} - C}{f_m} \times i$$

Lower class boundary

Frequency of the median class

f_m = frequency of the median class

i = class interval

n = total frequency

$\frac{n}{2} = \frac{370}{2} = 185$

$L = 31$

$C = 50$

$f_m = 125$

$i = 9$

$M = 31 + \frac{185 - 50}{125} \times 9$

$= 31 + \frac{135}{125} \times 9$

$= 31 + 9.72$

$= 40.72$

$\frac{n}{2} = \frac{400}{2} = 200$

$f_m = 165$

$C = 80$

$i = 9$

$L = 31$

$M = 31 + \frac{\frac{n}{2} - C}{f_m} \times i$

$= 31 + \frac{200 - 80}{165} \times 9$

$= 31 + 6.54$

$= 37.54$

Calculate the median value of the following variable from the table of simple frequency distribution

variable (x) : 1 3 4 5 6

frequency (f) : 5 12 8 3 2

variable	frequency	cumulative frequency
1	5	5
3	12	17
4	8	25
5	3	28
6	2	30

$n = 30$ (even)

$\frac{n}{2} = \frac{30}{2} = 15$ $\frac{n}{2} + 1 = 16$

$M = \frac{15 + 16}{2} = 15.5$

15.5 lies in the 17

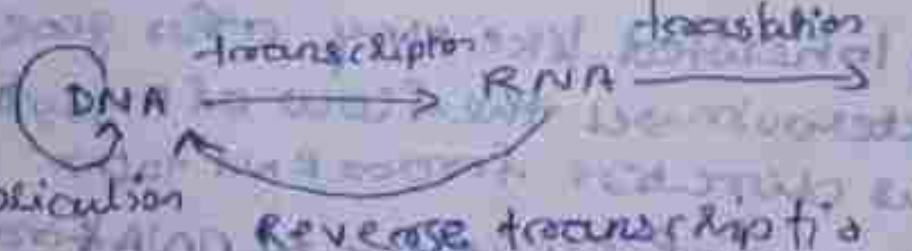
$\therefore$ median value = 3

Jun 5
Sat

Central dogma revised

- In 1970, Howard Temin & David Baltimore suggested the existence of an enzyme reverse transcriptase in tumour viruses. This could synthesise DNA on RNA template, it is also known as RNA dependent DNA polymerase
- Since this process involves a reverse of the normal transcription (from DNA-RNA) it is called reverse transcription so central dogma revised. It is also known as Temin's Baltimore termination after the discoverers (Temin) 1970.
- It is also known to occur in some viruses like HIV, and in some eukaryotes.

RNA can serve as a template for the creation of DNA, that is, RNA can synthesise the DNA.



> DNA Retro-Provirus

The flow of information from DNA to RNA to protein was considered to be unidirectional & was the essence of the central dogma of molecular biology. The C.D remain unchallenged for over 40 years until the discovery of reverse transcriptase & proved that the central dogma is violated in retroviruses. HIV is a retrovirus.

Retro are RNA viruses whose genetic material is double stranded RNA when these viruses infect a host cell they synthesize a double stranded DNA from RNA genome. This DNA is inserted into host's genome. It is then translated like any other gene in eukaryotes the flow of information is reverse direction from RNA to DNA. This process of synthesis of DNA from RNA is called

DNA ——→ RNA ——→ protein
(transcription) (translation)

> Retrovirus (RNA)

- 1st step — initially the viral RNA transcribes a single stranded DNA which bind to the template RNA to form DNA-RNA hybrid
- 2nd step — RNA strand is hydrolysis by enzyme
- 3rd step — broken RNA strand is replaced by complementary DNA strand so as to produce a double stranded DNA. This double stranded DNA incorporate in host's genome

> RNA → DNA strand (reverse transcriptase)

because it is genetic DNA coded protein product

(transcription) Synthesis of viral RNA is called minus stranded DNA

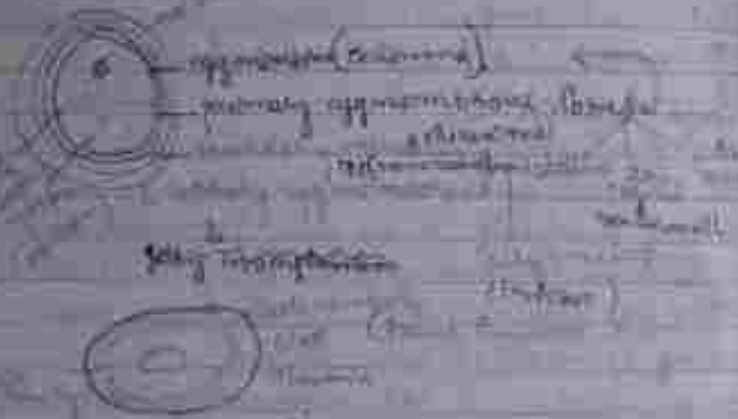
by using viral RNA as template

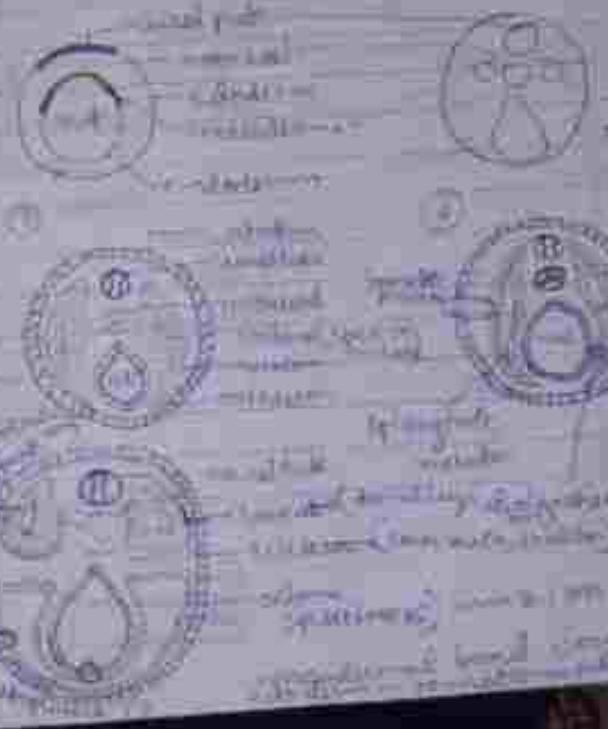
Note book

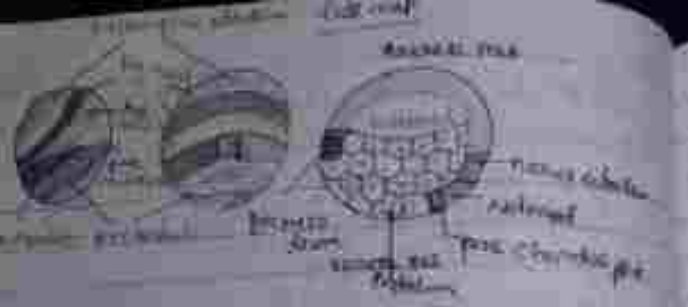
Housekeeping genes (constitutive genes)

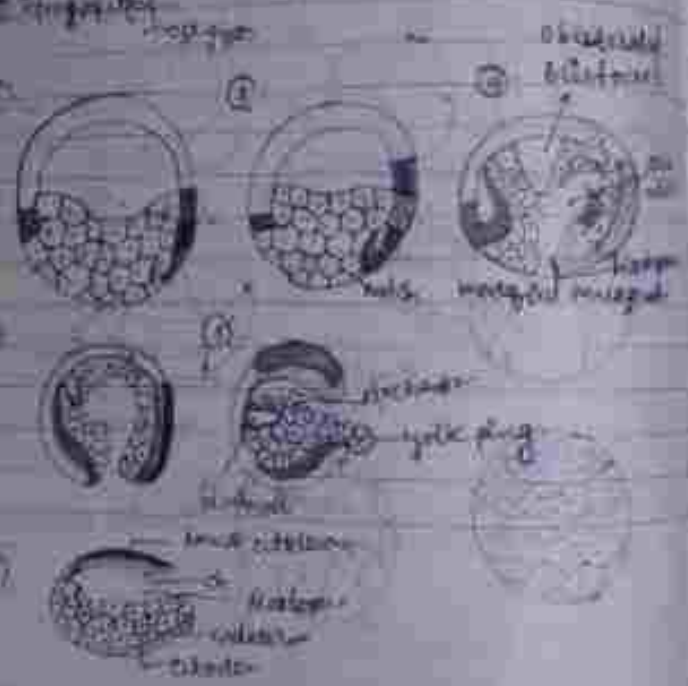
- Housekeeping genes are involved in basic cell maintenance and their function are expressed at a relatively constant expression level in all cells and continue they are functional in all types of body cells as cell-specific expression is not the time they are necessary for basic cellular activity they are not regulated
- eg: Genes associated with glycolysis are active in all types of cells and all time throughout life
- Housekeeping genes are predominantly for cellular maintenance for energy production, normal operations & genomic stability
- Advances in ability to measure RNA expression have resulted in a greater awareness for the role of constitutive housekeeping genes

- These genes are not always expressing their genes at a constant rate, they regulate production of the gene & its expression. The activity of any cell or at a certain time, only certain that produce are needed. There are certain housekeeping genes of specialist genes.
- Human contains approximately 200 different types of cells such as skin cells, liver cells, muscle cells, each cell varies in both the genes and the sets of genes are expressed in each of them. Eg: the neuron also some gene is expressed only in pancreatic beta cells they are switched on & off according to the requirement of cellular activity
- eg: The gene for nitrate reductase in plants, factor system for expression cell. There are some gene in the human body which are present in all the body cells but some are functional for kidney









ectoderm

- formation of double layer embryo
- mainly of grey cerebral cortex
- cells ectoderm
- embryo cells

complex embryonic bilateral symmetry

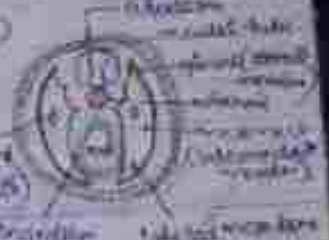
anterior = cerebrum, cortex
posterior = cerebellum, pons, cerebral aqueduct
- midbrain
- hindbrain
- spinal

(1) during gastrulation, cells of grey area retain ability to differentiate
(2) optic vesicle
(3) cells become lens of eye
(4) placode
- 5 principal
dendrite
(5) cells migrating epidermis
cells degenerate etc.









01 NOVEMBER
Wednesday

Development of chick :-

Structure of egg, Fertilization, cleavage, blastulation, gastrulation and formation of germ layers, salient features of chick embryo at primitive streak stage, 21, 33 & 48 hrs stage. Development and formation of embryonic membranes



- Oval shape, centre white yolk called latebra and white yolk surrounded by concentric layers yellow yolk.
- The latebra upper portion Neck of latebra.
- The upper portion is blastodisc contain active cytoplasmic area and Nucleus of pander
- egg must rotate, chalaziferous membrane - produce chalazae and rotate in shell so act as balancers.
- Balancers keep blastodisc in upper portion chalazae are balancers.

2017

Albumin starts to accumulate and in 3 layers:
(i) Outer less dense albumin
(ii) Middle dense albumin
(iii) Inner less dense albumin
of Shell membrane and are closely attached each other and separated only at posterior region i.e. air space only after egg laying
Bf it is in body air space help in respiration.
Outer - calcareous shell.
3° membrane are albumin shell membrane and calcareous shell. These are formed in oviduct when coming out of the body.
* Fertilization is internal.
* Egg is cleidoic egg - shelled and layed on the land.
* Macrolecithal egg and extremely telolecithal
* ♂ bird dismount ♀ and cloaca come close to each other and spermatozoa is introduced. This is called "cloacal kiss" and ovum come down oviduct it get fertilized.

Cleavage :-

* Meroblastic discoidal cleavage
& Partial incomplete cleavage
→ cleavage is limited only to disc like cytoplasmic area

30 OCTOBER Monday





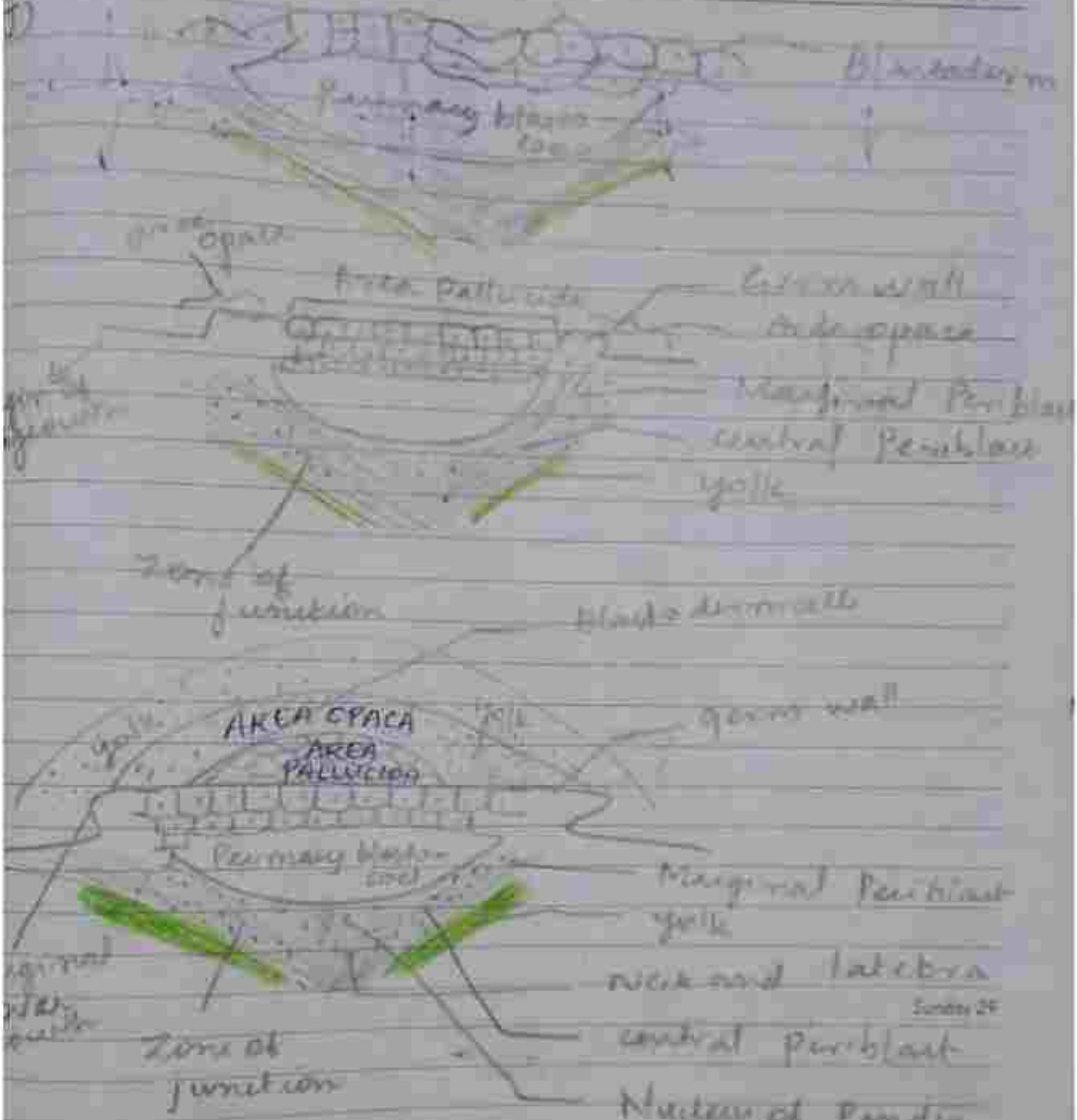








2017


Area opaca
Area pellucida
Zone of junction
AREA OPACA
AREA PELLUCIDA
Zone of junction
Nucleus of pandiv.

Sunday 29

27 Friday

- cleavage is confined to ant. cytoplasmic area
- 1st cleavage is meridional and 2nd is meridional @ right angle to 1st one and never go from cytoplasmic area
- 3rd - Vertical and double III to I & II
- 4th - cut all cleavage furrow centrally placed blastomere are formed and they rupture

- Centrally placed cells and marginal cells are present division occur at centrally placed cells and marginal cells have contact with yolk
- yolk is reduced.
- Centrally placed cells develop horizontal furrow dividing it into 2 layers - 1° blastocoel
- Central cells divide horizontally and 2 layers of cells are formed. and many layers are added. and multilayered are formed.
- yolk free transparent area is called "Area pellucida" and their sides are opaque called Area Opaca.
- Nuclei can be seen around the 1° blastocoel
- Nuclei move rim of blastocoel and margin of blastocoel. and become syncitial mass and this region is called Peri blast.

central Peri blast (Nuclei are in rim)

marginal blastocoel (Nuclei on boundary)

Sir 2017

* Nuclei develop cell boundary and grow to
* The cell added to blastoderm from periblast is called germ wall.
* They grow over the yolk known as marginal cell growth
* Cells still retain contact with yolk is called yolk syncytium.
* After cleavage a blastula is formed called discoblastula resulted from meroblastic discoid cleavage



Fate map



This is seen in post blastular stage.



2017

25 October

Gastrulation and formation of Germ layers

1. Infiltration theory – Peter
2. Polyinvagination theory – Pasteels
3. Determination theory – Spat
4. Theory of Involution – Patterson
5. Theory of Invagination – Jacobson







Tuesday 24



8hrs.

Development — primitive streak



18hrs chick embryo.

Definitive Primitive Streak

According to Invagination theory the yolky heavy cells (yolk Lauzelen) falls to Blastocoel and a 2nd layer is formed called endoderm or hypoblast

- upper of layer — epiblast (ectoderm).

According to Polyinvaginat° — different cell from da

2017

23 OCTOBER
Monday

(3) According to determinat° — the lower layer from migrating cells separate from upper layer and lower layer become endoderm.

(4) Theory of Invagination — posterior slit like opening appear yolky cells detect from posterior region and enter blastocoel through slit to form endoderm.

(5) Invagination theory — The cells invaginate to form the Endoderm.

* when cells separate from posterior region and migrate below endoderm and below endoderm is Archenderon.

(6) formation of Primitive streak and ~~Endoder~~ Mesoderm

- The Primitive streak is the region to reach Organ forming area — It is same as Blastopore.
- The cells from posterior region of blastoderm converge towards midsagittal line that region is thickened and it is called primitive streak since it is not mature it is called short primitive streak.
- The movement of cells occur about 18 hours of incubation and attain maturity called primitive streak and it is elongated.

2017

- With Primitive bold and groove
- The thickened anterior node is called Hensen's node and below a depression called Primitive ~~streak groove~~ Pit.
- After 18 hrs it is situated on posterior plate like region called Primitive knot.
- Ant. somatic cells move to Primitive streak and lateral mesoderms reach from Posterior region and the primitive streak is joined with the hypoblast (endoderm). So, the tubulation take place ie; Notochord extend and Mesoderm is arranged.
- Hensen's node — Head ~~and~~ process develop from this.
- The posterior tail bud region primitive streak get placed Allantois.
- Mesoderms never grow over Head process.
- This mesoderm free area is called Proamnion.

20 OCTOBER
Friday





2017

10 Wednesday

- Area vitellina – Yolk laden.
- Area vasculosa –

3 days chick embryo

Heart < ventral aorta
dorsal aorta

- Ventral aorta arches divides it grows downward
- Heart receive sinus venosus and end in a set of veins called omphalomesentric veins that collect blood from yolk
- Auricular canal connect omphalomesentric vein and ectoy called sinus terminalis
- Auditory pit is on rhombencephalon
- Foregut grow downward and reaches to mid gut region.

4 days chick embryo.

- Heart develop well.
- "flexure" and torsion

Cervical flexure is between hind brain and spinal cord

Cranial :- Anterior region of head show a bending. one at hind brain and one at mid brain. Mid brain give head to backside. Hind brain region turn head towards right side



→ Telencephalon
→ Notochord.

OCTOBER
Tuesday
17

→ Eye
→ Infundibulum
→ Rathke's pocket
→ Telencephalon
→ Truncus arteriosus
→ Bulbus arteriosus
→ Ventricle
→ Anterior Intestinal Portal
→ Amnion
→ Neural tube

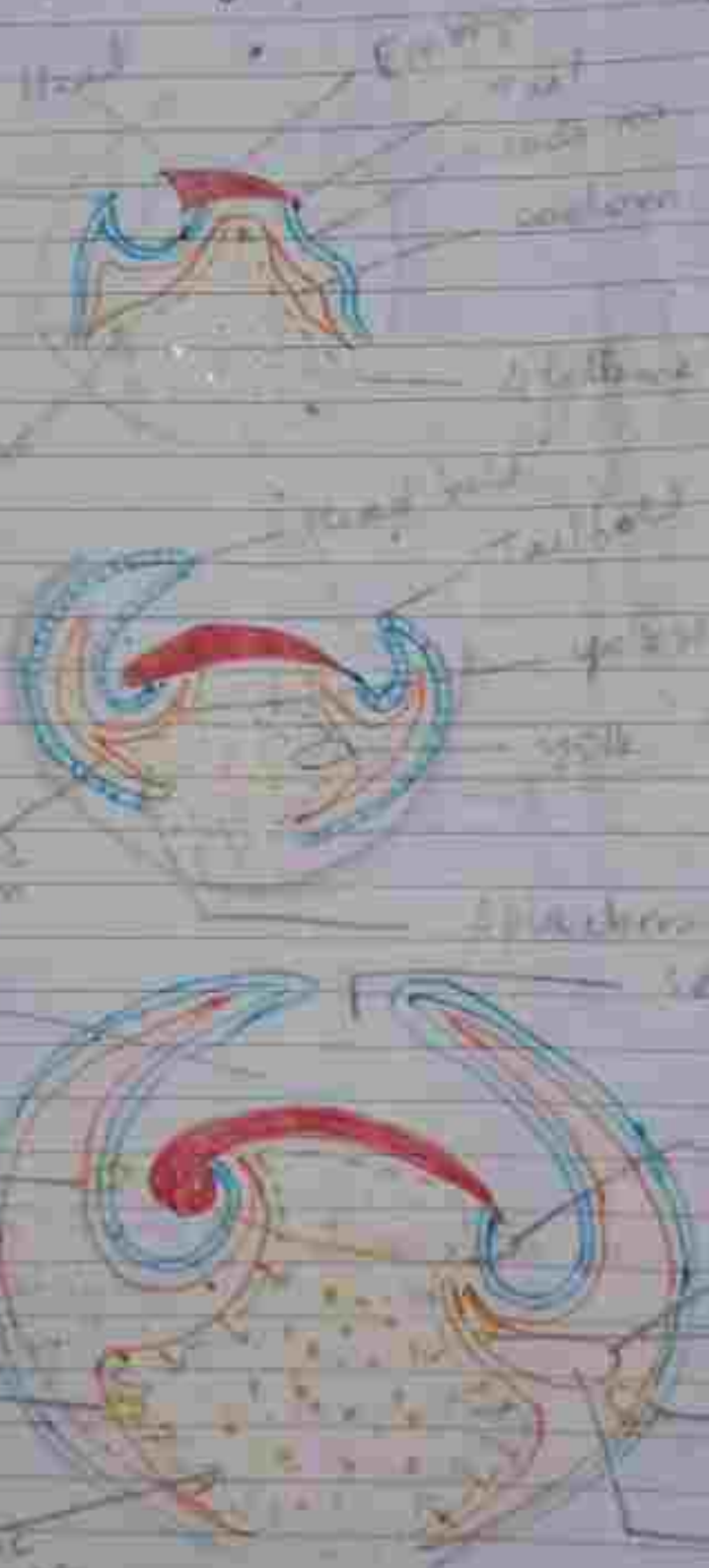
Torsion :- The embryo lie flat on yolk with its Ventral side. When they proceed a antero-posterior turning ie; twisting of embryo. So that embryo lie on yolk with its left side on the yolk. That twisting is torsion. They will have a 'C' Shape.

2017

- 26 pair of somites.

16 OCTOBER
Monday

Development and functions of extra embryonic membrane



OCTOBER
Saturday
14



Sunday 15

Basis on presence of embryonic membrane
- Anamniotes
- Amniotes
  - Eg: Reptile, bird, mammal

H. Extra embryonic membranes :-
(R) Amnion

2017

13 | OCTOBER | Friday | 286-079

Allantois help in calcium brain absorption brain used for the embryo through it help in Maturity

(b) chorion – Protective, Respiratory along with allantois
(c) yolksac – completely cover yolk & help in absorption
(d) Allantoic – Respiratory store house of all nitrogenous waste material & help in excretion

* Amnion and chorion develop from somatopleure
* yolk sac & Allantois " Splanchnopleure

* The somatopleure develop 2 fold one at anterior and other posterior.
* Head and Tail fold ~~effect~~ connect to form Sero-amniotic connection and there remains a depression / Thickened area called Seroamniotic raphae
* They separate as 2 sheet inner amnion and Outer chorion.
* ~~Somatopleure~~ b/w amnion and chorion is exocoel or extra embryonic coelom.
* From endoderm develop outer finger like projection to yolky area called yolksac cepta. This help in easy yolk absorption
* Splanchnopleure extend to extra embryonic coelom as a vesicle called allantois.
* Amnion + endoderm + Allantois = Umbilical cord
  Stalk stalk
* Amnion is formed inner ectoderm and outer ~~mesoderm~~ somatic mesoderm.
* Chorion is formed ~~inner~~ outer ectoderm and somatic mesoderm
  inner

Birthday & Anniversary

2017

* yolk sac formed from splanchnopleure
* Allantois formed from outer splanchnopleure and inner endoderm.
* Amnion act as artificial swimming pool, protect the embryo it act as shock absorber. provide defense
* Chorion along with Allantois help in respirat. of growing embryo.
* The fore gut move downwards and hindgut move to forward so the midgut get turned over the size reduced and this ^ funnel shaped is formed and one small opening is there called yolk duct and the one is called yolk sac.

09 JANUARY
Monday
009-356

Paper: ENVIRONMENTAL AND CONSERVATION BIOLOGY

Module 1:- Introduction, Ecosystems and Energetics.

Introduction to environmental biology: Definition, divisions of ecology, Modern branches and scope

Biosphere:- life exist "web of life"
part of earth where life exist
- It forms magnificent "web of life" with highest level of integration and Organisation
- Biosphere consist of ecosystem (self-supporting system)
- Biome - major group of ecosystem
  eg: Terrestrial, freshwater, ...
- Biota - sum total of flora and fauna
- Biotope - physical envt of biota. Spatial or geographic unit with characteristic physical and chemical conditions.

- Envt :- Complex network of mutually interacting physical, chemical and biological forces, and factors which influence life of Organisms.
(Environner - to encircle, surround)
- Abiotic and biotic envt are there. Abiotic none

2017

living physico-chemical envt include medium (water, soil, air) and climate (temp, humidity, rainfall, sorow, light, wind, ...) Biotic - living Organisms and interactions.

- Habitat - place where Organisms live.
  Microhabitat - local and immediate conditions closely surrounding Organisms.

- Ecological niche - role/function status of an Organism as a member of a community in a habitat.
  - habit as Organism's address and niche as its profession or way of life.
  - Organism's niche include food relation, providing habitat, energy transformation, response, ...

* Organism may have same or similar ecological niche in diff geographical areas. They are called ecological equivalents.

* If there are in the same area or community they may compete with each other until one displace other. It is called competitive exclusion principle or Gause's law.

law hold that:-
* 2 or more spp of community can never share same ecological niche.
* 2 or more spp with same niche cannot co-exist

11 JANUARY
Wednesday
wk 03 011-354

Environment biology or Ecology

* Taylor (1936): Science of stn of an Organism to all their envt.

* Ernst haeckel (1866): coined term ecology study of organism in their largest home nature.

• Ecology is also termed as envtal biology by smith.
• Explain how the "household" of nature kept in Order.
* Envtal Science.

* Individually or in groups of individual called population or in groups of population called Communities. Their diff level of interact° result in relatively stable and more or less self supporting system called ecosystem.

Ecology (Evt Biology):

• It is essentially study of source, reactn, transformat° transfer and fate of energy and matter in the biosphere.

• It is a science at service of mankind.
It provide a key to know how to manage the living world in better way to ensure survival of mankind with sustainable exploitat° of natural resources

* Many of envt problm are Anthropogenic conflict between man and nature.

Divisions of Ecology

1. Autecology
2. Synecology
3. Habitat ecology

Autecology :- study of individual Organism or individual spp in relation to their envt

- Popul^n ecology deals with individual Organism or popul^n
- Sps ecology deals with diff spp of Organism

Synecology :- study of group of Organisms which associate to form functional unit such as communities and ecosystem.

2 sub divisions :-

a. Community ecology
b. ecosystem

Habitat ecology :- study of habitat or envt & effect on Organisms.

- Terrestrial ecology
- Freshwater ecology
- Marine ecology
- Estuarine ecology

13 JANUARY
Friday

genetics of bacteriophage

Conjugated transduction sex

06/01/2017

Ecosystem Energetics:- Photosynthetic production and energy fixation. Energy flow in the ecosystem, Energy flow and laws of thermodynamics Energy transfer and Energy transformation [Trophic dynamics or community dynamics, Lindeman's model of energy flow] ecological efficiency

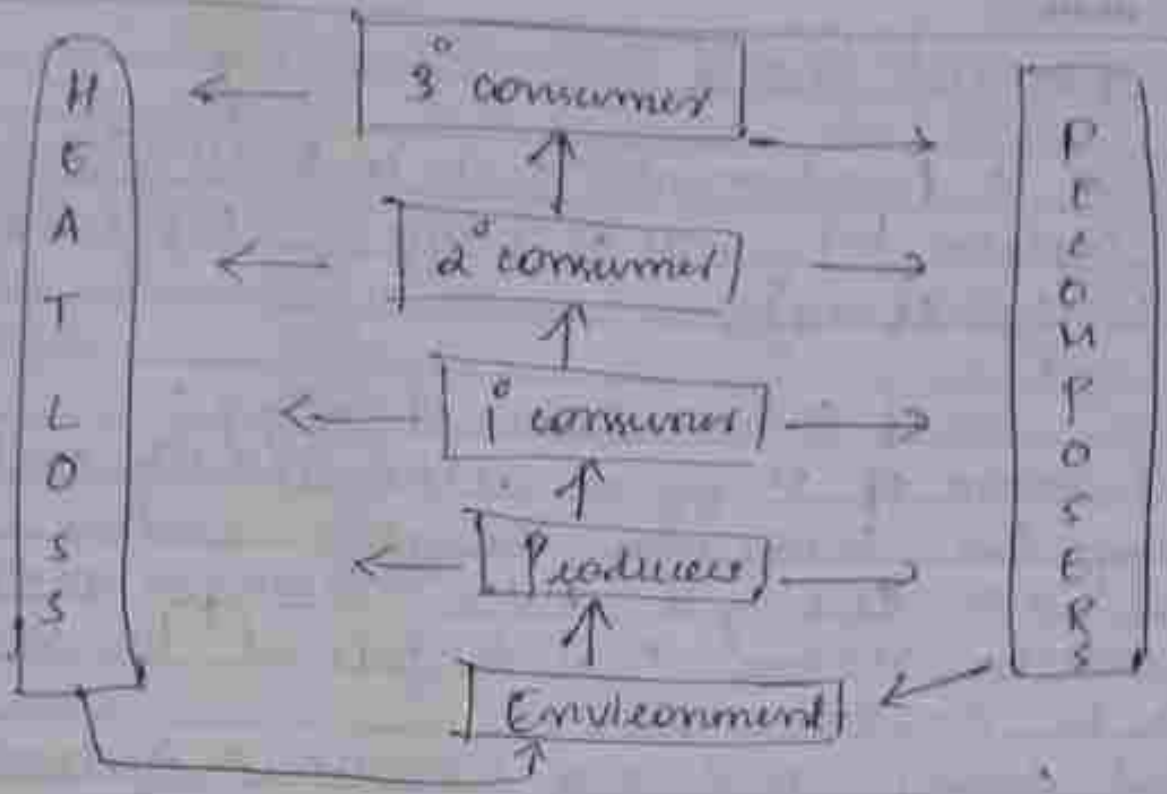
ENERGY FLOW IN ECOSYSTEM

Ecosystem is said to be functioning only when continuous flow of energy from one organism to another.

- Energy flow reaches from diff levels from producers - consumer and decomposer.
- Orderly, step by step transfer or flow of energy from producers to decomposers through successive level of consumers is called energy flow.

* flow of energy is unidirectional, linear, non-cyclic and non-reversible.
* some energy would be lost in each trophic level by metabolic consumption, excretion and decomposition and also as heat.

2017



* There is a progressive ↓ in trophic level so, it require continous input of energy 'ie' Sun.
* Transfer of one energy from one trophic level to next is never 100% efficient.
* Lindeman estimated that only 10-20% of capital energy is transferred from one trophic level to next. This called Lindeman's efficiency or Law of ten Percent.

16 JANUARY
Monday

Energy flow and laws of thermodynamics

- It follows 2 fundamental laws of thermodynamics which explains behaviour of energy & expenditure and storage of energy

1st law = "law of conservation of energy"

statement — All forms of energy are interconvertible and during this conversion energy is neither created nor destroyed but is transformed from one form to another and transfered to one source to another source

- so, total energy content of an isolated system or unit of universe remain constant

2nd law "Law of entropy"

statement — during transformation or transfer of energy, a portion of it dissipates as unusable heat energy causing entropy or energetic disorder (energy in randomized state of energy)

- so, energetically isolated system tend to move toward a state of greater disorganization and also that entropy steadily ↑ on the universe

* 1st law — One all balance sheet of energy conversion

2nd law — consist with "direction" of change and predict whether or not a particular ↑/or change can occur

2012

JANUARY
Tuesday
17

Ecosystem associated with two events :-
① Transformation of energy from one form to another
② Loss of energy during transfer.

Radiant energy → Electrical energy → Chemical Energy → Biological Energy → Metabolic Energy

Photosynthesis

Respiration

- Net production from Primary Production (NPP) is used in metabolic function.
- Herbivores feed on Producers they get 10% energy

- The flow of material - bound energy ends in the recovery of the material to be used again.
- energy is not completely recovered this due to operation of 2nd law of thermodynamics.

Energy transformation and Energy transfer

- Trophic dynamic is the functional aspects of ecosystem characterized by transfer and transformation of energy - It represent energy dynamic in food chains and food web.

Lindeman - said energy through food chain and food web. He explained two basic aspects of each trophic level namely :-
① level of energy store
② Efficiency of energy transfer.

2017

- Organisms with similar food preferences and feeding habitat collectively called trophic level
- Energy content of trophic level - Λ (capital lambda)
- Energy passed from one trophic level to next by the greek letter λ (small lambda)
- Energy received by photo trophs from solar radiation - λ_1
- Thus Λ_1 - Ist trophic level (producers)
  Λ_2 - I^{o} consumers
  Λ_3 - ...

  General Λ_n can be any of them if it is herbivore Λ_{n+1} is carnivore and Λ_{n-1} is producers.

- Energy transfered from one trophic level to next - λ_n it is 10-20% of energy store
- work done by organisms in trophic level Λ_n and portion of energy received (λ_n) from previous trophic level (Λ_{n-1}) get dissipated as heat.
- Loss of heat energy per unit time is represented by R At diff trophic level heat loss - R_1, R_2, R_3...
- The loss of heat per unit time (R) plus energy (λ_{n+1}) passed to next trophic stage (Λ_{n+1}) per unit time is

Symbolised as $\lambda_{n'}$

$$\lambda_{n'} = \Lambda_{R1} + \lambda_{n+1}$$

If λ_2 represent heat loss per unit time from $\Lambda_2(R_2)$ plus the potential energy that of $\Lambda_3(R_3)$ i.e. λ_3.

- Based on Lindeman's Nomenclature an equation to express the rate of change of energy content of any trophic level (Λ_n)

$$\frac{\delta \Lambda_n}{\delta t} = \lambda_n + \lambda_{n'}$$

⇒ This implies rate of change of energy content of a trophic level or standing crop = rate of energy absorption (λ_n) − the rate at which energy of is lost from it ($\lambda_{n'}$).

"minus" represent that $\lambda_{n'}$ is always −ve

Ecological Efficiency

It is the efficiency for transfer of useful energy from one trophic level to next. It reveal how much energy a trophic level can pass on to next trophic level.

2017

20 January
Friday

- It is a ratio b/w energy input and output within trophic level
- Ratio of energy assimilated by previous trophic level is called coefficient of ecological efficiency.

Categories of ecological efficiency:-
(i) Energy transfer b/w diff trophic level
(ii) " " within a single trophic level.

- Ecological Efficiency = $\frac{\text{Energy transferred to next trophic level}}{\text{Energy received from previous trophic level}} \times 100$

Different types of E E
- Assimilation, ingestion and Production.

2017

Pearl culture: Method of pearl formation, selection and preparation of host, Preparation of nucleus and implantation, post operation care, post operation culture and collection of pearls

Pearl the gem produced by a living animal is generally obtained from 5 spp of pearl oysters. They include the marine oysters Pinctada fucata, Pinctada maxima, Pinctada margaritifera, Pteria penguine and the fresh water mussel Hyriopsis schlegelli. In India the marine pearls are collected mainly from P. fucata and P. margaritifera.

P. fucata is known as Indian pearl oyster. It is the most dominant spp. It contributes much to the pearl fisheries of gulf of mannar and gulf of kutch. The pearl banks of gulf of mannar is known as "paars" are located 10-20 km away from the coast at 15-45 m depth. The pearl banks of gulf of kutch known as "chankars" are intertidal located upto a depth of 11 m.

P. fucata is the main spp in pearl culture. Production of culture pearl includes various techniques & procedures such as selection and preparation of host, preparation of nucleus implantation, nucleus implantation, post-operative care, post operative culture and collection of pearl.

MAY
Thursday
04

Selection & Preparation of Host :-

Healthy and adult Oysters preferably those among above 45 mm size are selected for production of cultured pearls. Oysters may be collected either from nature or from culture systems.

Opened is the best site the body of the oyster for the insertion of the foreign particle (nucleus) which can induce pearl formation. The inactive or resting phase just after spawning is the ideal time for the insertion of nuclei since in the phase of short duration maturation may be delayed by keeping oysters under low temperature.

If dried specimens are alone available the maturation is accelerated and they are induced to spawn. This could be done by placing the animals in warm temp. Later the oysters are used for nuclear insertion.

Preparation for Nucleus insertion

(a) Preparation of Graft tissue :- the graft tissue is obtained from a healthy donor oyster. The oyster is opened carefully & the mantle is removed. The dirt and mucus on the mantle are removed using the blunt edge of the Scalpel. A 2-3 mm wide strip is then cut off from the palial zone of the mantle. The strip is cut into 2-3 mm Squares. The mantle strips are kept in sterilized and filtered Sea water. It is better to use the graft mantle tissue within 10-15 min of preparation.

2012

(b) Preparation of Nucleus :- The portion in binding of "mace" tissue place most satisfactorily around calcareous particles. The shells of other spp are used for the preparation of nucleus. The shell is made into small spherical beads of 2-5 mm diameter using machines. The beads are polished slightly but more smoothly

(c) Opening of the shell :- Many host (receipient) Oysters are made ready for operation. They are placed in a plastic basin with the hinge portion of the shell downwards. Seawater is then poured slowly into the basin fully immersing the oysters. A little amount of menthole powder may be sprinkled over the water. The shell valves start to open in a few minutes a wooden plug or key is then placed b/w the valves to keep them open. Thus the oysters are conditioned for nucleus implantation.

(d) Nucleus implantation :- The conditioned oysters mounted on a stand. Gonad is the organ for nucleus implantation. A sharp incision is made on the gonad carefully. The graft mantle tissue from the donor oyster is inserted into the gonad. This is followed by nucleus insertion. The nucleus is placed in contact with the outer epithelium of the graft mantle tissue.

The no: of nuclei to be inserted

MAY
Tuesday
02

It depends upon the size of the nucleus. 2-5 nuclei are put into an oyster. If they are 3 mm or less in diameter, only one nucleus is inserted when it is larger than 3 mm. The oyster is then taken out of the stand and the plug is removed.

II Post-Operation Care :-

After nuclear implantation oysters are placed in a plastic tub filled with sea water for recovering from the effect of anesthetic. Water is changed periodically or provisions for steady flow of water should be maintained.

After 20-60 min the oysters are placed in nylon baskets and then hung in large tanks in sea water. The operated oysters are kept under observation here for a few days. Those oysters showing disease symptoms and those rejecting the nuclei are removed. During this period the oysters recover from the operational ~~shock~~ shock and repair the injuries. The oysters are then placed in metre cages of 40x40x10 cm size and transferred to the farm.

IV Post-Operation culture :-

The healthy and nucleus implanted oysters are farmed by raft culture or long line culture method. After a few months of post operation culture, the oysters are X-rayed to check the presence of pearls.

Good quality pearls are obtained

when oysters are cultured in clean calm and sheltered bays of about 5-10m depth. The duration of post-operation culture depends on size of nucleus implanted, water temp, food etc. It varies from 6-18 months.

(8) Collection of pearls :-

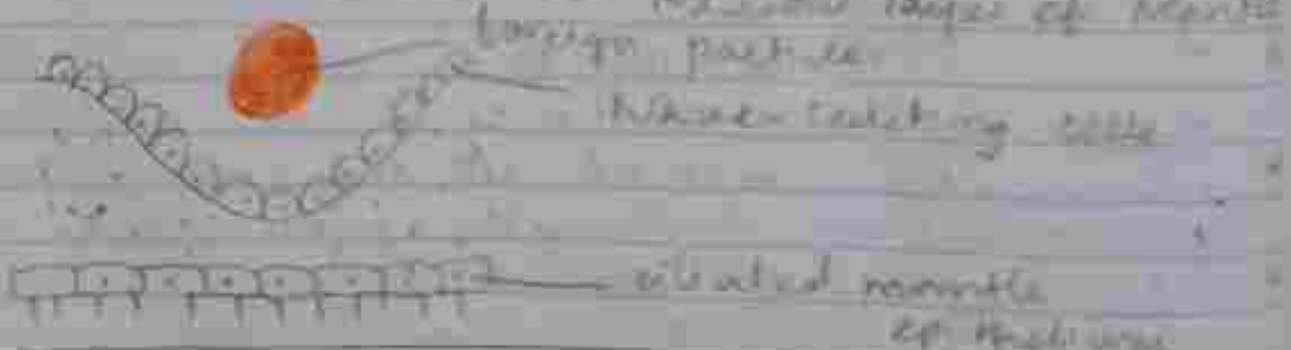
The cultured pearl oysters are brought to shore. They are opened individually and pearls are separated. They are sorted according to size and then marketed.

Method of Pearl formation

When a foreign particle (eg: Sand grain, silt particle, shell piece, parasite etc...) enters the space b/w shell and mantle. The epithelial cells of the mantle gets irritated and secrete a pearl sac around the foreign body. This inner layer of the pearl sac secrete nacreous substance called "nacre". around foreign body. This in course of time develops into a natural pearl.

A similar procedure is adopted for the procedure of culture pearls. In this case a round

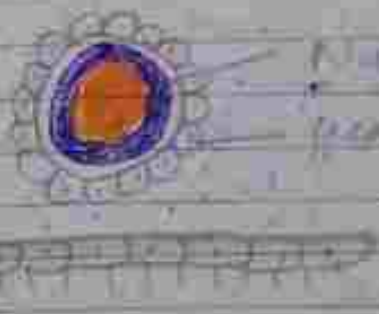
(1)



piece of mantle from one oyster (donor) with a foreign particle nucleus is inserted into the gonad of the receipient oyster by surgery. The pearl culture technique was 1st developed by Japanese. In India CMFRI has achieved a breakthrough in production of culture pearls in 1973. The pearls obtained from marine pearl oysters are of great demand, compared to those produced by fresh water mussels.

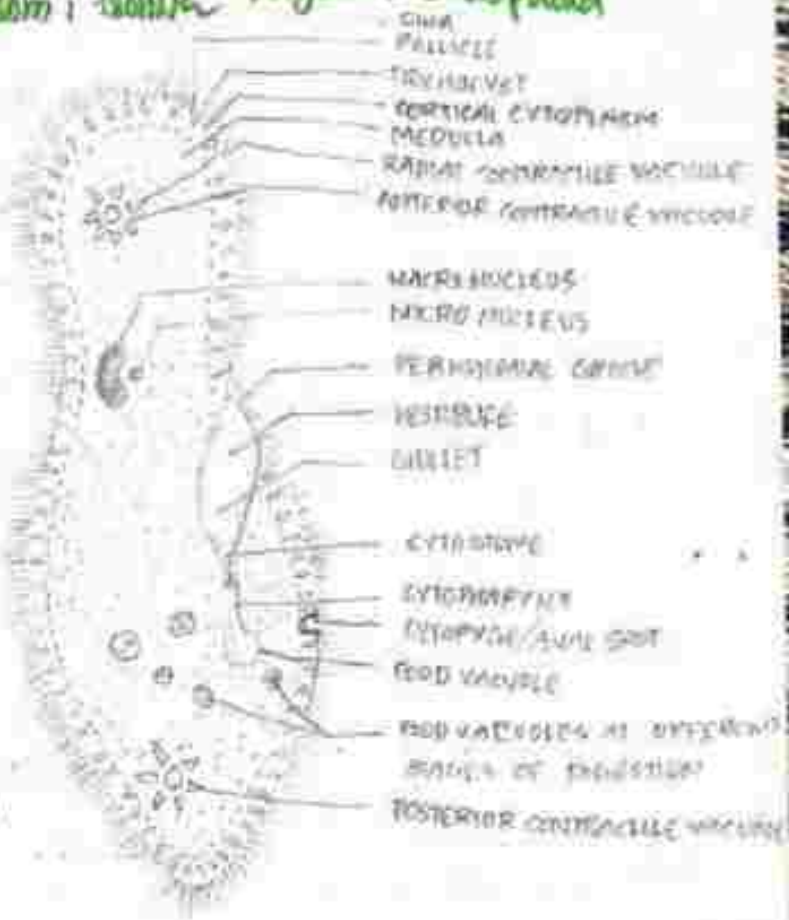
P. margaritifera (blacklip pearl oyster) It produces precious steel black pearls and half pearls, is present in sea around and among Nicobar Island and Andaman Island. Because of declining Population of ~~Pearl~~ Oysters in the sea around India and considering high value of natural pearls, Indian pearl fisheries are strictly under government control.





PARAMECIUM CAUDATUM

Kingdom: Protista Phylum: Ciliophora



- FW form, FW Pond, lakes etc.
- Seen in HAY INFUSIONS ∴ Infusoria
- aka : SLIPPER ANIMACULE
- PELLICLE : formed from cortical cytoplasm • leathery living membrane • 2ble layer • aka Periplast • All over surface Cilia is coated. maintains shape & form.
- CILIA : HOLOTRICHOUS Arrangement Uniformly arranged • CILIA at caudal reg^n is elongated.
- b/w Pellicle and cortical ectoplasm present TRICHOCYST for offence & defence. Paralyses small preys, enemies.
- Inside the pellicle cytoplasm can be ÷ into ↑ out - Ectoplasm : CORTICAL CYTOPLASM; In : MEDULLA : transparent loosely packed
- P. caudatum is characterised by dimorphic nuclei MACRO NUCLEUS (for Metabolism) and MICRO NUCLEUS (for reproduction)
- Contractile Vacuoles - 2 ANTERIOR CV & POSTERIOR CV : only for FW Sp^s functions OSMOREGULATION : they live in Hypotonic H_2O.
- RADIAL CV takes excess H_2O from body & pass it to contractile vacuole then burst out the H_2O to o/s to maintain hypertonicity inside the body
- The blunt end of P. → Anterior ; pointed end Posterior.
- On the MIDDLE REGION of flattened (Ventral) side a tubular elongated ^gn called PERISTOMIAL/ORAL GROOVE leads to funnel shaped VESTIBULE thru to cylindrical structn GULLET opens to CYTOPHARYNX thru small opening CYTOSOME end with FOOD VACUOLE ⇒ Totally called INGESTIAL APPARATUS

In/s Peristomium CILIA IS PRESENT. COMPLICATED. called Undulating membrane, helps in forward direction.

F.V is pinched off from CYTOPHARYNX into cytoplasm & many F.V at different stages of digestion can be seen freely moving in cytoplasm

Unwanted substances are removed through a temporary opening called CYTOPYGE / ANAL SPOT / CYTOPROCT ie, open only @ time of excretion.

Possess cell organelles such as mito, ER, GB, Centrioles, Ribo, lysosomes etc.

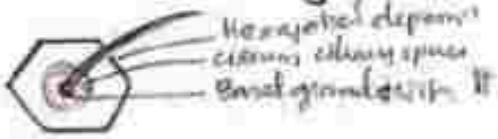
— LOCOMOTION —

The entire P. is covered with Pellicle bearing cilia in hexagonal depressions

cilia arises from basal granule at circum ciliary space at the bottom of each hexagonal depressions in longitudinal row

longitudinal strands run towards cytopharynx ⇒ Inter ciliary strands

There's also transverse interciliary strand & move towards cytopharynx.



@ Cytopharynx NEUROMOTOR ORGAN controls ciliary action.

Cilia beats obliquely backward towards right & move towards forward direction through Left turn ⇒ EFFECTIVE STROKE then back to original position ⇒ RECOVERY STROKE.

All cilia do not beats @ same time.

Cilia in longitudinal row beat one after other META SYNCHRONOUS RHYTHM

Cilia of transverse row beats simultaneously ⇒ SYNCHRONOUS RHYTHM

The more are less directly backward beating of peristomial cilia (powerful) also aids in left spiralling of P. body.

—NUTRITION—

The food vacuoles are released from cytopharynx & move freely in cytoplasm, are numerous.

Inside Endoplasm; Streaming movt of F.Vs in cytoplasm is called CYCLOSIS.

Inside endoplasm Enzymes injected along with lysosomes into FV ∴ size of food vacuole reduces then unwanted substances are excreted out through cytopyge ⇒ Ejestion.

—REPRODUCTION—

ASEXUAL REPRODUCTION → (i) BINARY FISSION

@ Fist both micro & macro nuclei elongate then divide simultaneously with cytoplasm.

Macro → Amitotically simple ÷; Micro → Mitotic ÷

When plane of ÷ sharpens we get anterior and posterior halfs

Anterior → Proter } Posterior → Opisthe

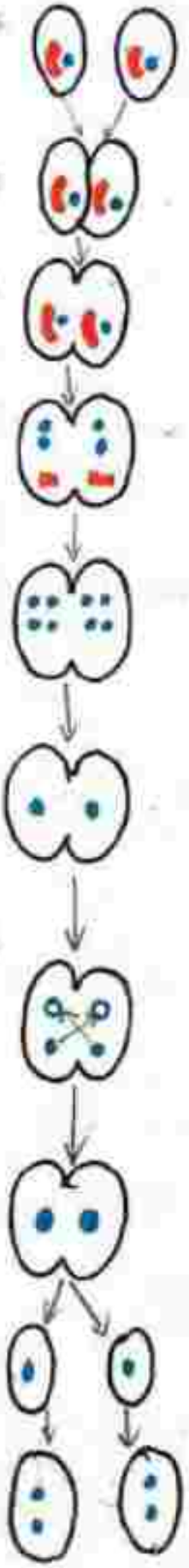
oral grove ÷ 2

Total process of BF is of 2 hrs.

Both anterior and posterior CV of Parent form posterior CV of daughter Individuals & New CV is formed in them afresh anteriorly.

BF ⇒ Clones.

CONJUGATION : Parasexual process in which 2 paramecia meet in pair, undergo partial & temporary union, mutually exchange their micronuclear material & then separate & ÷



The individuals which undergoes conjugation ⇒ CONJUGANTS

2 conjugants appose on ventral side.

The pellicle & cortex dissolves @ the region of contact Endoplasm continuity established ⇒ ENDOPLASMIC BRIDGE

Macronuclei start to disappear Micronuclei ÷ twice

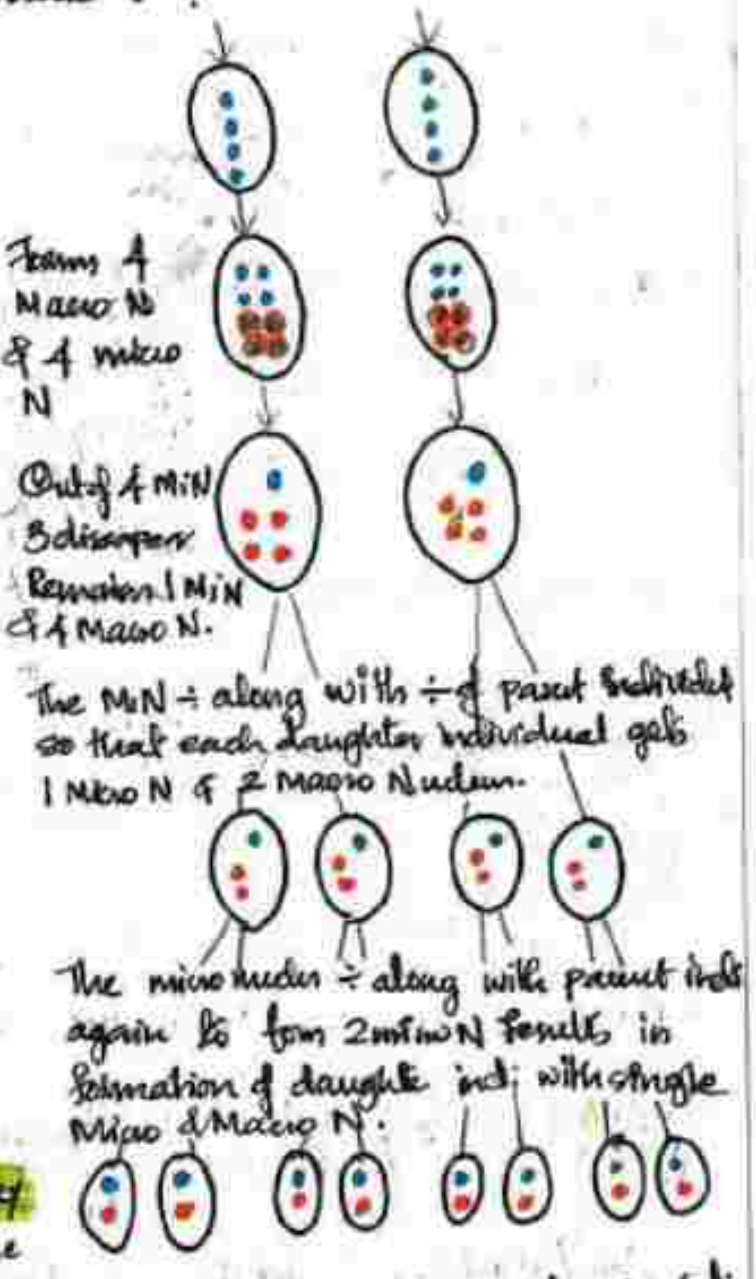
Micronuclei undergoes mito ÷ 2 rise results in 4 diploid nuclei in each conjugant

out of 4 3 degenerate & disappear resulting 1 remaing in each conjugant & undergoes ÷

Forms large passive STATIONARY PRONUCLEUS & small movable MIGRATORY PRONUCLEUS
The MPN of one conjugant move to other conjugant & fuse with SPN

Formation of CONJUGATION NUCLEUS shortly after this. 2 conjugants separate.

Formation of EX-CONJUGANTS
Then ÷ thrice & forms 8 nuclei



Forms 4 Macro N & 4 micro N

Out of 4 MiN 3 disappear Remain 1 MiN & 4 Macro N.

The MiN ÷ along with ÷ of parent individual so that each daughter individual gets 1 Micro N & 2 Macro Nuclei.

The micronuclei ÷ along with parent inds again to form 2 mitotic N results in formation of daughter inds with single Micro & Macro N.

1 parent ⟶ 4 daughter inds.

SIGNIFICANCE OF CONJUGATION

DEMERITS OF BINARY FISSION

If P. undergoes BF generation after generation it enters to stage of SENILITY & DECAY IN RACE
Lose in Physiological efficiency & Reduced in size
Degeneration in Organization & enters into state of DEPRESSION

MERITS OF CONJUGATION

※ Rejuvination of senescent organism
※ Reorganisation leads to renewed vigour
※ Creation of new hereditary combination.

OSMOREGULATION

Paramecium body should always be kept hypertonic to freshwater that's surrounding
This is by eliminating excess water from the body.
I/side the body H2O by: Endosmosis, Metabolic product, Ingestion during feeding.
H2O collected by terminal portion of feeder canal then when filled discharges to centrally located CV on attaining its maximum size it burst water outside.
This requires enormous energy & vigorous mitochondrial activity

Phylum Cnidaria

Gp of • diploblastic
• radially / biradially symmetrical &
• tentacle bearing metazoan with • blind sac bpl.
• Tissue grade of orgnztn

Salient features :—

Radial / Biradial Symmetry

- divisible into 2 similar halves in vertical sectn in any plane passing through oro-aboral axis.

All are aquatic forms ; marine mostly few FW

Tissue grade Organisation

- Cells arranged to form tissues in organized functional groups. Epithelial cells muscle cells nerve cells & nervous co-ordination is seen.

Diploblastic body wall

- Cnidarians are diploblastic / 2 layered
- Outer — Epidermis inner - Endo / gastrodermis
- between these two gelatinous extracellular matrix → Mesoglea

Tentacles

- Helps in defence, locomotn offence & food captme
- Armed with batteries of offensive & defensive cells called cnidocytes.

Presence of cnidoblasts & cnidae

- Cnidoblast is an unique feature of cnidarians
- It's specialised sensory cum effector epidermal cell, concerned with offensive defence and food capture
- Each cnidoblasts contain a poison filled membraneous capsule → cnida / nematocyst / spirocyst

Presence of Coelenteron

- Internal digestive cavity → coelenteron / Gastro vascular cavity.
- Open out only by mouth, anus is absent.
- In coelenteron → Extracellular digestion
- In intracellular digestion amoeboid gastrodermal cells ingest food particle & digest them inside F.V

Primitive nervous system formed of nerve net

- Primitive nervous system with superficial nerve net or nerve plexus of inter connecting neurons ; Sensory neuron, motor neurons and inter neurons.

Presence of polypoid & medusoid individuals

- Two kinds of individuals / zooids are formed Polyps and Medusae among cnidarians.

- Polyp : • Stalked • Tubular • Attaching • Asexual form
  • Thin & poorly developed Mesoglea
  • Upwardly directed manubrium, mouth and tentacles.

- Medusa : • Umbrella like • Free swimming • Sexual form • Soft & Thick Mesoglea
  • downwardly directed manubrium, mouth and tentacles • Medusoid adults called 'Jelly fishes'

Polymorphism/division of labour.

- Polymorphism : Members of a sps exists in 2 or more structurally & functionally different form.
- Some colonial coelenterates shows polymorphism.
- Members of these colonies → zooids.
- There is clear division of labour among zooids.
  3 kinds → Gastrozooids / trophozooids : Nutritive
  Gonozooids : Reproductive
  Dactylozooids Defensive.

Asexual Reproduction : Budding

- Asexual reproduction → Budding / gemmation
- When daughter individuals as a result of budding

doesn't detach from parent, it forms colony.

Sexual Reproduction involves Planula larva

- Cnidarians shows indirect development in sexual reproduction involving; Ciliated free swimming pelagic larva : Planula
- Planula is the fundamental larva of Cnidaria.

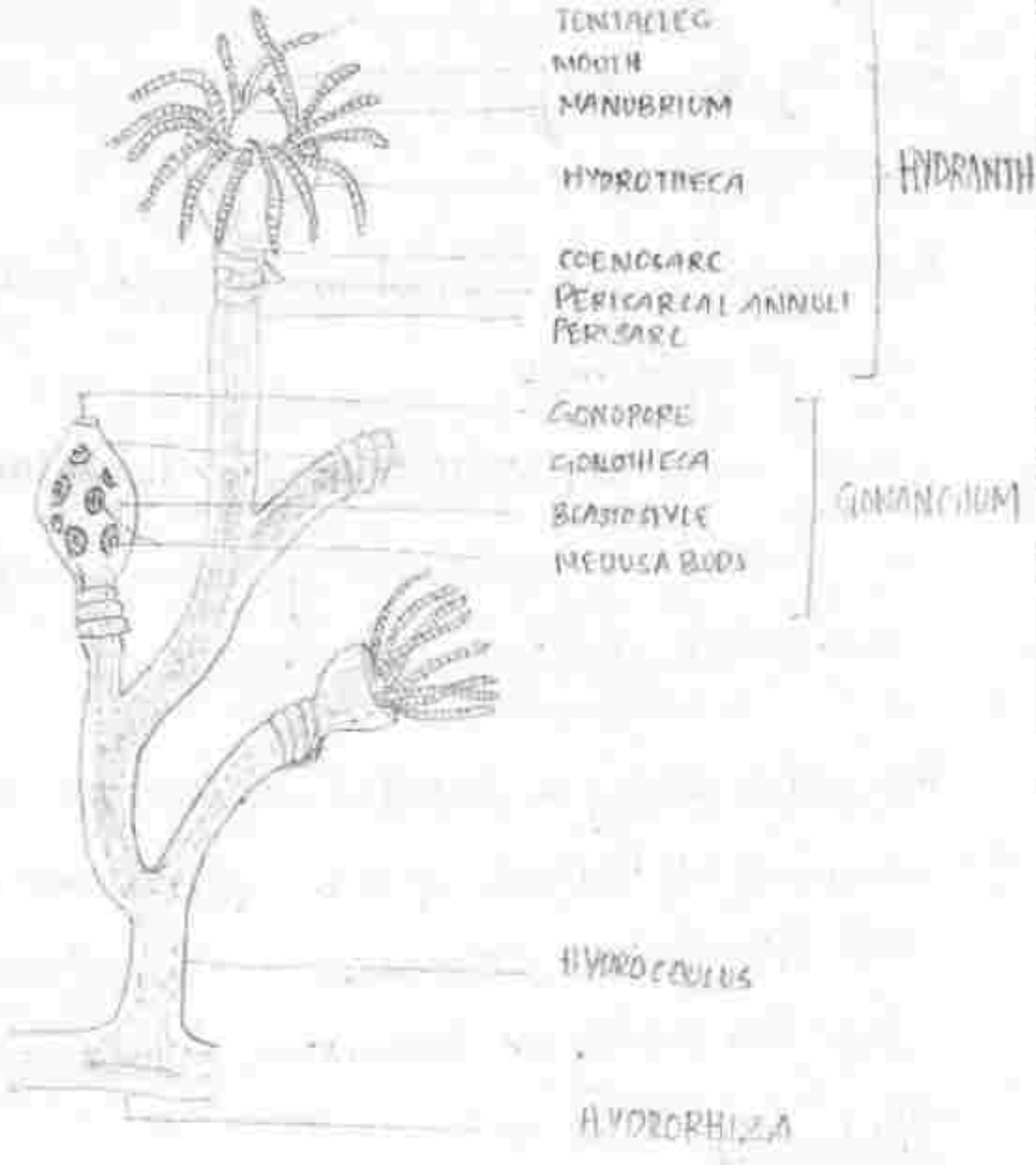
Metagenesis / Alternation of generation

- There's a regular alternation b/w asexual (polypoid) generation and sexual (Medusoid) generation in the life cycle of many cnidarian called metagenesis.

Polypoid form $\xrightarrow{\text{Budding}}$ Medusoid form $\xrightarrow{\text{sexual Reproduction}}$ Polypoid form.

Type : Obelia geniculata

Obelia is marine polypoid dimorphic colonial coelenterate with branching sessile form, often seen attached to the substratum. Obelia colony is characterised by polymorphism & alt of metagenesis.



Obelia is, at first a single polyp : Hydula it undergoes division and branching. Then each branch end in certain individuals called Zooids

Zooids of Obelia is of 2 kinds Gastrozooid / Hydranth (Nutritive) and Gyonozooids / Gonangium (Reproductive)

There by the colony of obelia is dimorphic and has division of labour.

They attach to the substratum through horizontal stem ⇒ Hydrorhiza

Stand erect by vertical stem ⇒ Hydrocaulus

Hydrocaulus undergo branching, each branch ends with either gastrozooid / gonozoid.

The entire colony is protected by chitinous non living structure ⇒ Perisarc, which encloses the living soft bi matter ⇒ Coenosarc, which encloses the digestive cavity ⇒ Coelenteron / Gastro vascular cavity

Hydranth

- The hydranth has a cup like structure ⇒ Hydrotheca
- Inside it has living coenosarc forming conical structure ⇒ Manubrium its apex is with Mouth surrounded by Tentacles.
- Mouth opens directly into Coelenteron that extends

thrughout the colony.

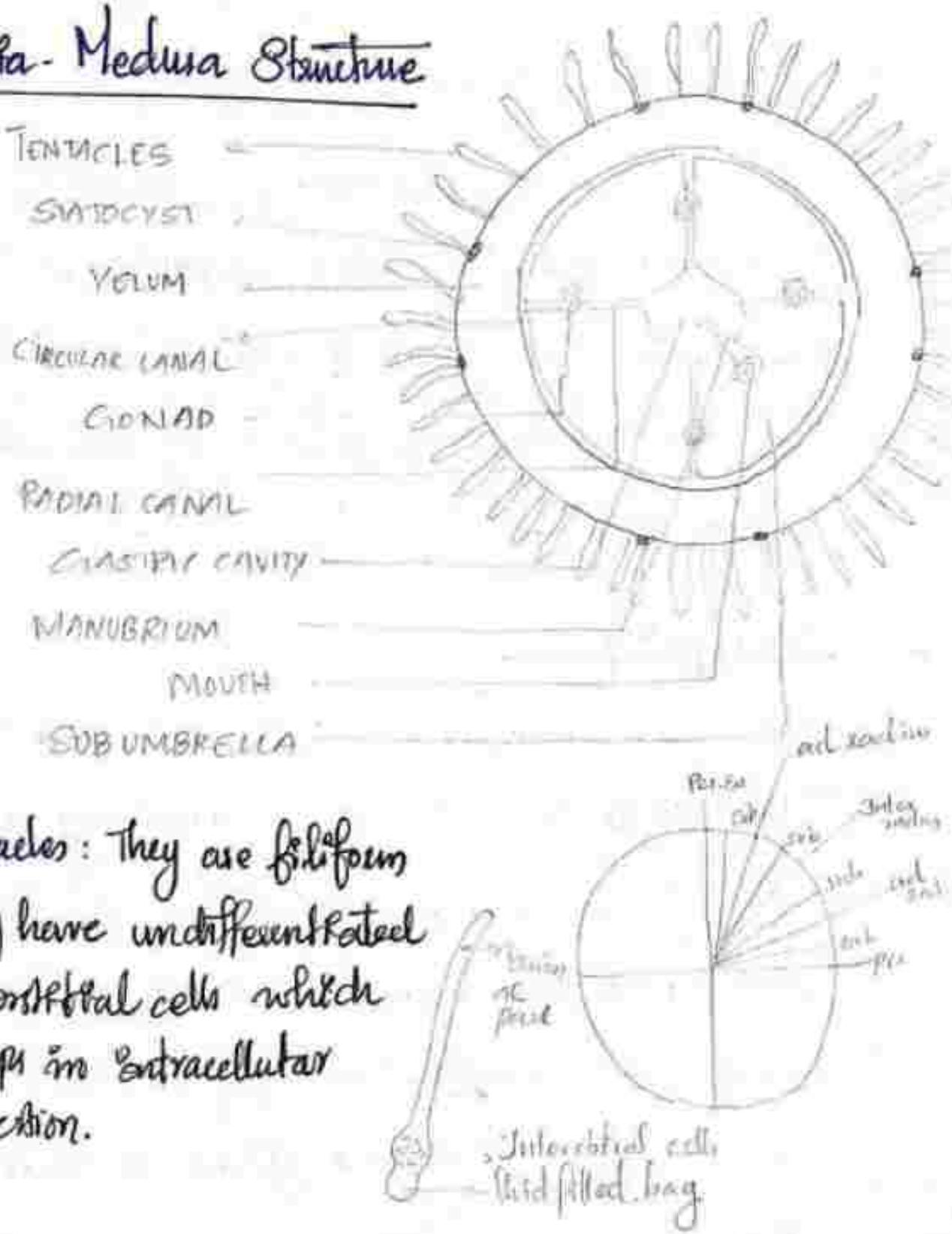
- Tentacles are provided with no: of Cnidoblast/ nematocyte or stinging cells for offence and defence & for food capture.
- The inner layer of coelenteron secretes digestive enzymes.
- There are ring like structures at the end of zooids
  ⇒ Perisarcal annuli ; when hydranth is irritated the mouth, manubrium & tentacles are withdrawn into the cup like hydrotheca by the contraction of this annuli.

Gonangium

- Coenosarc end in a blunt/club shaped structure
  ⇒ Blastostyle with a perisarcal covering gonotheca.
- Gonangia reproduce asexually by budding
- produces Medusa buds from blastostyle.
- When the asexually produced medusa buds mature they escape from gonangium through Gonopore Thus freely swimming Medusa formed.

- The medusa undergoes sexual reproduction by fusion of gametes and polypoid form of individual is formed. This simply is Alternation of generation

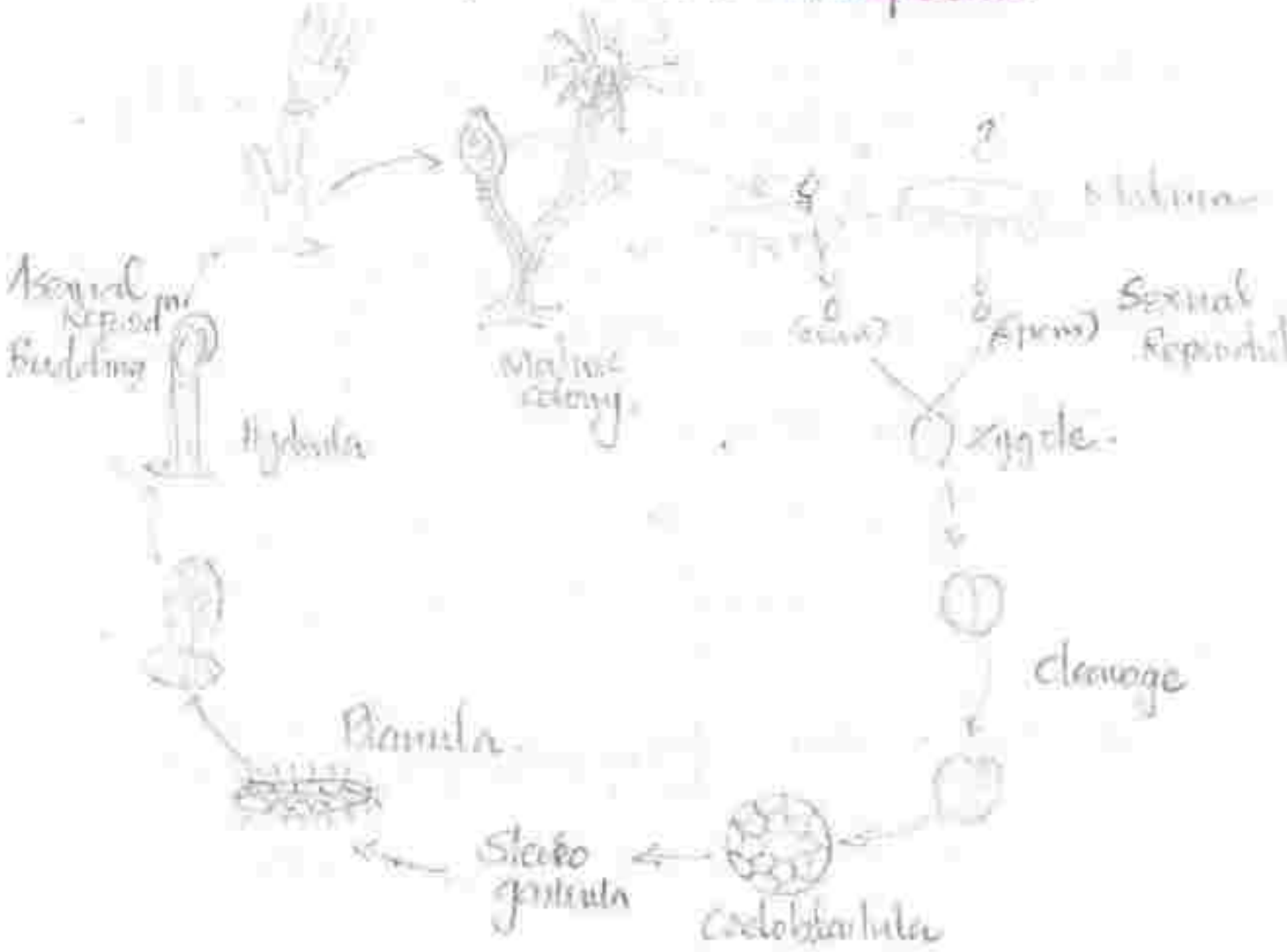
Obelia - Medusa Structure



- Tentacles: They are filiform They have undifferentiated interstitial cells which helps in extracellular digestion.

- Tentacles in the ad-radial position has Statocyst to maintain equilibrium (8 in no:)
- 4 Gonads at peri-radial position and Obelia-medusa is termed as Gonochoristic, ie, they're sexually dimorphic
- The margin of umbrella is folded towards sub medulla umbrellar surface → Velum

  Medusa with Velum → Craspedote
  Medusa w/o Velum → Acraspedote



Reproduction, development Life cycle

The polypoid colony undergoes asexual reproduction by means of budding and the medusae reproduce sexually by syngamy.

The whole body is developed from single polyp ⇒ Hydula

Hydula gives rise to hydrorhiza and buds out several hydrocauli, this buds off hydranth and gonangia.

Gonangia $\xrightarrow[\text{Budding}]{\text{Asexual}}$ Medusae $\xrightarrow[\text{Mature Syngamy}]{\text{sexual}}$ Polyp.

Sperms from ♂ and ovum from ♀ medusa (Gonochorism) discharged to the sea water, Mostly fertilization is in the open water ie, External fertilization but occasionally sperm reach ♀ medusae through water current and internal fertilization may occur.

After fertilization zygote undergoes holoblastic and equal cleavage ⟶ form a solid ball

of blastomeres → Morula —Blastulation→ Blastocoel in
fluid filled cavity appears
Coeloblastula
(Hollow ball of cells.

Then followed by Gastrulation → Mass migration
→ rearrangement of cells
→ disappearance of de blastocoel

Results in solid gastrula → Stereogastrula

→ gets elongated
→ gets ciliated

This then transforms into

Ciliated free swimming Pelagic short lived larva called Planula

It settles down, attaches to substratum elongate loses its ciliation, mouth manubrium & tentacles appears at free end ⇒ Planula ⟶ Hydrula

Hydrula undergoes repeated budding and form Colony.

- Marginal sensory structures concerned with maintaining eqlbm, muscular coordination active swimming movts are called Statocysts.
- 8 in no:, located the base of 8 ad radial tentacles.
- It has fluid filled marginal vesicle enclosing calcarous concretion – Statolith
- sensory hairs from the marginal vesicle project arch over statolith.

Canal System in Sponges

! Unique feature of sponges

- Sponges show system of poses canals and cavities through which water enters the body from outside circulates within the body and finally passes out of the body

! Canals are lined by flagellated collar cells Choanocytes

! This helps in sponges in nutrition respiration excretion & reproduction

Types of canal system :-

- Asconoid type
- Syconoid type - simple
- Syconoid type - complex
- Leuconoid type
- Rhagonoid type.

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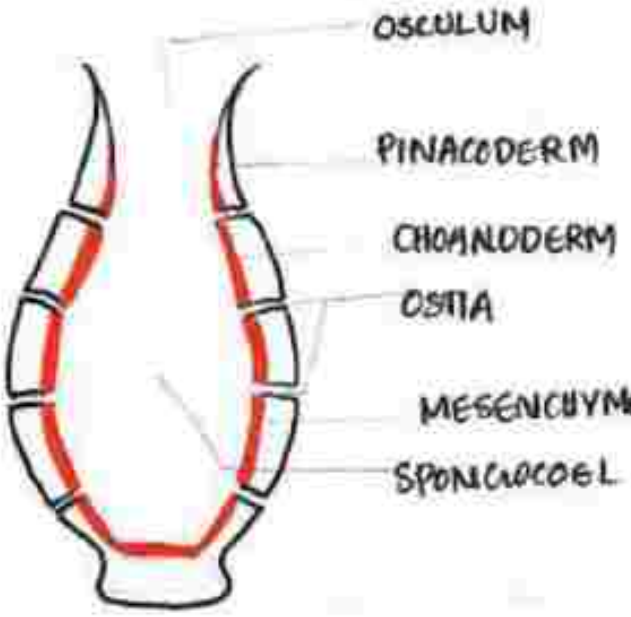
Asconoid type

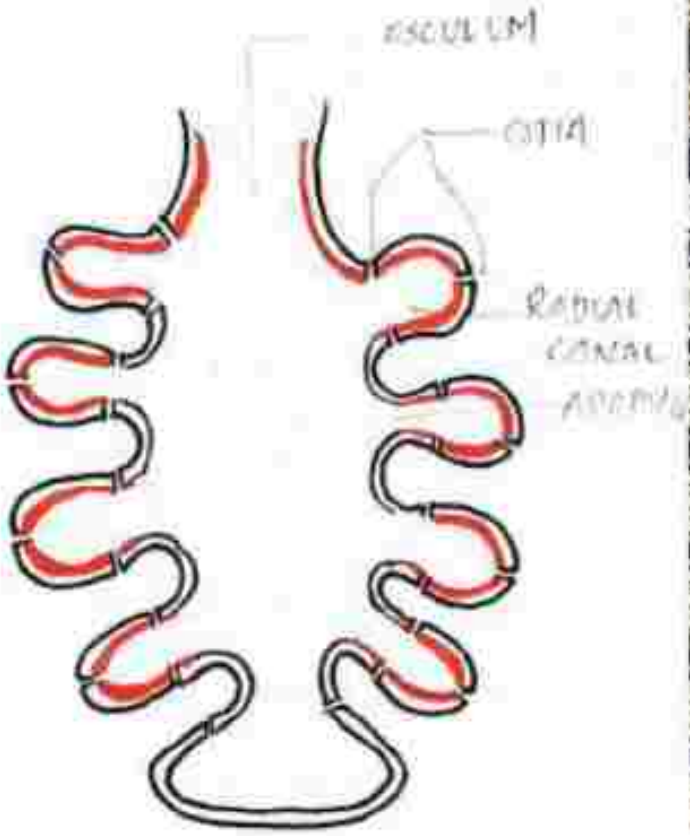
- Simplest type of canal system with,
  - simple wall
  - Complete & continuous lining epithelium of choanocytes, interrupted only at the ends of porocytes



- They have vase like structure
- Body wall is composed of 3 layers
  - o : Pinacoderm
    - Pinacocytes
  - m : Mesenchyme
    - with skeletal SPICULES, amoebocytes
  - i : Choanoderm
    - choanocyte
- Body wall is thin and encloses a cavity - Spongocoel
- Spongocoel opens out through Osculum
- Numerous perforations on walls : Ostia

outside → ostia → spongocoel → osculum → outside

Syconoid Type



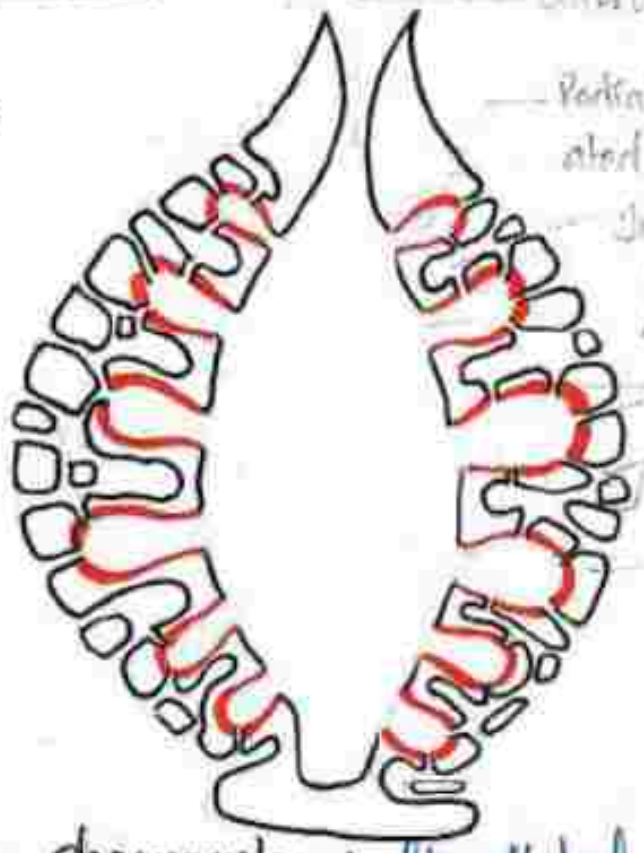
- Modified ascanoid type
- Body wall is having projection ⇒ Radial Canal
- Choanocyte line the cavity (spongocoel) interceptedly
- Radial canal opens into Apopyle
- Apopyle open into spongocoel.

outside → Ostia → Radial canal

↓

Osculum ← Spongocoel ← Apopyle

Syconoid type - Complex



! In advanced form, radial canal walls fuse together leaving a space tubular space called Incurrent canals

! Incurrent canals are lined with epidermis & opens to exterior through Dermal Ostia

! Radial canals lined with choanocytes ⇒ flagellated canal

! Radial canal opens into spongocoel through Apopyle

! The wall b/w Incurrent canals & Radial canals are with numerous minute pores ⇒ Prosopyle

! Spongocoel opens o/s through Osculum.

Outside → Dermal ostia → Incurrent canal

↓

Prosopyle

↓

Radial canal

↓

Apopyle

↓

Spongocoel

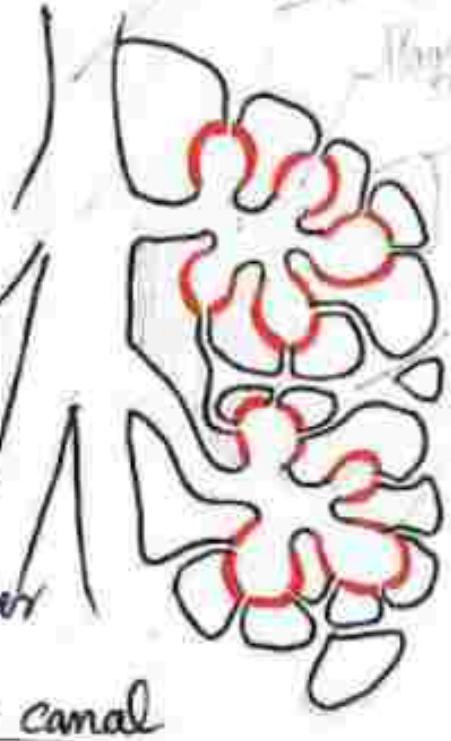
↑

Osculum

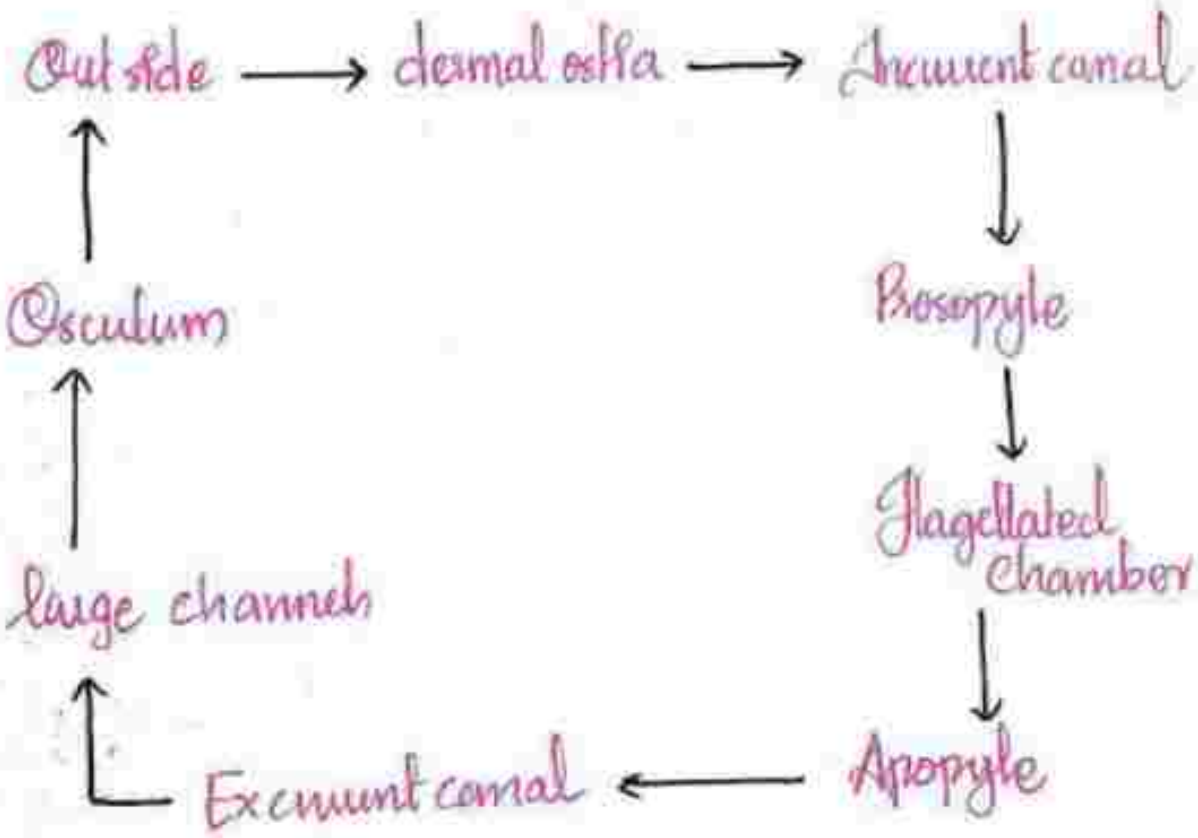
↑

Outside

Leuconoid type



- Modified syconoid type
- Increased outfolding of choanoderm and further thickening of bodywall
- Choanoderm of radial canal evaginates & forms cluster of small round/oval flagellated chamber
- This replaces the elongated Radial canal of syconoid stage.
- Spongocoel is usually obliterate, sponge becomes irregular in form & structure
- Sponge is covered with epidermal epithelium with dermal ostia, leads into Incurrent canals which branches irregularly through mesenchyme.
- Incurrent canals leads to flagellated chamber through prosopyle then to the Excurrent canal through Apopyle. The Excurrent canals unite to form larger tubes then to Osculum

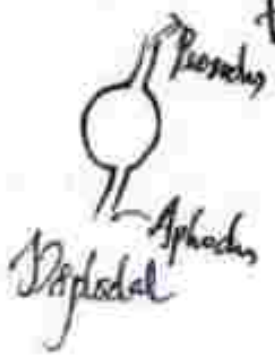


Types of Leuconoid stanchus.

1 Enuypylous

2 Aphodal : Apopyle with tube like process

3 Diplodal : Prosopyle with tube like procus; prosodus along with Aphodus.

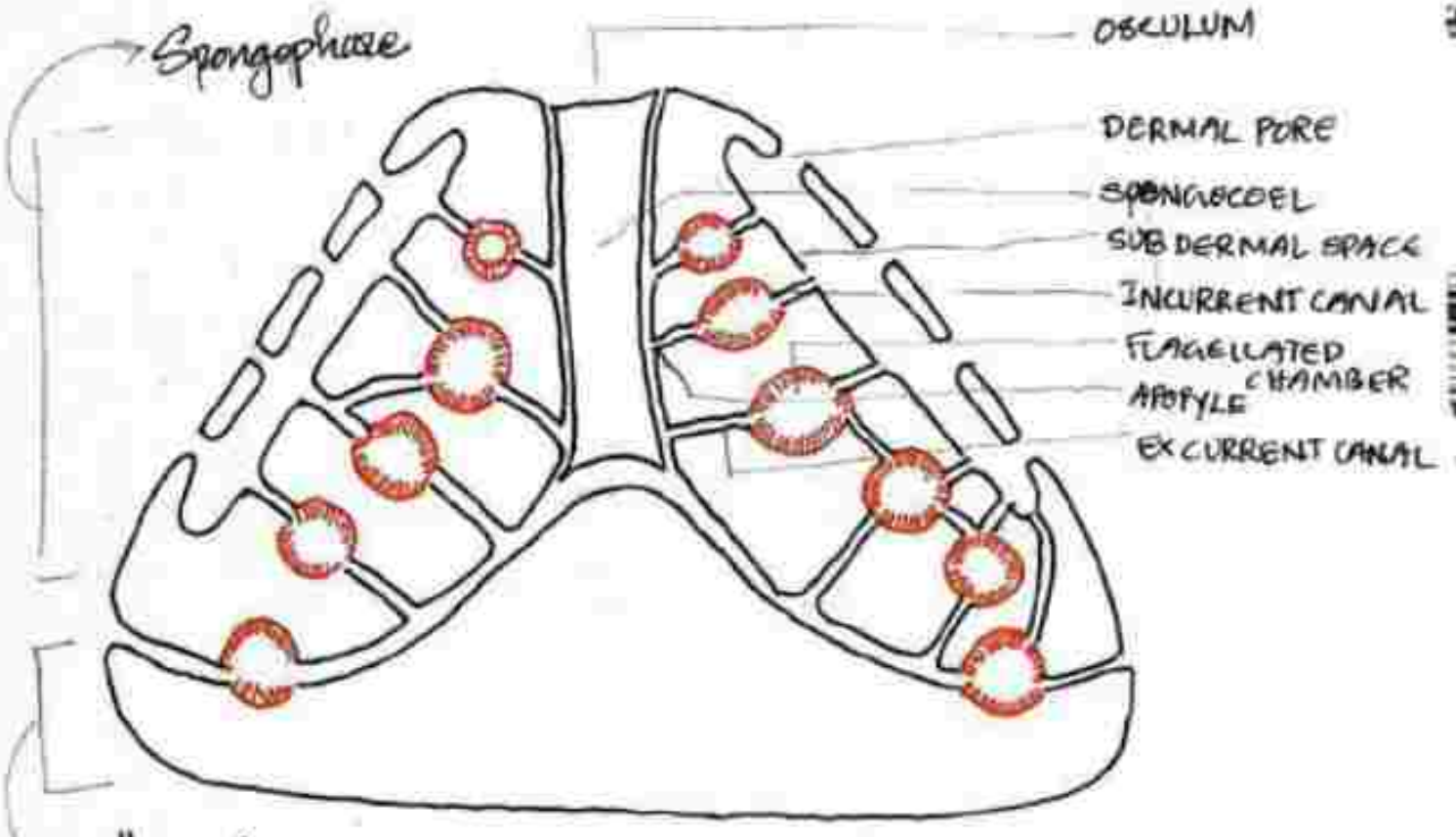




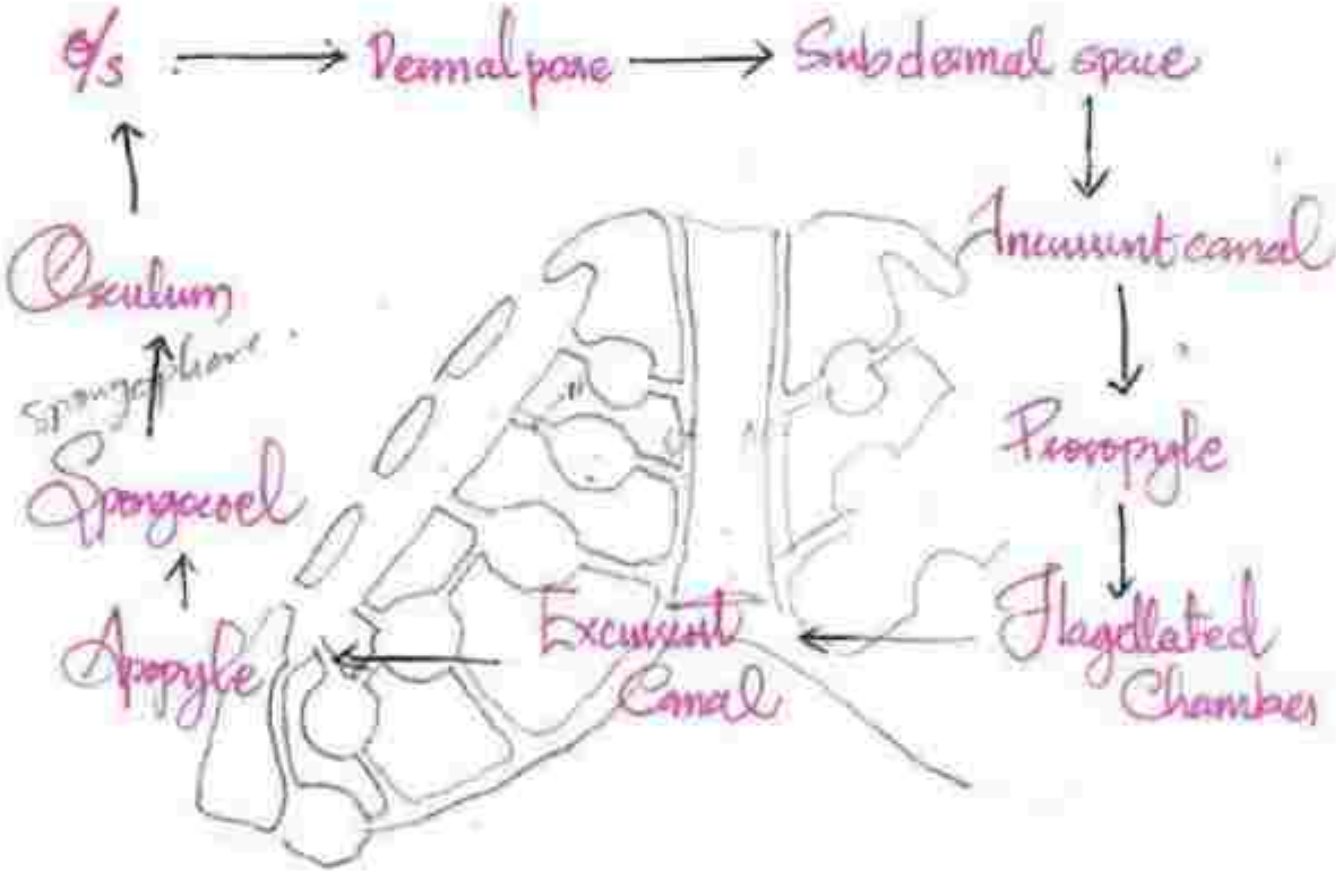
Spacial features of leuconoid canal system

- Choanocytes are limited ~~to no long~~ to small, flagellated chambers
- Mesenchyma is highly developed
- Incurrent and excurrent canals are complex
- The course of water current is very efficient.
- Most of the sponges are of leuconoid structure and they attain considerable size.

Rhagod Type



- Common to class Demospongiae
- Modification of leuconoid type
- Canal system is in the form of a pyramid with anterior end (spongocoel) and posterior end (Hypocoel)
- Hypocoel is devoid of flagellated chambers.
- The flagellated chambers are only lined with Choanocytes
- The inurrent and excurrent canals may be complex and branched.



Hypocoel

Polymorphism in Cnidarians with special reference to Siphonophores

① Polymorphism : Members of a sps exists in diff more than one kind of structural and functional forms.

② It's accompanied by division of labours

③ Different functions are assigned to different individuals rather than different parts of individual.

④ It's the characteristic feature of colonial coelenterates due to low level of organisation and lack of organs & inability of individuals to undergo specialisation to perform diverse functions.

⑤ A particular individual performs a specific function.

Basic Polymorphic Forms

⇒ 2 types of basic polymorphic forms are there.
Polyp & Medusa, each formed from each other.

Polyp

- Sessile, tubular asexual form
- They are provided with oral tentacles, upwardly directed mouth and manubrium.
- They have long oral-aboral axis.
- Usually Mesoglea is thin
- Elongation, branching & colonisation of the body.

Medusa

- Free swimming umbrella shaped sexual form
- They are provided with downwardly directed marginal tentacles, with mouth & manubrium.
- They have short oral aboral axis.
- Massive, thick mesoglea
- Radial expansion of body

Different classes which has polyp & medusa & both:-

HYDROZOA : Polyp and Medusa

SCYPHOZOA : Medusa is prominent

ANTHOZOA, CNIDOZOA } : Exclusively medusoid.



Morphological variations of Polyps :-

Zooids of the colony are.

- Structurally . functionally different individuals
- Organically connected / continuous in a colony
- These are modified into polyp & medusa.

Morphological varients of Polyps are.

- Gastrozooid
- Gonozooid
- Dactylozooid
- Autozooid
- Siphonozooid

※ Gastrozooid aka Siphon / Hydranth

- It is tubular / saccular nutritive polyp.
- It has mouth manubrium basal tentacles for food capture, ingestion
- Spacious coelenteron for extracellular digestion
- They have tentacles armed with batteries of

nematocysts. This will paralyses the prey.

- The tentacles are having 6 lateral branches called Tendillae

※ Dactylozooid a.k.a Mechanozooid

- Tubular highly tensile, protective and defensive polyp
- No mouth manubrium and oral tentacles. Much reduced coelenteron. Long unbranched basal tentacles with nematocysts. It exists in two forms.

Spiral dactylozooid : protective polyps with vertical tentacles.

Tentaculozooid : also called Feelers / palpons with sensory cells & without tentacles. when associated with Gonophores then called Gonopalpons.

- The modified form of dactylozooids variously known as nematophore nematocalyces or sarcotyles.
- They are 'Guard polyps' armed with nematocystes
- They spring from the tiny theca called nematotheca

seen on hydrotheca / stem of gastrozooid.

- Nematophore is capitate / club shaped, they have nematocytes and adhesive cells.
- In capitate, nematocytes are employed to deal with large prey.
- In club shaped, adhesive cells produce sticky substance which capture small prey.

※ Gonozooids aka Blastostyle

- They are reproductive polyps that produce medusae asexually.
- No mouth manubrium and tentacles (mouth present in Velella, Porpita)
- Reduced Coelenteron
- They produce sexual medusae by budding.
- Gonozooid sometimes modified into branching stalk called gonodendron which bears grape like clusters called gonophores provided with gonopalpons.

※ Autozooids & Siphonozooids

They are polypoid zooids seen among Alcyonarians

[gp of anthozoans - eg: Pennatula Ptilorhi]

Autozooids : Nutritive zooids with tentacles, well developed mesenteries & siphonoglyphs

Siphonozooid : Exhalant zooids, without tentacles but with gonads & reduced mesenteries & very large siphonoglyphs

Morphological variants of Medusae

⇒ Nectocalyces / nectophores

⇒ Hydrophyllia / phyllozooids

⇒ Gonophores

⇒ Pneumatophores.

※ Nectocalyces

- aka nectophores / swimming bells
  Usually very common in siphonophores (order)
- They are locomotor zooids.
- They are actually medusae with bell, velum four radial canals and a ring canal.
- They lack mouth manubrium tentacles and sense organs
- They may be in different shapes such as bilaterally flattened, prismatic, elongated or irregular.
- They are highly muscular & hence have great swimming powers.

※ Hydrophyllium

- aka Phyllozooid / bract
- Protective zooid

- They are thick gelatinous prismatic / helmet shaped with simple / branched gastrovascular cavity.
- They have no similarity with medusae
- Seen in Siphonophore colonies.

※ Gonophores

- Reproductive medusoid zooid.
- They also have bell velum manubrium and radial canals.
- No mouth tentacles & sensory organs.
- They occur singly or in clusters
- Gonads are borne in manubrium.
- In Velella & Porpita, the gonophores are set free at sexual maturity.
- Gonophores then discharge sex cells. Then gonophores perish
- They are dioecious ♀ Medusoid ♂ saccular

※ Pneumatophores

- aka Floats are the gas filled hydrostatic or floating zooids.
- Common in siphonophores
- Usually a colony has a single pneumatophore.
- It increases the bouyancy and keep the colony on floating in surface of water.
- Pneumatophore represents inverted bell of Medusa
- No mouth manubrium and tentacles.
- Pneumatophore has an outer ex-umbrellar surface and wall called pneumatocodon, also has an inner sub umbrellar wall called pneumato sacrus / air sac. Both are double layered & highly muscular
- It has gastro vascular space and this is divided into chambers by vertical septa

- The air sac has an opening which is upward and single called pneumatopore.
- This pneumatopore later reduced into minute pore guarded by muscular sphincter.
- Air sac has chitinous lining secreted by epidermis. At its bottom an expanded chamber called funnel or trichter.
- This trichter has chamber a gas gland secreting the air sac. Air contains O_2 N_2 Ar
- They have one or more openings seen at bottom of the float.

Patterns or Gracles of Polymorphism

Polymorphism is the primary accomplishment of Cnidarians. Polymorphism is significant only by Cnidarians.

Polymorphism may be Dimorphic, trimorphic & polymorphic.

※ Dimorphism

Members of a sps or colony are of two different kinds. ie, Nutritive and reproductive zooid.
In Hydrozoa, the polyps are called gastrozooid and gonozooid.
Eg: Obelia, Bougainvillea, Pennatula, Pteroides Tubularia, Companularia Corallium.

※ Trimorphism

Members of a sps or colony are of three different kinds, ie, Gastrozooid Gonozooid Dactylozooid.

Phylum Gastrotricha

▲ Gastrotricha is a small group of highly diverse
• Worm-like • bilaterally symmetrical • unsegmented
• coelomate • aquatic animals with • Spiny Cuticular covering & • 2 adhesive caudal tubes.

Major Characteristics of Gastrotricha

- Bilateral symmetry ; Unsegmented body ; Flat ventral side and arched dorsal side; Body is divisible into Head Neck trunk & tail
- Forked tail with two adhesive tubes containing cement glands which produce sticky secretion helping the animal to attach to solid objects.
- Bodywall is formed of Cuticle epidermis & circular & longitudinal muscles. Cuticular covering modified into scales spines & bristles on the dorsal side. Syncitial Epidermis with adhesive tubules.
- Spacious body cavity absent
- Digestive tract - straight tube with sub-terminal mouth, long & muscular pharynx, imperfectly

demarcated stomach & uncoiled intestine. mouth bordered by oral bristles and sensory bristles.

- Circulatory and respiratory systems are absent. Excretory system with internally flagellated Protonephridial Tubules.
- Nervous system consists of bilobed cerebral ganglion or brain pair of ventro-lateral Nerve cords & numerous nerve fibres. Sensory structures are cilia, bristles, small tentacles, ciliary pits Some sps are with ocelli / pigmented eye spots.
- Reproduction is sexual & asexual. Most marine sps reproduce sexually; they are also hermaphrodites. All fresh water sps reproduce asexually through Parthenogenesis.
- Locomotion by: ciliary gliding; locomotor cilia at the flat ventral side.
- Gastrotrichs feed on bacteria protists & fungi

Chaetonotus

- It's F.W gastrotrich living in sediments / detritus
- short & unsegmented body covered with locomotor cilia
- Elongated body with ventrally flat and dorsally arched sides.
- Body division shows distinct Head trunk & forked tail with 2/more adhesive ~~tube~~ organs
- Head bears mouth, photoreceptor, chemoreceptors & tufts of vibratile bristles on either sides
- Cuticle, syncitial epidermis & circular, longitudinal muscles forms the body wall
- Cuticle modified into scales spines & bristles
- Locomotion : Ciliary Gliding.
- Feeds on : Dead organic particles, protists, bacteria
- Pumping pharynx sucks the food into mouth
- ♂ are unknown, so reproduction : Parthenogenesis
- Parthenogenetic ♀ deposits eggs

TRYCHONYMPHA

Kingdom: Protista Phylum: Parabasalia

It's a symbiotic parabasalid Protists living in GUTS OF TERMITES AND WOOD EATING ROACHES

Oval/Pear shaped body covered with PELLICLE bearing longitudinal grooves, in these numerous FLAGELLA are seen arranged in 3 sets anterior middle and posterior.

Body differentiated into Anterior region Middle & Posterior region.

The tapering ant. end, Rostrum bears non-flagellated APICAL CAP. Middle region is with most flagella, Posterior region is round smooth and devoid of flagella. all flagella connected Internally through with BLEPHAROPLAST to parabasal body.

Cytoplasm differentiated to ECTOPLASM & ENDOPLASM

ECTOPLASM
- Alveolar layer
- Oblique fibres
- Transverse myonemes

ENDOPLASM
- Parabasal bodies
- Longitudinal myonemes



Trychonympha → OBLIGATORY ← Termites Woodroaches.

Cannot live o/s the host

← Shelter, Food, Protection

Termites gets the food digest with their help →

Cellulose is digested with help of enzymes provided by trychonympha.

The enzymes produced in trychonympha is by the ENDOSYMBIOTIC BACTERIA living inside it.

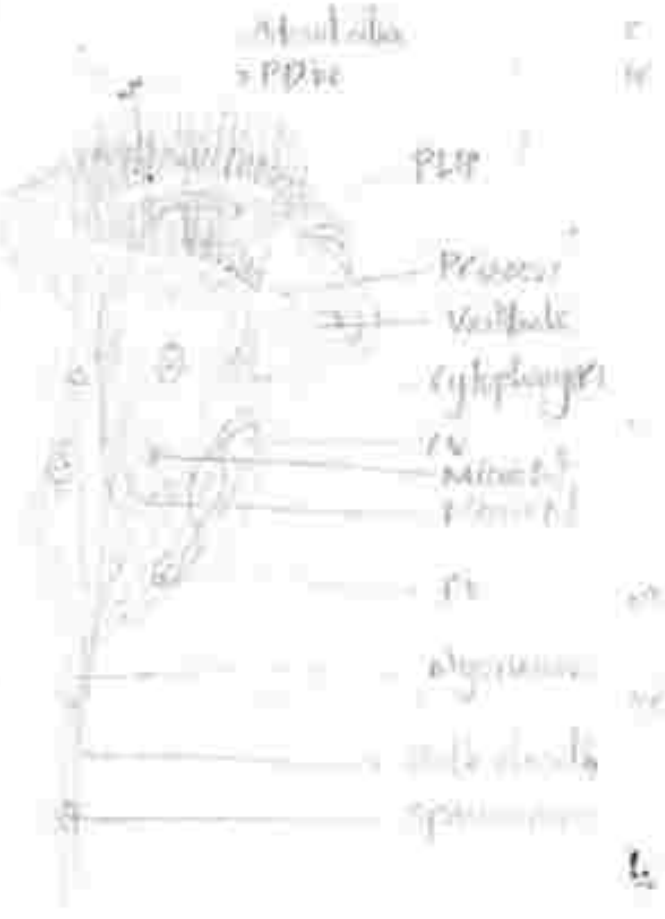
Cellulose —(cellulase)→ Cellobiose —(cellobiase)→ glucose units.

VORTICELLA

Kingdom: Protista Phylum: Ciliophora

sessile, solitary, FW ciliate with bell shaped body :.

- BELL ANIMACULE -



Often seen attached to substratum using stalk sheath.

Anterior most region there is a raised portion ⇒ PERISTOMIAL DISC around it there is a border ⇒ PERISTOMIAL BORDER/LIP b/w these PD & PB there is PERISTOMIAL GROOVE

The Bell shaped anterior region ⇒ PERISTOMIAL REGION/EPISTOME

On ventral region of PG there's depression called VESTIBULE which leads to funnel shaped CYTOPHARYNX (through an opening cytostome) and ends with FOOD VACUOLE

PG + V + CPh → Angestatory apparatus.

Cilia can be seen restricted to only in peristomial region it's ADORAL CILIATURE. It even enters into Vestibule helps in Food collection & angestation.

3 concentric row of cilia — 2 inner Oks & 1 Outer Oks.

* Thin pellicle covered in parallel striations & it contains contractile elements → MYONEMES in the ECTOPLASM along with a CONTRACTILE VACUOLE.
MYONEMES merge together & form SPASMONEMES in the STALK.

* MYONEMES & SPASMONEMES help it to RETRACT & RELAX the bell when it is disturbed.

* Endoplasm is with dimorphic nuclei, micro & macronuclei several food vacuoles in Cytoplasm.

* Reproduction — BF ; Conjugation.

* Nutrition — Holozoic

PHYLUM ROTIFERA

Microscopic animals pk a: wheel animacules

Actively swimming: found most common in fresh water habitat; some are marine

Most of them are benthic forms few are planktonic sps

Short-living but have high withstanding rates towards dessication and drought

Rotifers are bilaterally symmetrical unsegmented and Pseudocoelomate metazoans with ciliated trochal disc syncitial epidermis complete di.ca splzd jaws muscular pharynx & flame bulb type nephridia & w/o circulatory and respiratory organs.

Salient Features :-

Minute and microscopic body differentiated into head, trunk and tail.

Head region - broad with non ciliated central disc called apical field. It's encircled by ciliary zone known as Corona (Rotatory Organ / wheel organ) It's a feature that distinguishes from all other metazoans

It may be partly subdivided into retractile, locomotor and food collecting discs. → trochal disc.

Body has cuticular covering. sometimes it becomes hard and becomes a thick encasement called loricа
Rotifers with lorica : loricates w/o lorica : illoricates.

Epidermis is mostly syncitial except rgn of corona

* Perivisceral cavity is a spacious pseudocoel
* Pharynx is modified into a muscular mill called Mastax
It's provided with masticatory apparatus or Dental mill composed of hard and jaw-like cuticular structures trophi. Mastax and trophi are characteristic feature of Rotifers
Ammonotelic excretion with protonephridia with flame bulbs.
* Bilobed brain & Radiating nerves constitute NS.
* Sexually dimorphic with males being smaller & almost degenerate
# Eggs are of 2 types Syngamic eggs and parthenogenetic eggs
The former develops through fertilization and latter through parthenogenesis, without fertilization.
Many rotifers have the powers for Cyclomorphosis (seasonal change in the form, shape and proportion of body)
Cryptobiosis (death like state, suspended animation which protects the animal from adverse environmental cond^{n}

Classification of Phylum Arthropoda.

Subphylum :-

Trilobita — class → Trilobita

Chelicerata — class → Merostomata, Arachnida

Uniramia — class → Chilopoda, Diplopoda, Insecta

Crustacea

Sub-Phylum Trilobita

* Comprises single class - Trilobita.
* Entirely extinct and exclusively marine, abundant and widely distributed in Paleozoic seas.
* Flourished during the cambrian and Ordevician Periods.

Body

- 2-10cm long, segmented, dorsoventrally flattened
- Calcite exoskeleton
- divided into Head, Thorax & Tail or pygidium
- Has 3 longitudinal lobes marked by 2 longitudinal grooves. They are one Axial/Median lobe and 2 Pleural/Lateral lobe. Thus they are called trilobita

Head

- Formed of 5 fused segments and an unsegmented acron
- Covered by broad and 5 segmented carapace
- Bears a pair of compound eyes dorsally
- Bears ventrally 5 pairs of cephalic appdg ie, a pair of uniramous Sensory Antennae and 4 pairs of biramous Maxillipedes with Exopodite (respiratory) and Endopodite (walking).

* Mid ventral food groove
* J shaped alimentary canal with crop in the head region.

Thorax

- Formed of several articulated & flexible segments with hinged exoskeleton plates dorsally.
- The movable articulations enables them to roll to a ball when they are disturbed by any means.
- Thoracic appendages are typically biramous with respiratory exopodite leg like Endopodite & coxal lobes.

Pygidium

- Formed of few fused segments each with a pair of biramous caudal appendages.
- Exoskeletal plates fuse to form dorsal tail shield & terminal telson.

- Heamocoel in the axial lobe of the body.
- Sexes are separate. No sexual dimorphism Development with Protaspis Meraspis and Holaspis larval stages.

Phylogeny:

The ancestoral line of arthropod evolution
Descended from a pre-cambrian annelloid stock, which is ancestral to early arthropods also.
Trilobites represents the ancestral stock from which present day arthropods have evolved.
The nearest arthropod relative of trilobite are crustaceans.

Class- Merostomata

Group of marine chelicerates, characterized by 5/6 pairs of abdominal appendages modified as gills and by Spike like Telson
Excretory organs: Coxal glands
Involves free swimming larval stage called Trilobite larva.

Class Arachnida

Large heterogenous gp of Chelicerates
Mostly terrestrial and few 2°ly aquatic forms
Egs: Spider, Scorpions, ticks, mites
Very ancient gp with fossils dating back to carboniferous periods.

Class Chilopoda

(1) Commonly called Centipede
(2) Terrestrial, tracheate, carnivorous oviparous / ovoviparous, fast running forms.
(3) Largely nocturnal & Soil-dwelling forms with Dorsoventrally flattened body
(4) Soft and uncalcified exoskeleton.
(5) Antennae: long, many jointed & terminally tapering.

Class Diplopoda

Commonly called Millipede
Terrestrial, tracheate, detritivorous oviparous & slow moving form
Many are nocturnal, cave-dwellers with cylindrical or sub-cylindrical body.
Hard calcified exoskeleton
Antennae: Short, with few joints and club shaped.

Chelopoda

(6) Mouth parts are 3 pairs with mandibles (toothed and cutting) I^st and IInd Maxillae
(7) IInd maxillae fuse to form Labrum
(8) Trunk - monosegmental each with a pair of Legs and spiracles
(9) Legs are lateral
(10) I^st pair of legs modified to poison claws
(11) Opisthogoneate condition: Gonopores are posteriorly placed.
(12) Stink glands are absent

Diplo

Mouth par with max and man I^st Maxil absent.
I^st maxi form gn
Trunk - each wit of legs an
Legs are
Poison
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Class - Insecta

Large group of extreamly diverse tracheate and winged / wingless arthropods.

Comprises air-breathing, mostly terrestrial and aerial and rarely aquatic and parasitic arthropods

Largest and most successful existing animals in terms of no: of sps, no: of individuals, extensive distribution & extreame adaptive radiation

Constitute nearly 75 - 80% of known animal sps.

Succesfully conquered almost all kinds of habitats from arctics to tropics

Exhibits, polymorphism, division of labour, leadership and physical & chemical or pheromonal means of communication.

Sub-Phylum Crustaceae

They are group of primarily aquatic arthropods generally with hard, massive exoskeleton impregnated with Ca salts

Body has 3 region — Head, Thorax → fuses → Cephalothorax; Abdomen

Cephalothorax may be partly or fully covered by Carapace But Abdomen covered separately by dorsal and ventral plates called Sclerites.

Head formed by fusion of 6 segments and an acron.

The 5 fused cephalic segments bear 5 pairs of appendages - Antennules, antennae, mandible, Ist maxillae and IInd maxillae and a pair of Compound eyes are also present on the head.

Thoracic and abdominal region bear segmentally paired biramous appendages. Terminally abdomen bear telson.

Perivisceral cavity is ~~haemoly~~ haemocoel filled with haemolymph.

Eupagurus — Hermit Crab

* Marine crustacean, found in all seas. Lives in the empty shell of gastropods
* Often it kills and removes the gastropod body from the shell, making shell habitable for its stay. On its continuous growth it may change the shell periodically.
* Body is long oblong and somewhat compressed and asymmetrical. Body has 2 divisions (Head+Thorax)
  - Cephalothorax
  - Abdomen.
* Cephalothorax is large, broad and flat. It is periodically protruded and retracted
* Head bears a pair of stalked compound eyes a pair of biramous antennules (small) and a pair of long uniramous antennae
* Thorax has 5 pairs of legs.
  1st pair – chelate : Chelipeds

* Alimentary canal is straight and uncoiled and differentiated into Stomodaeum, Mesodaeum Proctodaeum
* Respiratory organs : Gills / Branchiae associated with appendages.
* Blood Vascular system : Open / Lacunar.
  with dorsal heart and system of open channels and spaces. The heart opens into haemocoel through Valvular Ostia.
* Excretory organs : pair of either Antennary glands or Maxillary glands or both.
* Nervous system : Circum Oesophageal nerve ring & a pair of ventral nerve cords.
* Sexes are separate with sexual dimorphism is most. Copulation & egg brooding are common, Parthenogenesis in some cases.
* Indirect development with fundamental nauplius larva.

* Right chelipede is larger than left one
* They are used to block the shell mouth on the retraction of hermit crab.
* Next 2 pairs of legs are large and non-chelate walking legs: locomotion
* Last 2 pairs of legs are much reduced remains in the shell.
* The abdomen remains permanently inside the shell. It's soft, fleshy elongated & spirally twisted to fit in the shell.
* Abdominal appendages are absent on right side, the 5 left ones are much reduced too.
* The last pair of abdominal appendages the Uropods are hook like for the clinging on the shell.



* Crustacean parasite which infects many spp of marine crabs.
* Remarkable for PARASITIC DEGENERATION, RETROGRESSIVE METAMORPHOSIS PARASITIC CASTRATION
* Adult sacculina is extremely degenerated with no trace of segmentation, appendages internal organs other than gonads

It's a tumor-like fleshy mass remain attached to the ventral side of abdomen of a crab by Stalk / Peduncle.

There are root like procm arising from Peduncle, pierce into the soft tissues of the host and absorb nutrients and also remove metabolic waste from the parasite to the host through these roots

There is a mantle opening on the lower side of Sacculina which leads internally into mantle cavity.

Mantle cavity surrounds the Gonads, nerve ganglion and a cement gland.

Sacculina is a Protogynous hermaphrodite with paired testes and ovaries.
ie, earlier maturation of eggs than sperm so self fertilization is impossible & cross fertilisation is the rule.

Mature eggs are cavity which sea stored there.

On the arrival through water ca early develop cavity.

The life cycle c
→ Nauplius
Internal sa

Nauplius is
It passes out
lava - Cyp
After 2-3 da
abdomen of
extreame
metamorpha
It loses app
some orga
& undergoes

- This forms a degenerate rounded mass known as kentrogon larva.
- This then dissolves the cuticle of host and enters blood stream & comes to stay on the lower side of the intestine of the host.
  It is now called Internal Sacculina.
- It then grows in size, develops gonads and mantle cavity, sends out root-like processes to soft tissues of host
- It then makes a hole on host abdomen and its central part pushes outside and grows into a fleshy mass.
  It is called External sacculina/adult parasite
- The parasitic effect of Sacculina on crab is called parasitic castration
- In this case the host undergoes morphological physiological & behavioural transformation
- The host gets sterilized & moulting cycle is suppressed, so it remains as a juvenile crab.
- If the host is ♂ crab it undergoes partial sex reversal ie, gets feminized by developing broad abdomen; characteristic of ♀s
- This broad abdomen is more advantageous to carry and protect the parasite.
- If the host is ♀ it may lose its gonads

Scolopendra

Common Centipede

- Nocturnal predatory carnivore found in tropical and sub-tropical countries.
- Commonly lives in soil, beneath stones bark and logs in moist and damp areas of human dwellings.

* Body : long flat and divided into head and trunk. Soft and flexible chitinous exoskeleton with low Ca.
* Head has dorsal covering → Cephalic shield.
* Trunk, segments has dorsal tergum and ventral Sternum covering connected by pleuron.
* Head → Mouth, labrum, paired antennae mandibles, I^st and IInd maxillae hypothorax phaynrx, group of ocelli.
* In trunk all the segments are alike with no differentiation into ~~head and trunk~~ thorax and abdomen.
* Each segment bears a pair of walking legs, ~~called walking legs / Maxillipedes if they are involved in feeding~~.
* The I^st pair of legs called maxillipede : they are involved in feeding, with 4 segments and a poison claw with terminally pointed fang.

* The last pair
* They are excl organs.
* Behind these known as
* Genital segmen
* Scolopendra fe annelid, worm paralyse the p the venom.
* Dorsal tubular Vascular syste
* Respiratory orga
* Excretory orga
* Ammonotelic
* Sexes are sepa oviduct, gonop connected to
* External fertil
* In some, ♀

Scutigera — House Centipede

- It is a small, black-coloured long-legged and agile centipede, living in damp places feeding small insects
- Dorsoventrally flattened body with two divisions, head and trunk.
- Head with paired antenna, mandibles, I[st] and IInd maxillae and compound eyes.
- Antennae are tactile organ / feelers with many segments. Near their base there is paired sense organ named Tomosvary organ, and are ~~hygroscopic~~ receptors hygroreceptors, detecting humidity.
- The compound eye, the cluster of numerous (200) ocelli function only for the detection of light and darkness in Scutigera.
- Trunk is lean and bears 15 segments pair of long and fragile legs last segments are monosegmented
- There is overlapping tergal plates, the no. of terga is less than that of sterna.
- There is progressive increase in length of legs from head to anal region.
- The I[st] pair of legs, maxillipede are modified as poison claws for food capture
- Remaining legs employs fast running
- Last pair of legs are exceptionally long backwardly directed, antenna like tactile organs.
- The last segment of each leg is annulated to reduce the slippage.
- The last trunk segment bears anal opening
- Tracheal system highly specialized for its active life and high metabolic rate

* Lung like trachea. Mid-dorsal, unpaired, non valvular closable Spiracle leads to atrium.

Spirostreptus — Common Millipede

1) It's a sluggish slow moving animal commonly living in damp places, underneath stones, logs among decaying leaves in rotten timbre.

2) Plays an important role in changing leaves and other organic debris into soil.

3) Cylindrical body with hard and calcified exoskeleton and is divided in to head and trunk.

4) Head bears paired antennae, mandible first maxillae and several ocelli.

5) Provided with teeth and rasping surface, there is gnathal/Masticatory lobe - the movable distal lobe of mandible.

6) Antennae short and tactile.

7) Gnathodi
2 sides of
like plate

8) Exoskeletal
Sternum a
segments
double seg

9) A diplosegm
Legs spirac

10) Limb len

11) 2nd 3rd A

12) I st pair

13) 7th seg. ♂

14) 7th seg of ♀

15) B/w 2nd &

16) Last segm

17) On the side
Stink gla

18) Respiratory
2 spi

19) Excretory

20) Sexes are separate

21) Dorsal tubular chambered and posteriorly closed Heart.

22) Curls to roll for protection

23) Protects itself by secretion from stink glands.

Praying Mantis

tiger of Insect world

1) It is mostly an arboreal insect, predatory carnivore feeding upon other arthropods, flies caterpillers grasshoppers spiders etc.

2) Body is long lean divisible into Head thorax & abdomen.

3) Head is small triangular freely movable bearing pair of antennae which is filiform, large compound eyes, three ocelli, chewing Type mouth part

4) 3 segmented thorax bears 3 pairs of legs and 2 pairs of wings.

5) Prothorax is exceptionally elongated and prothoracic legs are pincer like and raptorial for striking seizing and holding the prey, with sharp tooth like spines on femur, tibia

6) Flat and permanently folded wings

7) Abdomen is 10 segmented, the last segment bears anal cerci. For males anal style also present in 9th segment.

8) Being a skillful hunter, it only strike the prey until it approaches without knowing

9) Keeps its raptorial legs raised and held close together ready to strike this posture is similar to how humans pray hence the name 'praying mantis'

10) All mantis sps are remarkable for showing Cryptic colouration and concealing protective mimicry, providing concealment and protection from enemies.

11) Some closely resembles twig / stick / coloured like flowers some have leaf like expansion



The stealthy burrowing habits & cryptic coloration of them of mantis aided in their successful distribution all over the warmer countries.

The ♀ is cannibal. may kill and eat the male soon after courting and copulation

Lays eggs in ootheca attached to twig stones etc

Its a frothy material secreated by ♀ on abr exposure it hardens and forms an egg case.

Soon after hatching hangs suspended with help of silken thread until Iˢᵗ moult is over.

Lepisma — Silver fish

It is a household domestic pest which causes untold damages to books papers manuscripts clothes etc and enjoys cosmopolitan distribution.

Body delicate and broad body with the glistening silvery scales

Body is divided into head thorax and abdomen.

Head bears a pair of tactile antenna with many segments, Vestigial compound eyes with ocelli, Mandibulate mouth parts

Thorax bears 3 pairs of legs adapted for running.

Abdomen is 11 segmented bears ~~abdominal~~ 6 Rudimentary segments -

~~Anal segment bears many jointed cerci and~~ ~~a median long caudal filament.~~

Anal segment bears many jointed anal cerci and a median long caudal filament

Respiratory organs: Malpighian tubules
↓ ↑
Trachea Excretory org.

Sexes are separate.

Internal fertilisation

Direct development with nymphal

Troides minos

- endemic to South India.
- Southern bird wing
- State butterfly of KA

1) It is the largest Indian butterfly with wing span of 140-190 mm and is strikingly imposing and attractive butterfly.
2) It's a 'least concerned' in Red List of IUCN
3) Range of distribution ranges from Kerala to MH and more common in Western Ghats.
4) During feeding, it balances its body with hindwings and holds small flowers with its stout legs and inserts its proboscis into the small flower with pressure & imbibes the nectar.
5) Feeding time: morning and late afternoon.
6) Ixora, Lantana, Cleodendrum & Mussaenda are its favourite nectar plants.
7) Caterpiller of border sequester the toxin. aristolochial it, imbibed from host plant Aristolochia sps.
8) The accumulated toxins remains throughout their life life cycle.
9) It keeps away the predatory birds.

Papilio buddha

- Malabar banded Peacock butterfly
- State butterfly of Kerala

1) It's a sps of swallow-tail butterfly which is endemic to Western Ghats
2) Body is dark brown, sprinkled with green powdery scales. It may appear blue due to light interference.
3) Fore-wings are black with broad greenish blue band in the middle
4) The under side of fore wing is double colored.
   first part → dark brown & powdered white scales

1. EXTERNAL FEATURES OF FROG

Frog is an amphibious vertebrae which inhabits moist places, freshwater ponds, streams rivers etc.

The male frog is smaller and darker than the female.

The body is divided into head and trunk.

HEAD

* Head is flat and triangular with a blunt snout.
* Valvular external nostrils/external nares are present dorsally at the tip of the snout in pair
* Eyes located at the top of head.
* Eyelids, upper one is immovable and the lower one is movable
* Nictitating membrane is produced from the lower eyelids which is thin and transparent. They cover and protect the eyeballs.
* Tympanic membrane/Tympanum is located behind and below to the eyes on both sides and is a circular area of tough skin. Males have larger tympanum than females.
* Vocal sacs are possessed by the males (during the breading season) located ventrally on each sides of head. It amplifies the croacking sounds.

TRUNK ——

* Trunk bears fore-limbs and hind-limbs.
* At the posterior end of the trunk is the cloacal aperture. It's the common passage for digestive, excretory and reproductive systems.

* FORE-LIMBS are divided into 3,
  - Brachium ⟶ Upper arm
  - Antebrachium ⟶ Fore-arm
  - Manus ⟶ Hand, has 3 parts namely,
    - Carpus ⟶ wrist
    - Metacarpus ⟶ palm
    - Digits ⟶ Fingers, 4 in number.

  * Nuptial pad : In males, a paddle like swelling is developed on first digit during breeding season. They are absent in females.

* HIND-LIMBS are divided into 3,
  - Femur ⟶ Thigh
  - Crus ⟶ Shank
  - Pes ⟶ Foot, its divisible into.
    - Tarsus ⟶ Ankle
    - Metatarsus ⟶ Sole
    - Digits ⟶ Toes, 5 in number

  * Toes are joined together by a skin fold : Web.
  * Toes and web form a swimming paddle.

2 SKIN OF FROG ——

* The skin of frog is tough, smooth, slimy, moist and glandulas and devoid of exoskeleton.
* It is loosely attached by means of connective tissue bands to the underlying muscles at frequent intervals.

Skin has 2 main parts,

* outer, Epidermis :- consisting of several epithelial cell layers and has 2 distinct layers
  - outer, Stratum corneum, the corneous layer of
  - Inner, Stratum Malpighii, the Malpighian layer
* Inner, Dermis :- Connective tissue layer with connective tissue fibres, nerve fibres, muscle fibres Blood vessels. Dermis has 2 distinct parts,
  - Stratum spongiosum : loose outer part.
  - Stratum compactum : Compact inner part.

* Dermis also contains,
  - Cutaneous glands which includes
    - Mucous glands
    - Poison glands
  - Chromatophore, the pigments determines the pigmentation.

Eg: Melanophore (Black) Guanophores (Blue-green) lipophore (red).

Functions of skin ——

→ Protects the internal organs from adverse physical conditions, injuries and pathogens.

→ Mucous gland secretions make the skin slimy, which aids in swimming and escape from enemies.

→ Skin forms chief respiratory surface for gas exchange

→ Presence of nerve endings makes it function as sense organ.

→ Displays protective colouration by the activity of chromatophore to escape from the eyes of enemies.

→ The larval skin produces hatching enzyme that dissolves the egg membrane for hatching.

Different parts of Endoskeleton of Frogs ——

*The endoskeleton of frog is made up of bone and cartilage

*The skeletal system of frog as 2 divisions.

- Axial skeleton, which consists of skull and Vertebral column and.
- Appendicular skeleton which includes fore limbs, hind limbs and limb girdles. The forelimb girdle is the Pectoral girdle and hindlimb girdle is the Pelvic girdle.

5 Functions of Skeletal system in frogs ——

- Gives the body definite form and shape
- Provides proper support for the organism.
- Protects the internal organs.
- Forms levers for movement and locomotion
- Provides surfaces for the attachments of muscles.
- Serves as storehouse of minerals.
- Plays significant role in Erythropoiesis.

6. Cranium of Frog ——

* Cranium, is or brain-case is the bony casket that encloses the brain. It's # one of the six regions of the skull which is included in the axial skeletal system.
* The floor of cranium is formed by a dagger-shaped bone — Parasphenoid
* The roof of cranium is mostly formed by a pair of bones — Fronto-parietals. (formed by fusion of frontal and parietal bones.)
* The front portion of cranium is surrounded by ring-like bone - Sphenethmoid.
* The spinal cord leads out from the brain through an opening called Foramen magnum, which is located on the posterior end of cranium.

* The sides of the foramen magnum has 2 bones that is the exoccipitals. They meet from above and below.
* At the base of the exoccipitals, they bear 2 rounded prominences called Occipital condyles, as it has 2 of them, the skull of the frog is Diplocondylian skull.
* Occipital condyles articulates with I^st Vertebra.

7 Vertebral Column of Frog

* The vertebral column is the axial skeleton of the trunk.
* It covers and protects the spinal cord.
* The vertebral column of frog consists of 9 vertebrae and a terminal bone called Urostyle
* The successive vertebrae are held in such a way that, the posterior convex part of each vertebrae fits perfectly into the anterior concave part of the next vertebra.
* Paired lateral openings called intervertebral foramina is seen between the successive vertebrae for the passage of spinal nerves.
* The I^st/Atlas, 8th and 9th vertebrae differ from all others
* The vertebrae other than these are taken as typical one, the Typical vertebrae.

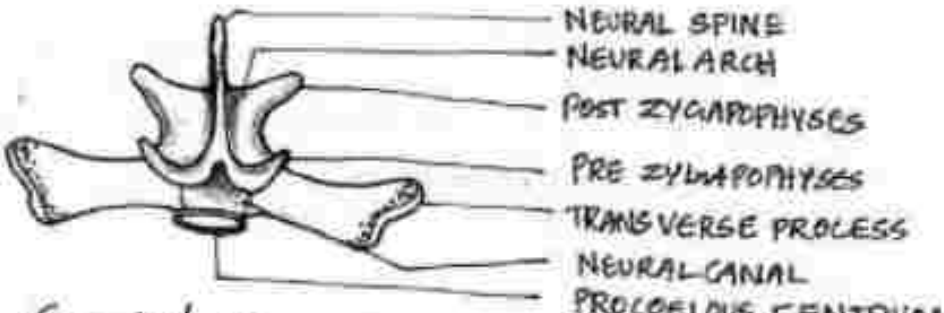
Typical Vertebrae

* It has disc-like body known as centrum and this centrum is concave anteriorly and convex posteriorly. This is then called Procoelous centrum.

* The centrum bears an arch → Neural arch, this encloses a space/canal called Neural canal/Spinal canal
the Spinal cord passes backwards through this canal.

* The neural arch has median neural spine/spinous process paired transverse processes and 2 pairs of articular process an anterior and a posterior Zygapophyses

* Anterior/Pre-Zygapophyses articulates the vertebra in front
* Posterior/Post-Zygapophyses articulates vertebra behind.
* Zygapophyses prevents the displacement of vertebrae.



Typical Vertebra.

Atlas vertebra

It's the Ist vertebra which is almost ring like with thin and reduced centrum.
It has 2 anterior articular depressions for the articulation of the occipital condyles of the skull.
Neural arch is produced from the centrums and this encloses the neural canal
The neural arch has only Post-Zygapophyses and reduced

neural spine, transverse processes and pre-zygapophyses are absent.

8th Vertebra

* 8th vertebra in frog is characterized by an Amphicoelous centrum ie. concave anteriorly & posteriorly. This produces the Neural arch.
* Neural arch encloses neural canal and it bears neural spine, a pair of transverse process and paired pre- & post- Zygapophyses.

    * 8th vertebra differs from typical vertebra only in having an amphicoelous centrum instead of procoelous centrum.

9th Vertebra

* 9th vertebra has biconvex centrum with 2 knobbed processes posteriorly. This fits into the corresponding depressions in Urostyle.
* Neural arch is produced from the centrum and encloses the neural canal.
* Neural arch has neural spine paired transverse processes & paired pre-zygapophyses
* Post zygapophyses are absent, the neural spine is reduced.
* The transverse processes are directed backward and are broad, terminally they articulates with pelvic girdle.

※ 9th vertebra differs from typical vertebra in having.

- its centrum biconvex
- 2 knobs/convexities posteriorly on the centrum
- Broad and backwardly directed transverse processes
- Absence of post-zygapophyses.

Urostyle

* The terminal portion of Vertebral column which represents the fused tail vertebrae of larva.
* Urostyle is long, flat terminally tapering bone.
* It has longitudinal ridge/crest formed by the fusion of neural spines of larval tail vertebrae, dorsally.
* The dorsal crest contains a canal called Canalis vertebralis (neural canal) which lodges the filum terminale (tip of spinal cord)
* Urostyle has 2 articular depressions/concavities anteriorly, for the articulation of posterior knobs of 9th vertebra.

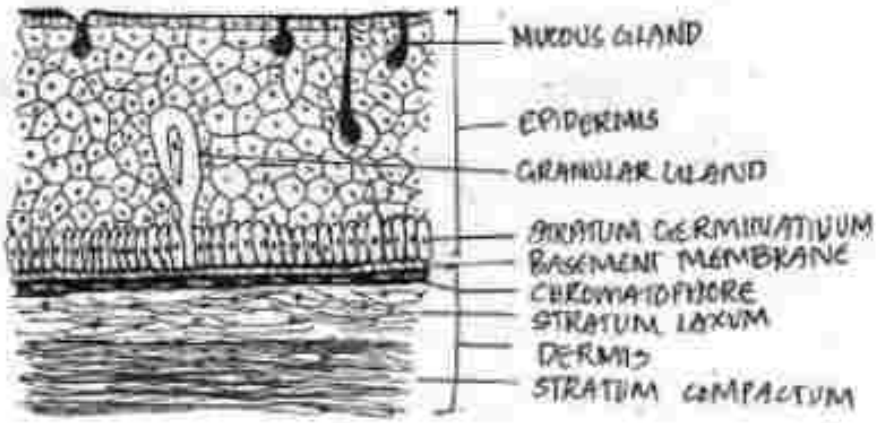
Body Wall in Mullet

The morphology of fish skin/integument is highly adapted to carry out its multiple functions
It consists of 2 layers and they differ in origin structure & function. • Epidermis ——→ Outer
• Dermis/corium ——→ Inner

Epidermis : • cellular structure, multilayered epithelium is derived from embryonic ectoderm.
• Comprises living, metabolically active cells.
• The multilayered condition is brought about by the active mitotic division of cells from
• Stratum germinativum.
• They contain multicellular & unicellular mucous producing cells.
• Epidermal scales are absent.

Dermis : • Dermis is fibrous structure with relatively few cells derived from embryonic mesenchyme of mesodermal origin.
• Lying under the epidermis, have connective tissue, blood vessels, nerves & sense organs
• They are richly vascular and provide nourishment to epidermis.
• Proteinaceous collagen fibres & mesenchymal cells represents connective tissue.

- Mesenchymal cells differentiate into bone forming cells which produces various dermal bones.
- Scales are dermal derivatives ie, they are derived from mesenchymal cells of dermis.
- Chromatophores are derived from neural crest cells and lie in outer part of dermis both above & below the scales. They gives skin colour of fishes.
- The colour producing pigments lie within chromatophores.



skin of fish without scale.

1. — EYE —

Eyes are the visual organs / photoreceptors lodged in the orbits of the skull

Each eye has a fluid filled and elliptical eye ball with out eye lids. They are guarded by transparent nictitating membrane

The eyeball is held in position and moved in different directions by six eye muscles namely recti muscles (4) and oblique muscles (2) and they are arranged in 2 sets.

The Recti muscle includes superior rectus, inferior rectus, anterior rectus and posterior rectus

The Oblique muscles include superior oblique and inferior oblique

Eye ball is innervated by the 2nd cranial nerve / Optic nerve

Eye ball is formed of three concentric layers,
- Outer cartilagenous layer, Sclerotic coat
- Middle vascular & pigmented Choroid coat
- Inner nervous layer, Retina

The exposed part of the sclerotic layer is modified into flat and transparent cornea and the same part of choroid layer forms a vertical curtain called Iris.

There is a large opening at the centre of Iris for the passage of light called Pupil. It is not adjustable ∴ its diameter remains unchanged.

There is a silvery layer formed of crystalline & plaques of guanine, located basally in between sclerotic and choroid layer, called Argenteum. It acts as light reflecting layer, enables fish to see underwater. Resembles tapetum lucidum of chondrichthyes.

Retina is formed of two types of cells, Rod cells for dim light vision and Cone cells for bright light and coloured vision.

There is an area with intense vision at the back of retina called area centralis

The point where optic nerve ~~pierces~~ joins the retina is Optic disc

This spot is devoid of rods and cones thus making it insensitive to light, called as blind spot

The lens is large and spherical and is placed little behind the cornea. It is held in position by dorsal and ventral suspensory ligaments

Lens divides the inner cavity of eyeball into two unequal chambers, Aqueous chamber, the outer one and is filled with aqueous humours and Vitreous chamber, the inner one, filled with vitreous humour.

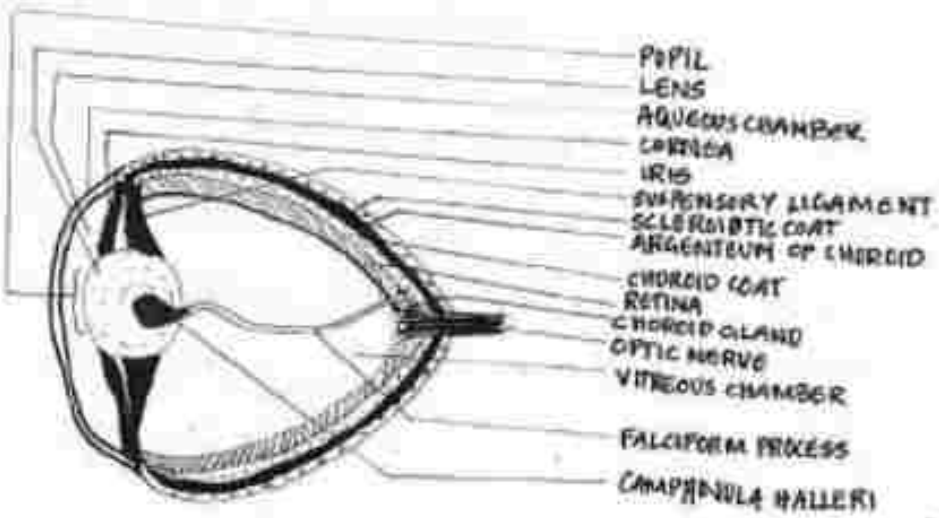
∵ the lense place closely behind the flat cornea, the area of aqueous chamber is very much reduced.

Around the point of entry of optic nerve into the choroid layer, there is a knot / mass of blood vessels, called retia mirabilia or choroid gland but it's not a true gland.

The strand of vascular tissue extending between the choroid layer and back of lense is the falciform procen, arises as the sickle shaped fold of the choroid.

Falciform procen reaches the lense and ends in a knob like muscular body called retractor lentis / campanulla Halleri.

The muscle fibres of retractor lentis and falciform procen are concerned with focusing the lens efor distant & near visions.



2 —Accomanodation in Mullet eyes——

Accomodation is the focusing of the lense in relation to the distance of the object so that an image is formed exactly on the retina.

Ciliary bodies are absent in mullets so. accommodation is not possible by altering the convexity/curvature of the lens.

Accommodation is brought about by the forward & backward movements of the lens. This is possible by a special apparatus which consists of the falciform process and retractor lentis.

The contraction of this apparatus pulls lens backwards towards retina for near vision. It's also believed to alter the thickness of lense.

3 — Stato-acoustic organs (Internal ear). —

The balancing and hearing organs of mullet include a pair of closed and fluid-filled ectodermal sacs called membranous labyrinths / internal ears (external and middle ears are absent).

They are enclosed within the auditory capsules of the skull.

The portion of the auditory capsule, that encloses the membranous labyrinth, is called bony labyrinth.

Membranous labyrinth has two parts, namely a central portion called otosaccus / vestibule and three semicircular canals.

Semicircular canals include anterior vertical, posterior vertical and middle horizontal canals, both ends of these canals open to vestibule and one end of each canal form an ampulla.

Vestibule has 2 parts Utriculus and a sacculus. They are joined together by a short utriculo-saccular duct.

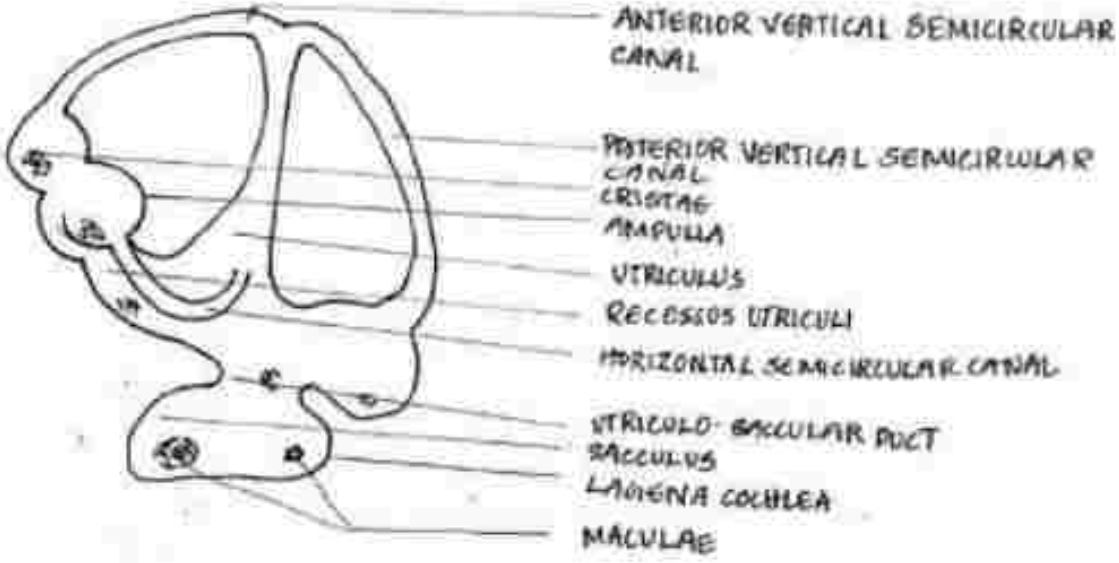
Utriculus has small outgrowth, called pars neglecta / recessus or utriculi anteriorly and Sacculus has rudimentary outgrowth called pars lagena / lagena cochlea posteriorly.

Pars lagena represents fore runner of the cochlea of higher vertebrate.

Utriculus, sacculus, lagena and ampullae bear patches of sensory hair cells. It's called maculae in utriculus, sacculus & lagena and in ampullae are called cristae.

The membranous labyrinth is filled with a fluid called endolymph and bony labyrinths filled with perilymph.

Otoliths are solid bodies seen in endolymph.



3 4. — URINO-GENITAL SYSTEM IN MULLET —

The urinary/excretory/renal system of mullet consists of a pair of opisthonephric kidneys lying between the vertebral column and gas bladder.

They fuse together posteriorly but free anteriorly.

Kidneys are compound tubular glands, formed of coiled renal tubules called uriniferous tubules/nephric tubules/nephrons

Each kidney has anterior non-renal part and posterior renal part, and hence the name opisthophros kidney.

Leading backward from each kidney is urinary duct.

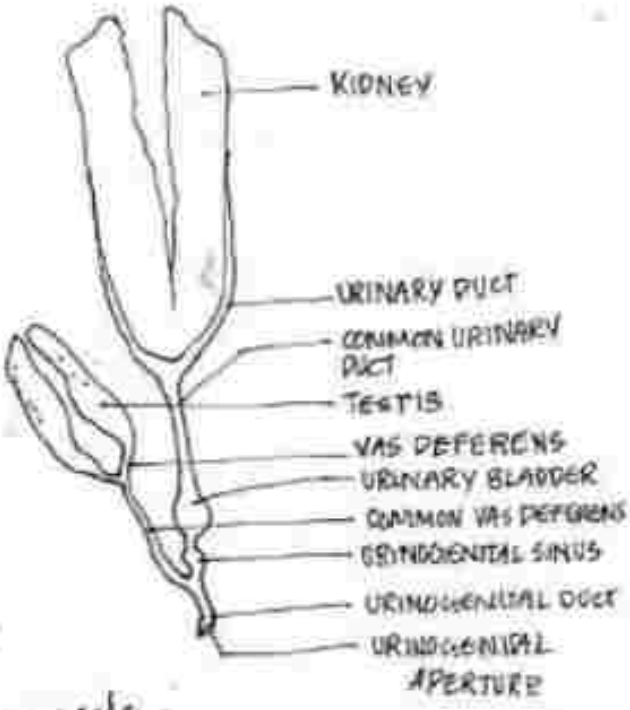
Right and left urinary ducts joint together terminally, forms a common urinary duct which expands to thin walled urinary bladder.

The urinary bladder is mesodermal in origin. This leads to the Urino-genital sinus which in turn opens out by

uro-genital opening behind anus.
* cloaca in absent in mullets.

— Male Genital Organs ——

* Consists of a pair of testes, each of them suspended from the body wall by a fold of peritoneum, called mesorchium.
* Leading from each testis are numerous minute sperm ductules, called vasa efferentia.
* Terminally, they all join to form a large sperm duct, called Vas deferens

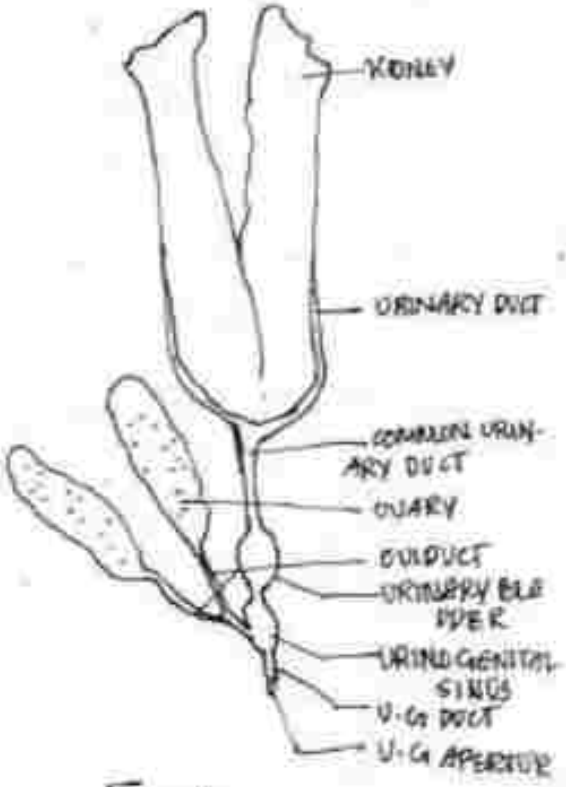


- male -

* The right and left vasa deferentia join together & form a common duct which opens to uro genital sinus.
Copulatory organs are absent in mullet.

— Female genital Organs ——

* Consists of a pair of compact, massive and saccular ovaries, which occupy posterior part of the body cavity.
* Each ovary is suspended from body wall by peritoneal fold called ~~mesoxelor~~ mesovarium.
* Leading from the ovary is an oviduct.
* The oviducts from each ovary join together terminally & form a short common oviduct which opens into uro genital sinus.



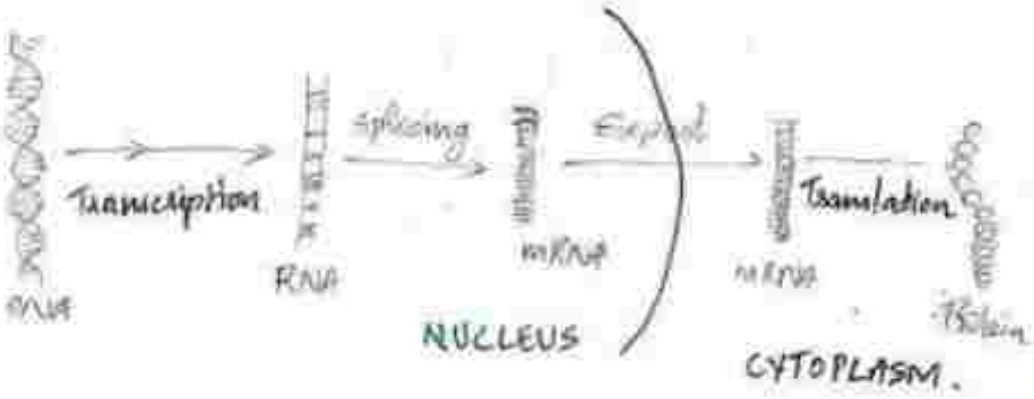
Female.

4/6/2021

GENE EXPRESSION

THE MOLECULAR PROCESS BY WHICH THE GENETIC INFO CONTAINED IN GENES IS CONVERTED INTO THE GENE PRODUCTS. POLYPEPTIDE CHAINS THAT DETERMINE THE METABOLIC & OTHER POTENTIALS OF THE CELLS & ORGANISMS

The process by which biological information in the genes is made available to the cell through the processes of transcription translation and protein synthesis.



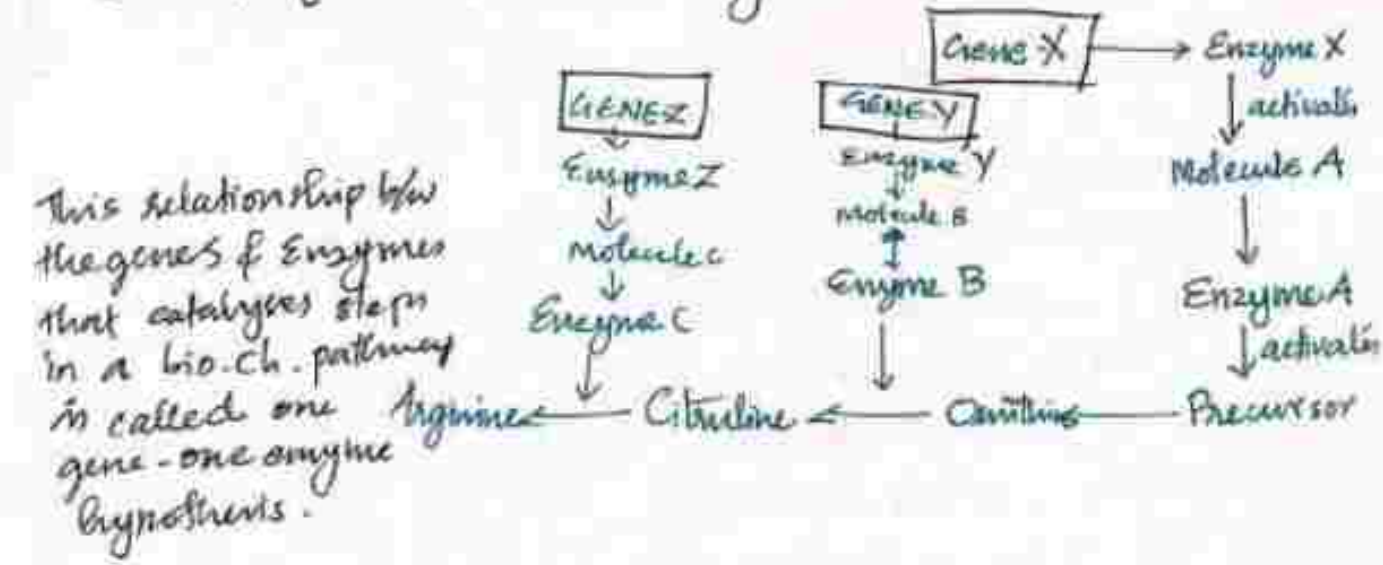
ONE GENE - ONE ENZYME HYPOTHESIS

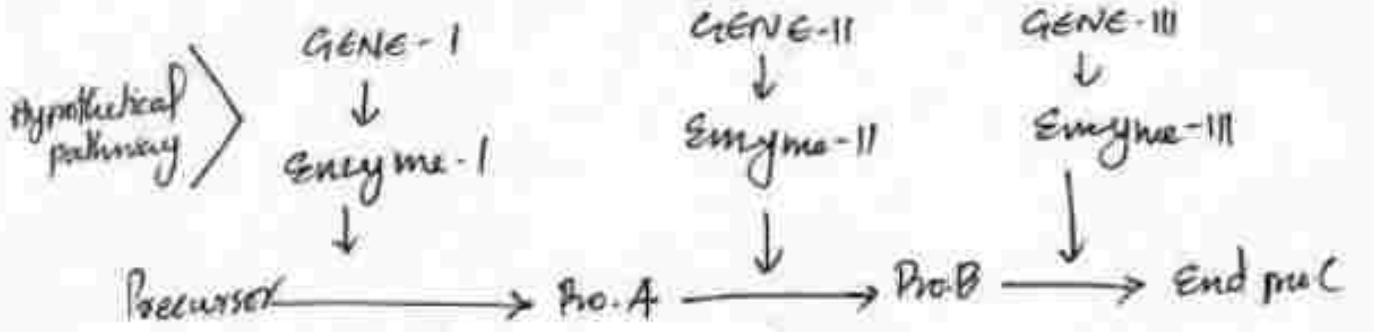
A. Garrod
info encoded wh DNA of chromosomes is responsible for the production of specific enzymes

→ later George Beadle and Edward Tatum conducted expts with bread mould Neurospora crassa and proved the relationship between genes & enzymes.

→ conducted experiments with nutritionally deficient strains of different culture media proved that each step in a bio-ch pathway is catalyzed by a particular enzyme which in turn specified by one specific enzyme.

one gene specifies a particular enzyme





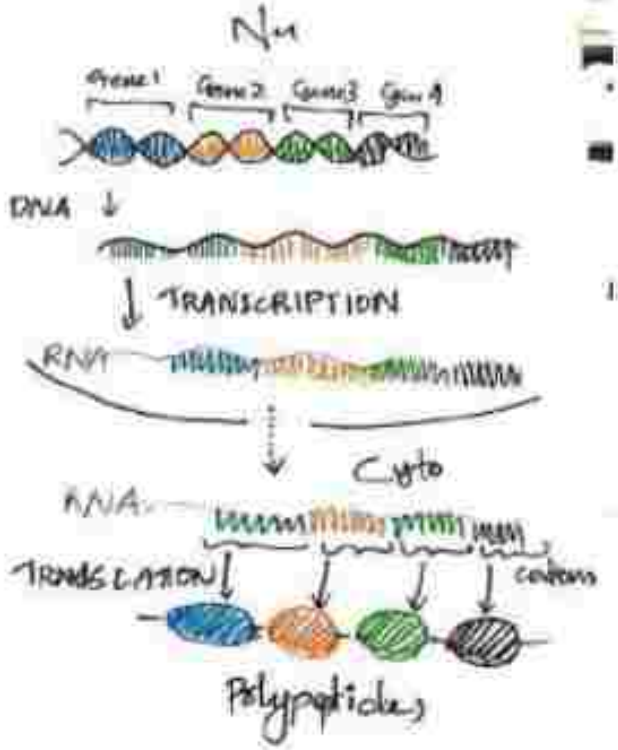
Since an enzyme is a polypeptide chain this hypothesis is know known as <u>one gene – one polypeptide hypothesis</u>

→ An Enzyme contains two or more polypeptide chains & each is coded by specific genes.

Eg: In E.coli, tryptophan synthetase is composed of 4 polypeptides — 2 α chains ← try A gene
→ 2 β chains ← try B gene.

Many enzymes contains multiple protein/polypeptide subunits & specific gene encodes info for the synthesis of only one type polypeptide ∴ 1G-1E Hy. Is known as 1G – 1 polyp Hy.

→ The info for the synthesis of a protein may be coded by several genes, and the no: of genes depends on the number of different polypeptides that forms the protein/enzyme.



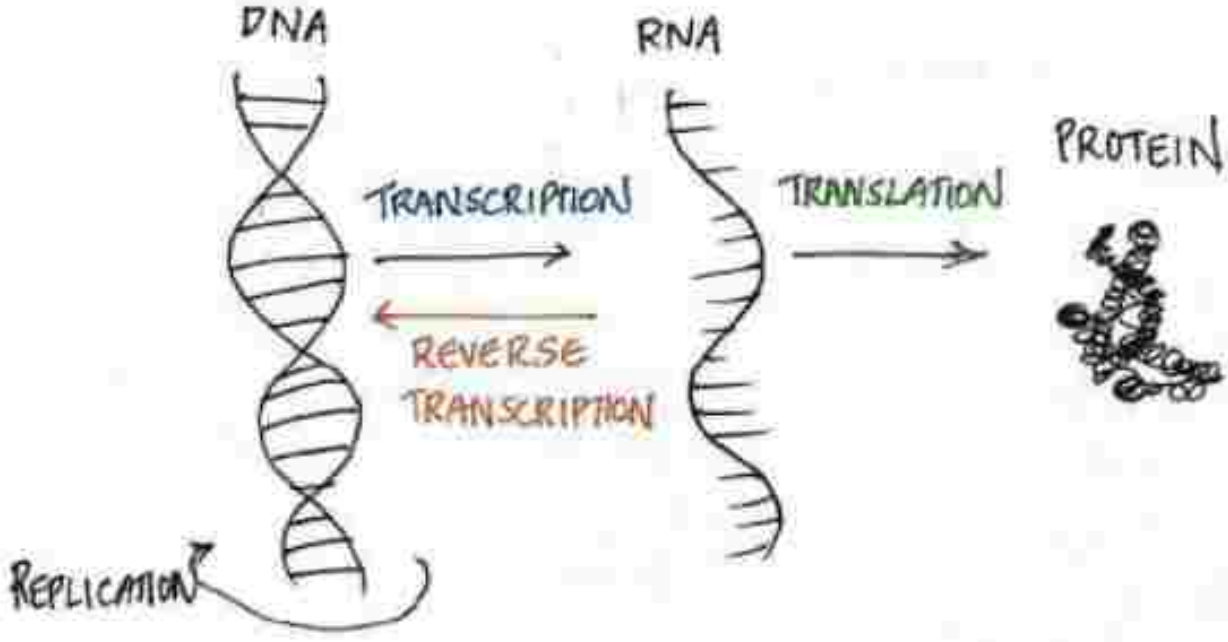
One gene - One polypeptide hypothesis

CENTRA DOGMA OF MOLECULAR BIOLOGY

⇒ DNA cannot produce protein directly bcz in Eukaryote, DNA is in chromosome which is inside the nucleus.

⇒ the protein syn. takes place in Riborsomes in Cytoplasm.

⇒ ∴ DNA needs an Intermediate molecule to transfer the info from nucleus to cytoplasm → RNA



* RNA is chemically very identical to DNA
  - Synthesised on a DNA template
  - RNA is complementary in base sequence to region of one strand of DNA double helix
* Cells which are actively engaged in protein synthesis are rich in RNA
* Autoradiographic studies using tritium labelled uridine (— precursor of RNA) revealed that RNA is first detected in nucleus & subsequently in cyto.

DNA Replication

DNA duplication in prokaryotes is completed in 3 major steps - Initiation, Elongation, Termination

- Primarily a cut is made on the intact chain strand one strand of DNA by endonuclease activity. This break is called nick. It would however quickly be repaired by DNA ligase (Polymerase I)
- Nicking results in the breakdown of H bonds & thereby the unwinding & separation of the complementary strands in the replicon.
  - Strand separation
  This is catalysed by enzyme DNA helicase with ATP utilized.
- DNA unwinding protein keeping away the exact rejoining, separation & shielding of the separated strand and prevent the re-winding to double helix
- The unwinding & rotation of the strands may produce heavy tension & strain on non-replicating parts. This is relieved by enzyme gyrase called DNA topoisomerase.
- The local separation of strands in a portion of DNA forms a bubble like structure - Replication Bubble. The junction between this bubble & the rest intact adj part is called Replication fork. This moves forward as strand separation continues.
- Soon after separation, each strand acts as a template / master copy & guides the synthesis of complementary companion strand. Initiation of this process requires the formation of RNA primer for the polymerisation of deoxyribonucleotides.
- This is because enzyme DNA polymerase III cannot synthesis initiate the synthesis of new polynucleotide chain. It can only elongate an existing one.
- ∴ DNA synthesis begins only after the incorporation of RNA primer which provides a free 3-OH for covalent bonding of 3' deoxy nucleotide.
- The synthesis of RNA primer 6-9 proteins form a complex - Primosome - This complex decides the initiation/promoter site where RNA primer is to be synthesized. The synthesis is initiated by the activity of enzyme RNA polymerase.
- Once RNA primer is formed synthesis of new DNA strand occurs by the addition of dNTP nucleotides on to the RNA primer. Here each template strand attracts a complementary deoxyribo nucleotide triphosphate and binds with H bonds.
- The successive nucleotides thus aligned to the template strand are soon polymerised one by one from the initial end through ester bonding mediated by DNA polymerase III.
- Shortly after, the RNA primer will be hydrolysed and removed from the forming site by the RNA ase activity by DNA polymerase I. The resulting gap is soon filled by DNA nucleotides. These are polymerised by DNA polymerase I itself & not by DNA polymerase III
- The short DNA fragment thus formed is Ligated to the previous one by the enzyme DNA ligase.
- Thus a complementary companion strand is synthesised on each template strand. Once required length of daughter strand is attained, replication stops. This is mediated by the enzyme telomerase.
- DNA polymerase III can polymerise the nucleotides only in 5'→3' direction. So polymerisation occurs forward on one strand and backward on other strand template strand. As we see the 2 strands are antiparallel and with opposite polarity
- Elongation of 5'→3' strand is continuous & formed proceeds continues nonstop from single RNA primer alone as synthesis of 3'→5' strand is discontinuous and backward process from several RNA primers one after the other. In this case several incomplete polynucleotide fragments are formed. They are called OKAZAKI FRAGMENTS. They are then joined through phosphodiester bonds by DNA ligase.
- Continuously synthesised 5'→3' strand is called Leading strand & discontinuously synthesised 3'→5' strand is called Lagging strand.

1. uncontrolled multiplication due to defective cell cycle regulation.
2. Absence of Anchorage dependence: normal cells show anchorage dependence i.e. they die when kept in suspension in a medium. But Cancer cells show anchorage independence i.e. they proliferate even in suspension

3. Reduced cellular adhesion and loss of Contact Inhibition: Normal cells are surface are sticky and adhesive mainly due to the presence of fibronectin. This results in the tight adhesion of neighbouring cells i.e. cellular adhesion. The adj. cell membranes are held together by Cell Adhesion Molecules (CAMs). The cellular adhesion inhibits the uncontrolled multiplication of cells & results their movement. This is called contact inhibition.
In Cancer cells there is extreme reduction/total absence of fibronectin and CAMs ∴ cellular adhesion is considerably reduced and contact inhibition is almost completely lost. So the cells can multiply independent of each other & move away from each other.

4. Metastasis invasiveness and destructive growth: Due to their reduced cellular adhesion the cancer cells easily detach from their neighbouring cells and migrate to far away organs & invade and destroy distant tissues and multiply there.
- METASTASIS / DISSEMINATION.

5. Loss of cell recognition and tissue specificity: Normal cells have the capacity of cell recognition and thereby tissue specificity
But Cancer cells have no power of cell recognition ∴ are not tissue specific in their attachment - so attach to any tissue.

6. Biochemical & Physiological Despecialization: Cancer cells have a tendency for biochemical and physiological despecialization, which is attained by the loss of marker enzymes which have crucial roles in functioning of normal cells.

7. Inability to respond to stimuli: Tumor cells often fail to respond properly to those stimuli, which in normal cells would evoke metabolic responses to maintain homeostasis.

8. Weakened or disrupted physiological symptoms (feedback mechanisms): In cancer cells the internal feedback mechanisms for biosynthetic process are weakened or totally disrupted. Their enzymatic reactions are not self regulated.

9. **Metabolic Imbalance**: The metabolic imbalance is brought about by the prevalence of catabolism over anabolism in the case of CBD. and Reverse conclation in the metabolism of nucleic acid, putamines and polyamines. This metabolic imbalance aids the neoplastic cells some selective advantage for rapid growth.

10. **Ability to produce embryonic type of proteins**: Several cancer cells possess this ability and this might be the reason for their undifferentiated, immature and embryonic form.

11. **High adaptation to unfavourable condition**: This gives them high ability to interact with vitally important metabolites, growth factor & some ions in small concentrations.

12. **Cataplasia / Defective differentiation**: Cataplasia is state of morphological biochemical, physiological defective differentiation of cells and tissue. A typical feature of Malignant tumor. Cancer cells are poorly/variably differentiated where undifferentiated ~~cancer cells are called~~ condition is called Anaplasia and partially differentiated condition is called dysplasia. It results from gradual weakening/disappearance of tissue specific features.

13. **Potential Immortality and resistance against Apoptosis**: Normal cells ~~have~~ survive upto a limited number of division as they have Hayflick limit where they gradually undergo senescence and apoptosis.
But cancer cells go on dividing infinitely surpassing their Hayflick limit as if they are potentially immortal and ~~be~~ with resistance against apoptosis. This is due to very high concentration of telomerase in them, which mediates the encoiling of the telomeres of chromosomes. They prevent them from ageing.

14. **Chromosomal incompetency of Genetic instability**: Chromosomes in cancer cells undergo Qualitative and Quantitative structural changes i.e, rearrangement of chromosome segments and addition/loss of chromosome material respectively.

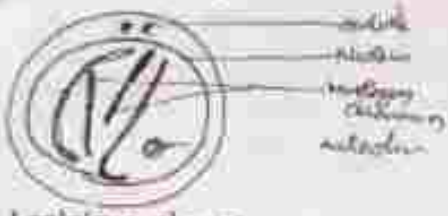
15. **Inactive Golgi bodies and disorganised cytoskeleton**: GB are numerous but inactive and functionless in CC. Cytoskeleton in CC is highly disorganised, disintegrated depolymerized.

16. **Enhanced Glycolysis & high Sugar utilization**: Considering the slow rate of aerobic resp^n in cancer cell despite their high energy requirement for rapid growth & x^n, the anaerobic resp^n i.e glycolysis. Activate Ef factors Blocked → Reduced aminoacid → Increased uptake of sugar & its utilisation for G4 x^n → glycolysis to meet the energy

17. **Increased Production of Proteolytic Enzymes**: Increased production of Pengsin activates the inactive serum protein Plasminogen forming active Plasmin which in turn activates some collagenase enzymes of surrounding benign cells.

18. **Increased net charge on PM**: Due to alteration in the distribution of ions on 2 sides of membrane

Prophase-I



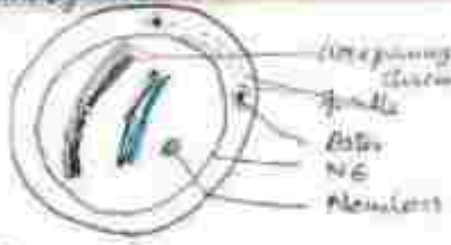
Leptotene stage

- onset of meiotic cycle
- discernible filaments indicate beginning of elongation of chromosomes to form beaded like chromosome
- Later they undergo condensation and condensation & become short and thick
- In adjacent cells simultaneously centrioles move to opposite pole and mitotic type spindle appears
- Leptotene chromosomes are typically 'U'
- There is a distinct non-chromatic area called nucleolus consisting of bundles of fine fibrils surrounded by chromatin
- In Gymnosperms these nucleoli disappear and chromosomes become monocentric



Pachytene stage

- Longest in MCq, begins with complete synapsis
- The synaptonemal complex continue to hold together the bivalents and exists as bivalents, dark-staining thin coiling filaments
- 2 genetically important molecule exist like that in Pachytene stage
  - Crossing over
  - Recombination
- There involve exchange & interchange of genetic material the homologous chromatids
- one chromatid of each homologue overlaps / cross over a genetically identical chromatid of the other homologue at one or more points. These crossing of non-sister chromatids
- At these sites of the exchange of a fragment, cut & made on the non-sister chromatids. The broken segments are mutually exchanged by these. Each exchange segment from with corresponding portion of non-sister chromatid with help of enzyme



Zygotene stage

- Starts by close pairing of homologous chromosomes - Synapsis
- Terminalization and nuclear spindle is laid down
- The chromosome pairs are generally called bivalents or tetrads in the sense that each pair has 2 chromosomes / 4 chromatids. The paired condition is till diplotene stage.
- The members of the pair are called homologues. Maternal in origin are maternal and paternal.
- 3 types of synapsis Terminal, Paternal & Random passing.
- The two homologues are completely together throughout their length by complex material Synaptonemal complex. This provides structural framework (E)
(E) is modified type of enzyme combining complex

- Diplotene stage is where the paired homologous chromosomes separate partially from each other due to repulsive force developed by them.
- Chromosomes of synaptonemal complex
- Chromosomes exhibit frequent chiasmata formation
Simultaneously chromatids of each homologous also segregate from another synaptonemal complex. The chromatids of each bivalent synchronously & depict Lamp Shape.
- Towards the end, nucleoplasm disappears & spindle appears. Uneven, patchy organization of parts of each bivalent metabolized
- Eventually - nucleoplasmic molecules enter cytoplasm & nucleus



Diakinesis

- Prolongation of prophase-I
- characterized by maximum condensation & shortening of chromosomes
- At late Dia the chromosomes will become identical & nucleus is not seen before.
- Now chromatin thickly move to the tip of chromatids - terminalization of chiasmata
- Its committed all bivalents are compacted and lying beneath chromosomes.
- Towards the end the nuclear membrane disintegrates. Now bivalents chromosomes get ready for spindle attachment

Metaphase-I



- Chiasmata migrates towards the equatorial plane - spindle fibres and centromeres attached with spindle. The centromeres moving towards the poles. Now chromosomes are arranged in metaphase plate



Diplotene stage

Zygotene stage (Contd.)

- The whole process makes homologous mutual exchange of segments between of chromosomes organized & called crossing over. It brings about new combinations of maternal & paternal genes in the chromosomes & makes the genetic constitution of the individual different from parents.
- Here only 2 of the 4 chromatids of the bivalent are involved.
- The products consequent recombinants consists of 2 non-sister / non-crossover parental chromatids pairs with 2 genes combinations and 2 mutant or hybrid chromatids with different gene combinations

Anaphase-I

- Chromosomes start moving towards the poles. Centromeres lead the chromosomes & arms trail behind.
- Each chromosome has 2 chromatids joined at centromere
- Each chromosome has 2 chromatids joined at centromere
- Each chromosome has 2 chromatids joined at centromere

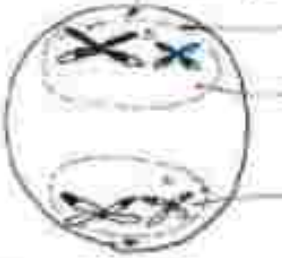
Anaphase I



very much ~ to Mitosis 2 major diff.
4 stages: Prophase I, Metaphase I, Anaphase I, Telophase I

- Tells 1 chromosome of homologous pair
- Once spindle fibres attached, separation of their homologous chromosomes leading to random segregation of maternal and paternal chromosomes
- By the end of Anaphase I, each pole of the parent cell will contain a haploid number of double stranded chromosomes

Telophase I



- Each chromosome consists of 2 identical sister chromatids
- Each chromosome is a diploid number of double stranded chromosomes

Prophase II



- Very brief stage as marked by the appearance of mitotic spindle apparatus
- Formed nuclear envelope would disintegrate subsequently
- Does not depend on # of crossing over at T-1

Metaphase II



- Chromosomes undergo movement to centre of the cell - metaphase plate/equatorial plate
- Attach to spindle fibres at kinetochore/centromere
- In metaphase oocyte, meiosis gets suspended @ this stage
- It is resumed only & completed only after activation by fertilization

Anaphase II



- Centromeres of each chromosome separated from each other & the sister chromatids segregate from each other & migrate to opposite poles by spindle action.
- Each pole receives haploid set of single stranded chromosomes

Telophase II



Last stage of meiosis
Nuclear membrane around haploid set of chromosomes & nucleolus appear inside it.

Both cleavages undergo disappearance of spindle fibres

Spindle apparatus disappears & cytokinesis takes place

Each cell has 2 chromosomes

The end of meiosis is marked by formation of four haploid daughter cells from a parent cell

The daughter cells may not be genetically identical to each other and identical to parent cell. Since they have acquired new genetic combination through recombination.

Telophase I

- The chromosomes either slightly uncoil & partially present to form interphase condition / pass directly to 2nd meiotic division
- Usually no nucleolus is formed during T-1
- Cytokinesis may/may not occur
- Thus the number of DNA in the cells at the end of telophase I is half the number of DNA in the original mother cell

— INTERKINESIS —

- This is very much similar/interphase condition
- If DNA replication is done partially
- If centriole duplication is done partially
- Centriole pairs are seen
- Chromosomes do not undergo duplication
- Sister chromatids are no longer identical
- The 2 daughter cells & 2 sister chromatids sometimes represent the IV phase

Glycogenolysis : Catabolic process which denotes the degradation of stored glycogen.

Site: liver and skeletal muscles in vertebrates.
It's accomplished by two principal processes — Phosphorolysis & Hydrolysis.

Phosphorolysis —

→ The step-by-step breakdown of branched glycogen molecule into glucose-1-phosphate units.

→ With the help of Inorganic phosphate (Pi) and enzymes: Glycogen phosphorylase, debranching enzyme and glucan transferase.

- Glycogen undergoes phosphorolytic cleavage from the non-reducing end, the α(1-4) glycosidic bonds b/w adjacent glycosyl residues are broken down with the enzyme Glycogen phosphorylase as catalyst.
- Thus separated glucose units get phosphorylated with Pi simultaneously through an ester bond. This form Glucose-1-Phosphate.
- Glycogen phosphorylase cannot complete the breaking down process on its own.
- Phosphorylase cannot attack the branching points with α(1-6) glycosidic bonds. So it continues its action till branching point. This leaves out glycogen molecule with short branches, called limit dextrin.
- Then debranching enzyme/ α-(1-6)glucosidase comes into action on limit dextrin, break down the α(1-6) glycosidic bonds. Thus branches are separated.
- This separated segments are transferred to one end of the molecule forming an unbranched linear chain, with the help of enzyme glucan transferase.
- Phosphorylase takes over its action on this linear chain, and form glucose-1-phosphate molecules.
- Glucose-1-phosphate is isomerised by enzyme Phosphoglucomutase to Glucose-6-phosphate
- The fate of glucose-6-phosphate depends on the tissue.

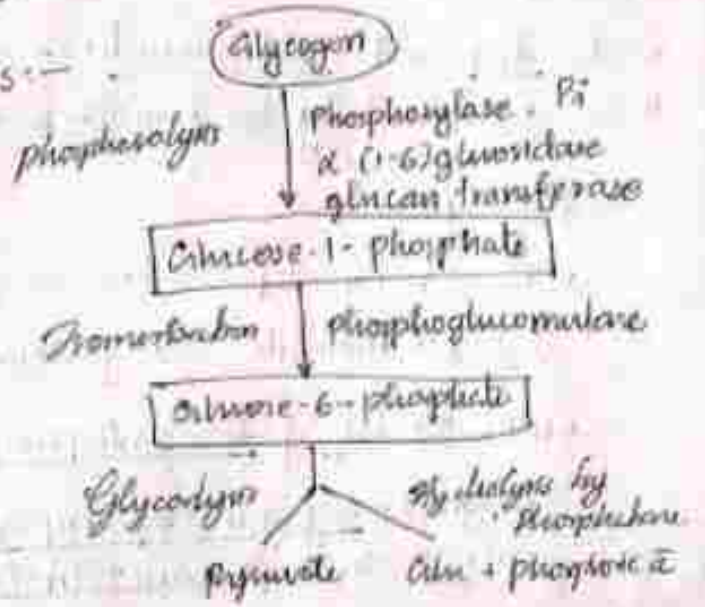
Hydrolysis

- Hydrolysis of glycogen is also known as Amylolysis
- involves the degradation of glycogen and to glucose molecules, which may get phosphorylated even & metabolised in the glycolytic pathway.
- Follows 2 pathways :- alpha amylolysis & gamma amylolysis

- Alpha amylolysis
  - catalysed by enzyme alpha amylase
  - α-amylase splits glycogen to oligosaccharides
  - these are then broken down into glucose units by glucosidases

- Gamma amylolysis
  - catalysed by enzyme gamma amylase
  - γ-amylase splits glycogen terminally giving a glucose residue and γ-dextrin
  - this process on repetition leads in complete breakdown of glycogen to free glucose units with the help of glucosidases to sever the glycosidic bonds.

Glycogenolysis



Hydrolysis :-

→ α-Amylolysis :-

$$\text{Glycogen} \xrightarrow[H_2O]{\alpha\text{-amylase}} \text{Oligosaccharides} \xrightarrow[H_2O]{\text{glucosidase}} \text{Glucose}$$

→ γ-Amylolysis :-

$$\text{Glycogen} \xrightarrow[H_2O]{\gamma\text{-amylase}} \gamma\text{-dextrin} + \text{Glucose}$$

$$\gamma\text{-dextrin} \xrightarrow[H_2O]{\gamma\text{-amylase}} \text{Glucose units}$$

Glycogenesis : Synthesis of glycogen which taken place in liver and skeletal muscles.

- The starting point of this process is glucose-6-phosphate, which can be derived from glucose-molecules with hexokinase as catalyst. (hexokinase-I & hexokinase II in muscles and glucokinase in liver)

D-Glucose + ATP $\xrightarrow{\text{hexokinase}}$ D-glucose-6-phosphate + ADP

- In an initiation step, glucose-6-phosphate is converted into glucose-1-phosphate by the catalysation of phosphoglucomutase.

glucose-6-phosphate $\xrightarrow{\text{phosphoglucomutase}}$ Glucose-1-phosphate

- Glucose-1-Phosphate is converted to UDPglucose, a nucleotide combined glucose molecule. Here 1 molecule of UTP and enzyme UDP-glucose pyrophosphorylase is involved. This conversion is considered as a trapping mechanism
- This releases ~~2 phosphates~~ one molecule as a pyrophosphate (PPi). This pyrophosphate is cleaved [illegible]

Glucose-1-phosphate + UTP $\xrightarrow{\text{UDP-glucose Pyrophosphorylase}}$ UDP-g

PPi + H_2O $\xrightarrow{\text{Pyrophosphatase}}$ 2Pi + Energy

---

Glucose-1-phosphate + UTP + H_2O ⟶ UDP-gluco + Energy

- The UDPG can be easily converted into UDP glucose.
- These cleaved glucose units are joined by α-(1- sidic linkage to the non reducing end of glycogen molecule, thus forming a glycogen chain, catalysed by Glyco synthase.
- The glycogen synthase can only catalys reaction which results in α(1-4) of 1st carbon of existing glucose and 4th carbon of coming glucose mol
- Then Amylo-(1-4) to (1-6) transglu

Now formation of chain is catalyzed by glycogen synthase.

Glycogen synthase cannot initiate the chain. It requires a primer. This can be formed via two pathways:

glycogen Primer pathway

→ New glycogen particles begin with autocatalytic formation of glycosidic bond b/w the glucose of UDPG & tyrosine residue on the protein glycogenin. This results in the formation of Primer, on which glucose residues are attached by the glycogen synthase.

Dichol phosphate pathway

→ for the formation of proteoglycans.

⇒ Dichol phosphate is a lipid molecule, movable through membranes.

⇒ glucose residues combines with dichol phosphate. This sometime attaches to the protein molecule, simultaneously cleaves Dichole phosphate. Leaving free protein and glycogen to the rest, forming proteoglycan.

Glycolysis

- Also known as EMP pathway, can be observed in most microorganisms and all higher animals for the degradation of glucose. The term glycolysis suggests the dissolution of sugar.
- Glycolytic pathway is seen to be degenerative or catabolic, as it starts with a single molecule of 6-Carbon glucose and ends with the production of 2 molecules of 3-carbon pyruvic acid. Energy is liberated in the form of ATP.
- The series of chemical conversion requires different enzymes for its completion. These chemical steps are differentiated into preparatory phase and pay off phase.

Step-1 : Phosphorylation of Glucose by ATP

- Phosphorylation of glucose to form glucose-6-phosphate with the ~~utilized~~ utilization of ATP
- The reaction is catalyzed by enzyme hexokinase
- This is irreversible process, it is called first priming rxn.

Glucose + ATP $\xrightarrow{\text{hexokinase}}$ glucose-6-phosphate + ADP + H^+

Step-2 : Conversion of glucose-6-phosphate to fructose-6-phosphate

- Glucose-6-phosphate is iso-merized to fructose-6-phosphate ie, an aldose to a ketose respectively by the action of enzyme Phosphohexo isomerase.

Glucose-6-phosphate $\xrightleftharpoons{\text{Phosphohexo isomerase}}$ fructose-6-phosphate

unstable

Step-3 : Phosphorylation of Fructose-6-phosphate to Fructose-1,6-bisphosphate

- Phosphorylation of fructose-6-phosphate to fructose-1,6-bisphosphate utilizing ATP, catalysed by the enzyme Phosphofructokinase-1 (PFK-1)
- This is an irreversible pre reaction and is the second priming reaction.
- This step is considered as the first committed step in the pathway. Fructose-1,6-bisphosphate entering to the next step of glycolytic pathway is certain. where as glucose-6-phosphate & fructose-6-Phosphate have other possible fates,

Fructose-6-phosphate + ATP $\xrightarrow{\text{Phosphofructokinase-1}}$ Fructose-1,6-bisphosphate + ADP + H^+

Step-4 : Cleavage of Fructose-1,6-bisphosphate to two triose phosphates.

- Fructose-1,6-bisphosphate undergoes aldol condensation to form to two different triose phosphate, glyceraldehyde-3-phosphate, an aldose and dihydroxy acetone phosphate, a ketose.
- This reversible step is catalyzed by the enzyme fructose-1,6-bisphosphate aldolase or simply aldolase.

Fructose-1,6-bisphosphate $\rightleftharpoons$ (Aldolase) Glyceraldehyde-3-phosphate + Dihydroxy acetone phosphate.

Step - 5 : Interconversion of triose phosphates

- Only glyceraldehyde 3-phosphate can be utilized and degraded in the further following steps in glycolysis.
- The other triose phosphate Dihydroxy acetone phosphate is subjected to rapid and reversible conversion to glyceraldehyde 3-phosphate, by the catalysation of enzyme triose phosphate isomerase
- This rxn marks the end of Preparatory phase of glycolysis.

Dihydroxy acetone phosphate $\xrightleftharpoons{\text{Triose phosphate isomerase}}$ Glyceraldehyde-3-phosphate

Step - 6 : Oxidative phosphorylation of Glyceraldehyde-3-phosphate to 1,3-Bisphosphoglycerate.

- It is the first step of pay off phase.
- Glyceraldehyde-3-phosphate undergoes oxidative phosphorylation and form 1,3-Bisphosphoglycerate
- This energy conservation reaction is catalysed by the enzyme glyceraldehyde-3-phosphate dehydrogenase, in the presence of NAD^+ and orthophosphate.
- This reaction results in the production of ATP

Glyceraldehyde-3-phosphate + NAD^+ + H_3PO_4 $\xrightleftharpoons[\text{dehydrogenase}]{\text{Glyceraldehyde-3-phosphate}}$ 1,3-Bisphospho-glycerate + NADH + H^+

Step - 7 : Phosphoryl transfer from 1,3-Bisphosphoglycerate to ADP

- Dephosphorylation occurs to 1,3 BPGA by the transfer of high energy phosphoryl gp from its carboxyl gp to ADP ; resulting in the formation of ATP. This rxn is also known as substrate level phosphorylation
- Reaction is catalysed by enzyme Phosphoglycerate kinase.

- So 1,3-Bisphosphoglycerate is converted to 3-Phospho glycerate, since there are 2 kinase phosphate included in the rxn, ∴ 2 molecules of ATP is produced.

1,3-Bisphosphoglycerate + ADP ——Phosphoglycerate kinase——> 3PGA + ATP

Step-8: Conversion of 3-Phosphoglycerate to 2-phosphoglycerate

- Reversible phosphoryl shift occurs between C_3 & C_2 of 3PGA, which catalyzed by the enzyme Phosphoglycero mutase.
- Thus 3-PGA transform to 2-phospho glycerate. and presence of Mg^{2+} is essential for this rxn.

3PGA ⇌ (Phosphoglycerate mutase) 2-phosphoglycerate

Step-9: Dehydration of 2-PGA to Phospho enol pyruvate.

- Reversible removal of a water molecule from 2-PGA gave phospho enol pyruvate, by the catalyzation of enzyme at once enolase.

2PGA ⇌ (Enolase, $-H_2O$) Phospho enol pyruvate

Step-10: Transfer of Phosphoryl gp. from Phosphoenol pyruvate to ADP to form pyruvate.

- The high energy PEP is utilized to phosphorylate ADP to form ATP and pyruvate. The rxn is catalyzed by Pyruvate kinase.

Phosphoenol pyruvate + ADP + H^+ —(Pyruvate kinase)→ Pyruvate + ATP

Glucose
↓ Hexokinase ← ATP
Glucose-6-phosphate
⇓ Phosphohexo isomerase
Fructose-6-phosphate
↓ Phospho fructo kinase-1 ← ATP
Fructose-1,6-Bisphosphate
⇓ Aldolase
Dihydroxy acetone phosphate ⇌ Glyceraldehyde-3-phosphate
(Triose phosphate isomerase.)
Glyceraldehyde-3-phosphate dehydrogenase
⇓ + Pi + NAD^+ → $NADH + H^+ \times 2$
2 × 1,3-Bisphosphoglycerate
⇓ Phosphoglycerate kinase + ADP → ATP × 2
2 × 3-Phosphoglycerate
⇓ Phosphoglycerate mutase
2 × 2-phosphoglycerate
⇓ Enolase → H_2O
2 × phosphoenol pyruvate
⇓ Pyruvate kinase + ADP → ATP × 2
2 × Pyruvic acid.

2. Metabolic fate of Pyruvic acid:

Pyruvate has different fates under different conditions.

→ Conversion of Pyruvate to ethanol:

- In yeast, Protists, some plants & in some invertebrates, Pyruvate is anaerobically converted into ethanol & CO_2. This is called alcoholic fermentation.

→ Conversion of Pyruvate to lactic acid (aka - cori cycle)

- In lactic ā bacteria, submerged plants, vigorously contracting muscles, the pyruvic acid will not be oxidized efficiently due to the lack of Oxygen.
- So the pyruvate is reduced to lactic ā with the help of enzyme lactic acid dehydrogenase, this process is called lactic ā fermentation.

→ Oxidative decarboxylation of pyruvate to Acetyl CoA.

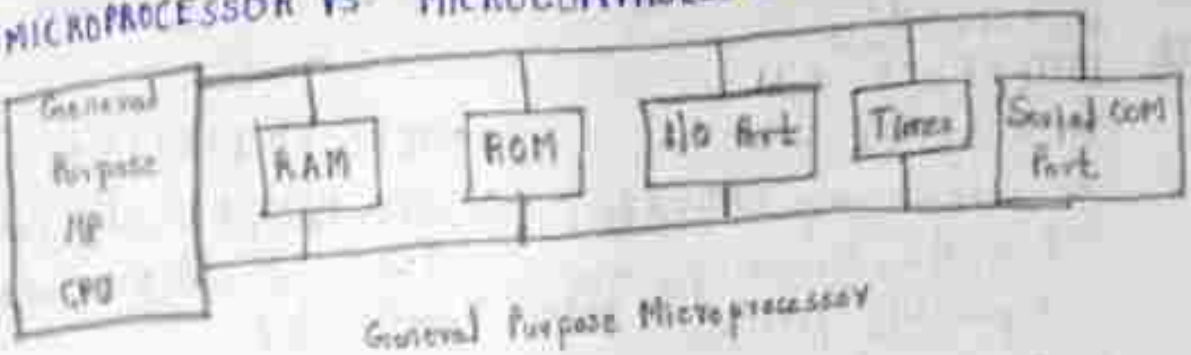
- In plants and animals tissue, under aerobic condition, pyruvate undergoes oxidative decarboxylation and combines with Co-enzyme A forming acetyl CoA.
- This conversion of CoA to acetyl CoA is very important, and is called "link reaction" as it links glycolysis with Krebs cycle.

Department of Physics

- Mohammed Mazidi

MODULE "AVR MICROCONTROLLER & MICROPROCESS EMBEDDED SYSTEM"

MICROPROCESSOR VS. MICROCONTROLLER



General Purpose Microprocessor



Microcontroller

A general purpose MP such as Intel 8085 contains no RAM, no ROM and no I/O ports on the chip itself. A microcontroller has a CPU(MP) in addition to a fixed amt of RAM, RAM, I/O ports and a timer all on a single chip.

MICROCONTROLLERS FOR EMBEDDED SYSTEM

An embedded system is controlled by it's own internal MP or microcontroller. Typically in embedded system, microcontro Her's ROM ... is burned with purpose of specific fn needed for the system. A printer is an eg. of embedded system.

WHAT IS A MP?

A MP is the controlling unit of a microcomputer wrapped inside a small chip. It performs Arithmetic and Logical operations and communicates with other devices connected with it. It is a single IC in which several fns. are combined.

MICROCONTROLLER

It is a chip optimised to control electronic devices. It contains memory, processor and programmable I/O ports. It is stored in a single IC

which is dedicated to perform a particular task and execute one specific application. It is specially designed circuit for embedded application and widely used in automatically controlled electronic device.

N.B. → DIFFERENCE B/W

MICROPROCESSOR	MICROCONTROLLER
(a) Contains only CPU: RAM, ROM, I/O, timers, etc. are separately provided.	(a) CPU, RAM, ROM, I/O ports, timers are all provided on a single chip.
(b) Designer decides on the amt. of ROM, RAM and I/O Ports.	(b) Fix amt of on chip ROM, RAM and I/O ports.
(c) Doesn't support bit addressability.	(c) Supports bit addressability.
(d) Better for multi tasking.	(d) Weak for multi tasking.
(e) General Purpose	(e) Special Purpose
(f) Architecture: Von nomann.	(f) Architecture: Harvard.
(g) High speed and cost.	(g) Low speed and cost.
(h) MP based system requires more hardware to be interfaced.	(h) Requires less hardware to be interfaced.
(i) 8085, 8086, core 2 duo, core i7	(i) Eg: AVR, 8051

are examples of intel processor.

→ CRITERIA FOR CHOOSING A MICROCONTROLLER

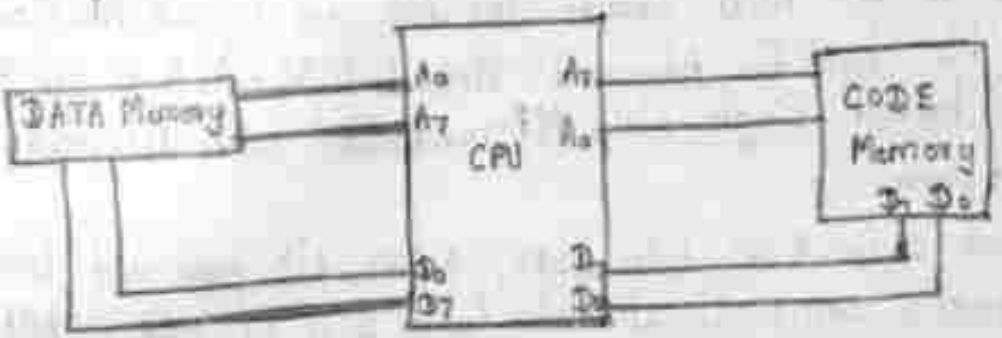
1. It must meet the task at hand efficiently and cost effectively. Other considerations in this category are: Speed, packaging, power consumption, on chip RAM and ROM, no. of I/O pins and timers on chip, ease of upgradation to
2. Higher performance or lower power consumption versions cost per unit.

2. How easy it is to develop products around it.
Availability of assembler, debugger, compiler, technical support, 3rd party vendor support.
3. Microcontroller should be available in needed quantities both now and in future.

→ HARVARD & VON NEUMANN(PRINCETON) ARCHITECTURES



Von Neumann (Princeton) Architecture



Harvard Architecture

→ FEATURES OF REDUCED INSTRUCTION SET COMPUTER(RISC) ARCHITECTURE

1. RISC processors have fixed instruction size.
AVR uses mostly 2 byte instructions as opposed to CISC in 8051 which uses 1, 2, 3 byte instructions.
2. It provides large no. of registers.
i.e; RISC processors provide 32 registers. So no need to use Stack for storing data.
3. It has limited no. of instructions compared to CISC (Complex).
4. 1 clock cycle instruction execution i.e; 95% of instructions are executed with 1 clock cycle.
5. It uses separate address and data buses for accessing Code and data memory.

6. Microcodes are used in CISC to implement more instructions. So it employs 60-80% of transistors in many CISC processors. RISC instructions are implemented using hardware method which takes no more than 10% of transistors.

7. RISC uses load/store architecture i.e; RISC cannot perform operation directly with memory and register. It first brings both operands into register and then perform the operation.

→ INTRODUCTION TO AVR FAMILY

AVR is developed by Atmel Corporation. Basic architecture of AVR was developed by 2 students Alf-Egil Bogen and Vegard Wollan. AVR stands for Alf and Vegard RISCer. It might stand for Advanced Virtual RISC. AVR is an 8-bit RISC based single chip MCU controller with Harvard Architecture.

It has code ROM, data ROM, RAM, I/O pins and timers. It supports some serial interfaces such as USB, USART, etc.

→ AVR FAMILY CLASSIFICATION

AVR can be classified into 4 groups.

1. Tiny AVR (ATtinyXXXX)

Some of it's characteristics are program memory 1-8 kbyte, limited instruction set, 8-28 pins.

Eg: ATtiny13

2. Mega AVR (ATmega XXXX)

These are powerful microcontrollers with more than 120 instructions and lot of different peripheral capabilities. Some of it's characteristics are program memory, 4-64 kbytes, extended instruction set, 28-100 pins.

Eg: ATmega 32

3. Special Purpose AVR

ICs of this group have special capabilities used for designing special apps. Some of it's special characteristics are USB controller, LCD controller, etc.

Eg: AT90USB1287

4. Classic AVR (AT90SXXXX)

This is the original AVR chip which has been replaced by new AVR chips.

Eg: AT90S2313

Angle modulation { freq modulation (freq of carrier signal is varied with information signal)
phase modulation

Phase modulation

The phase of carrier wave changes accordance with amplitude modulating signal.

Rate of variation a signal frequency

Phase (small bandwidth) ; frequency (large bandwidth)

Transmission speed will be high in phase modulation as BW small.

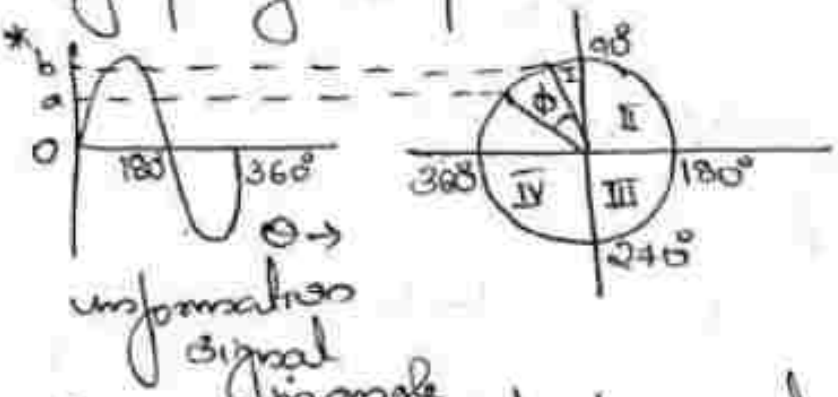
Advantages

→ Phase modulation and demodulation is easier compared freq. modulation.

→ Phase modulators are used

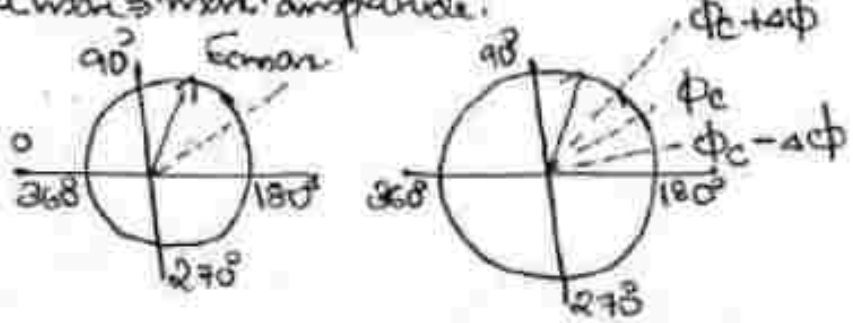
Disadvantages

→ frequency multipliers are used as it depends on freq.



is angle change btw starting and ending point of a wavefor is known as phase modulation ; ϕ_c ⇒ carrier modulation ; we get upper and lower band.

Ecmax ⇒ max. amplitude.



Unmodulated wave, $e(t) = E_{cmax} \cos(\omega_c t + \phi_c)$

In phase modulation, phase of carrier wave changes with information signal; $\phi_c \propto e_m(t)$

$\phi_c = K e_m(t)$ $K \Rightarrow$ phase deviation/loss

Instantaneous exp. of phase; $\phi_i(t) = \phi_c + K e_m(t)$

After modulation, $e(t) = E_{cmax} \cos(\omega_c t + K e_m t)$

$\because [e_m(t) = E_{mmax} \sin(\omega_m t)]$

$\therefore e(t) = E_{cmax} \cos[\omega_c t + K E_{mmax} \sin\omega_m t]$

$e(t) = E_{cmax} \cos[\omega_c t + \Delta\phi \sin\omega_m t]$

Equivalent b/w phase and frequency modulation;

The angular component of phase modulation is $\theta(t)$; which includes angular change;

$\theta(t) = \omega_c t + K e_m(t)$

Instantaneous value of ang. comp. $\omega_i(t) = 2\pi f_i(t)$

$f_i(t) = \frac{1}{2\pi}\omega_i(t) = \frac{1}{2\pi}\frac{d}{dt}(\theta_i(t))$

phase modulation $= \frac{1}{2\pi}\frac{d}{dt}[\omega_c t + K e_m(t)]$

$= \frac{1}{2\pi}\omega_c + \frac{1}{2\pi} K \frac{d e_m(t)}{dt}$ $\quad \frac{\omega_c}{2\pi} = f_c$

$$\left[\begin{array}{l} f_i(t)|_{PM} = f_c + \frac{k}{2\pi}\frac{d[e_m(t)]}{dt} \\ F_i(t)|_{FM} = f_c + K e_m(t) \end{array}\right]$$

Comparing these eqns we get, phase modulation is used to produce freq. modulation.

$e_m(t) = E_{mmax} \sin 2\pi f_m t$

$\frac{d e_m(t)}{dt} = E_{mmax} \cos 2\pi f_m t \cdot 2\pi f_m$

$\therefore F_i(t)|_{FM} = f_c + \frac{K E_{mmax} \cos 2\pi f_m t \cdot 2\pi f_m}{2\pi}$

$= f_c + K_{fm} E_{mm} \cos 2\pi f_m t$

$= f_c + \Delta\phi_{fm} \cos 2\pi f_m t$

$f_i(t)|_{PM} = f_c + \Delta f_{equivalent} \cos 2\pi f_m t$

Angle modulation Circuit Techniques

① FM generation — direct method (Varactor diode method) (indirect) [PM + IM]

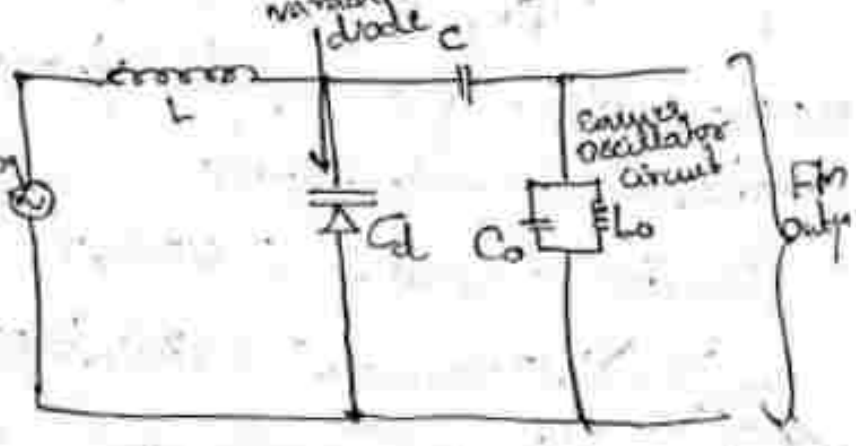
- Direct method (parameter variation method); modulating signal directly modulates with carrier.
- Carrier signal is generated with help of oscillator circuit.
- Oscillator circuit uses parallel ~~circuit~~ tuned L-C circuit
- An oscillator circuit whose freq is controlled by a modulating voltage is known as voltage controlled oscillator (VCO)
- Freq of VCO is varied according to modulating signal just by putting a shunt voltage variable capacitor with tuned circuit.
- Voltage variable capacitor is known as varactor or varicap
- Freq of oscillation of carrier generation is given by,

$$\omega_c = \frac{1}{\sqrt{LC}}$$

- Inductance L will also be varied according with modulating signal.

FM circuit using such inductor is called saturable reactor modulator

- Varactor diode is a semiconductor diode whose jn capacitance changes with dc bias voltage.



• Diode is connected in shunted with tuned circuit of carrier oscillator.
• V_0 is the polarising voltage to maintain a reverse bias across varactor diode.
• Voltage supplied across varactor diode varies in proportion with modulating voltage.
• Thus will vary with its capacitance of varactor diode.
• varactor diode is used with oscillator circuit, as voltage in varactor diode changes and also make changes in oscillator circuit hence produce carrier signal.

+ve cycle, voltage ↑ → capacitance ↑ → freq ↑ ∩∩∩

-ve cycle, voltage ↓ → capacitance ↓ → freq ↓ ∪∪∪

Cd voltage → I/P voltage + information signal voltage

$V_D = V_0 + x(t)$; tot instantaneous volt.

Capacitance, $C_d = \frac{K}{\sqrt{V_D}} = K(V_D)^{-1/2}$

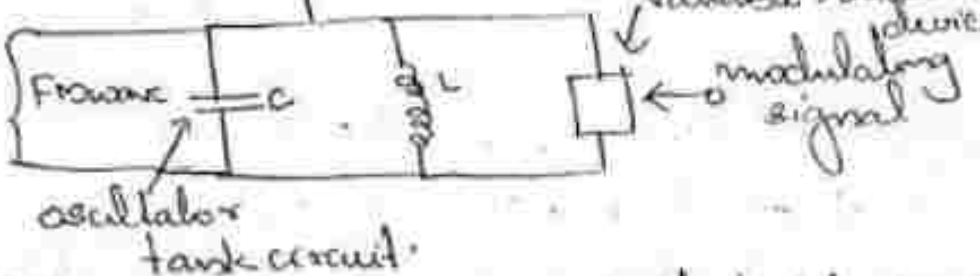
freq. $\omega_c = \frac{1}{\sqrt{LC}}$ total capacitance, $C = C_0 + C_d$

inst. freq, $\omega_i = \frac{1}{\sqrt{L_0(C_0 + C_d)}} = \frac{1}{\sqrt{L_0(C_0 + KV_d^{-1/2})}}$

Reactance Modulator

• In direct FM generation, the instantaneous freq. of carrier is changed directly in prop. with message signal.
• A reactance modulator changes the freq. of tank circuit of oscillator by changing reactance.
• A 2 or three terminal device is placed across tuned circuit

• Reactance of device is varied prop. to modulating signal voltage
• It will vary the freq of osillator produce FM
• Devices used are FET, transistor or varactor diode.



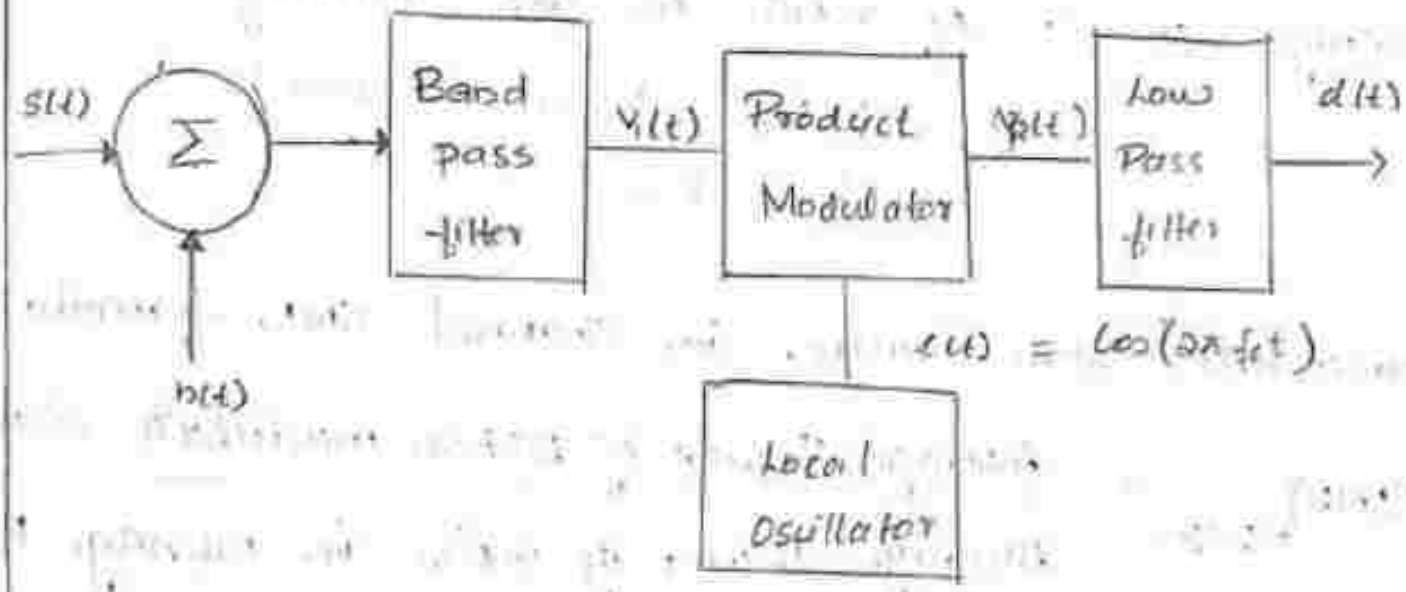
• freq. of osillator is changed by changing the reactive component involved in tuned circuit.
• If L or C of a tuned circuit of an osillator is changed in accordance with amplitude of modulating signal then FM can be obtained across tuned circuit.

Limitations of Direct method of FM Generation

• It is very difficult to get High Order stability in carrier freq. It is because in this method the basic oscillator is not a stable oscillator, as it is controlled by modulating signal.
• Due to non linearity of the varactor diode, FM signal is distorted, varactor diode produces freq variations are produced because of harmonics of the modulating or baseband signal.

SNR Calculation in DSBSC System

Consider the following receiver DSBSC system to analyse noise



- In DSBSC we have a full carrier with two side bands.
- The figure merit for conventional AM signal is less than one.
- For calculation of SNR we consider demodulator
- For DSBSC system, in the demodulator we have a product modulator and Band pass low pass filter
- the

We know that DSBSC modulate wave is

$$s(t) = A_c m(t) \cos(2\pi f_c t)$$

= product of message and Carrier

Average power of DSBSC modulated wave is

$$\frac{E_{max}^2}{2R} = P_s = \left(\frac{A_c m(t)}{\sqrt{2}}\right)^2 = \frac{A_c^2 P}{2}$$ → power of message signal

Average power of noise in the message B.W is

$$P_{nc} = WN_0$$ — Noise Component

↳ B.W

Substitute these values in channel SNR formula

$$(SNR)_{c,DSBSC} = \frac{\text{Average Power of DSBSC modulate wave}}{\text{Average Power of noise in message B.W}}$$

$$= \frac{A_c^2 P}{2WN_0}$$

Assume the band pass noise is mixed with DSBSC modulated wave in the channel as shown in figure. This combination is applied as one of the input to the product modulator. Hence the i/p of product modulator is

$$V_1(t) = s(t) + n(t)$$

$$V_1(t) = A_c m(t) \cos(2\pi f_c t) + \left[n_1(t)\cos(2\pi f_c t) - n_2(t)\sin(2\pi f_c t)\right]$$

↳ Inphase component ↳ Component

$$V_1(t) = A_c m(t) \cos(2\pi f_c t) + \left[n_1(t) \cos(2\pi f_c t) - n_Q(t) \sin 2\pi f_c t\right]$$

$$= \left[A_c m(t) + n_1(t)\right] \cos(2\pi f_c t) - n_Q(t) \sin(2\pi f_c t)$$

Local oscillator generates the Carrier Signal

$c(t) = \cos(2\pi f_c t)$. This Signal is applied as another input to the product modulator. ∴ the product modulator produces an o/p, which is the product of $V_1(t)$ and $c(t)$

$$V_2(t) = V_1(t)\, c(t)$$

Substitute $V_1(t)$ & $c(t)$ values in the above equation

$$V_2(t) = \left\{\left[A_c m(t) + n_1(t)\right] \cos(2\pi f_c t) - n_Q(t) \sin(2\pi f_c t)\right\} \cos(2\pi f_c t)$$

$$= \left[A_c m(t) + n_1(t)\right] \cos^2(2\pi f_c t) - n_Q(t) \sin(2\pi f_c t) \cos(2\pi f_c t)$$

$$= \left[A_c m(t) + n_1(t)\right] \left(\frac{1 + \cos(4\pi f_c t)}{2}\right) - n_Q(t) \frac{\sin(4\pi f_c t)}{2}$$

When the above Signal is applied as an i/p to low pass filter, we get o/p of low pass filter

When the Signal pass through LPF the high frequency components ie $\cos(4\pi f_c t)$ and $\sin(4\pi f_c t)$ components

will be removed then we get only low frequency component that is $A_c m(t) + n_1(t)$

$$d(t) = \frac{A_c m(t) + n_1(t)}{2}$$

In $d(t)$ we have message and noise component. To calculate SNR of receiver.

Singal component : $\frac{A_c m(t)}{2}$

noise component : $\frac{n_1(t)}{4}$

Average power of demodulated signal is

$$P_{sc} = \left(\frac{A_c m(t)}{2\sqrt{2}}\right)^2 = \frac{A_c^2 P}{8}$$

Average power of noise at the o/p is

$$P_n = \frac{W N_0}{4}$$

Substitute these value in output SNR formula

$$(SNR)_{0,DSBSC} = \left(\frac{A_c^2 P}{8}\right) / \frac{W N_0}{4}$$

$$= \frac{A_c^2 P}{2 W N_0}$$

Substitute the value in figure of merit of DSBSC receiver formula

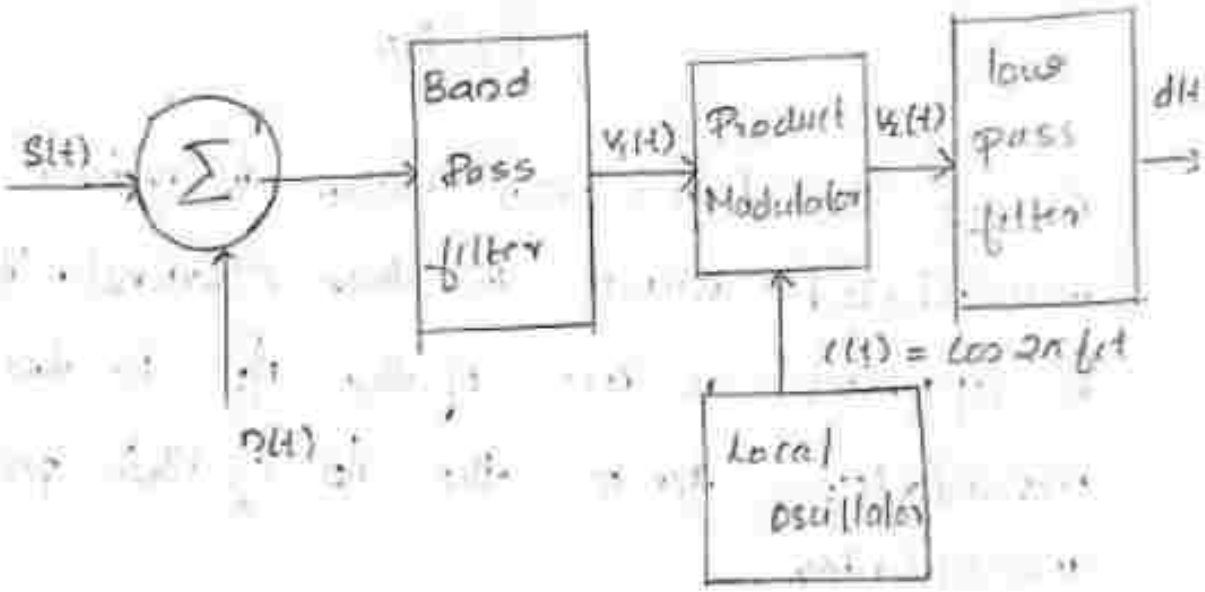
$$F = \frac{(SNR)_o}{(SNR)_i}$$

$$= \frac{A_c^2 P}{2WN_o} \Big/ \frac{A_i^2 P}{2WN_o}$$

$$\boxed{F = 1}$$

∴ figure of merit of DBBSC receiver is 1

SNR CALCULATION IN SSBSC SYSTEM



here only one side band ie only upper side or lower side band.

The SSBSC modulated wave having lower sideband is $S(t) = \frac{A_m A_c}{2} \cos\left[2\pi (f_c - f_m) t\right]$

Average Power of SSBSC modulated wave is

$$P_s = \left(\frac{A_m A_c}{2\sqrt{2}}\right)^2 = \frac{A_m^2 A_c^2}{8} \quad \because P_{RMS} = \frac{V}{R}$$

Average Power of noise in the noise in the message band width is

$$P_{nc} = WN_0$$

Substitute the values in channel SNR formula

$$(SNR)_{c,BSBC} = \frac{\text{Average Power of SSBSC modulated wave}}{\text{Average Power of noise message B.W}}$$

$$= \frac{A_m^2 A_c^2}{8WN_0}$$

Assume the band pass noise is mixed with SSBSC modulated wave in the channel. This combination is applied as one of the i/p to the product modulator. Hence, the i/p of this product modulator

$$V_i(t) = s(t) + n(t)$$

$$V_i(t) = \frac{A_m A_c}{2}\left[\cos 2\pi(f_c - f_m)t\right] + n_I(t)\cos(2\pi f_c t) - n_Q(t)\sin\sin(2\pi f_c t)$$

The local oscillator generates the carrier signal $c(t) = \cos(2\pi f_c t)$. The signal is applied as another i/p to the product modulator. ∴ product modulator produces an o/p which is product

of $V_1(t)$ and $c(t)$

$$V_2(t) = V_1(t)\, c(t)$$

Substitute $V_1(t)$ and $c(t)$ values in the above equation.

$$V_2 = \left[\frac{A_m A_c}{2}\cos(2\pi(f_c - f_m)t) + n_I(t)\cdot\cos(2\pi f_c t) - n_Q(t)\sin(2\pi f_c t)\right]\cos(2\pi f_c t)$$

$$= \frac{A_m A_c}{2}\cos\left[2\pi(f_c - f_m)t\right]\cos(2\pi f_c t) + n_I(t)\cos^2(2\pi f_c t) + n_Q\sin(2\pi f_c t)\cos(2\pi f_c t)$$

$$= \frac{A_m A_c}{2}\cos\left[2\pi(f_c - f_m)t\right]\cos(2\pi f_c t) + n_I(t)\left[\frac{1+\cos^2(4\pi f_c t)}{2}\right] - n_Q(t)\,\frac{\sin(4\pi f_c t)}{2}$$

$$d(t) = \frac{A_m A_c}{2}\cos(2\pi f_c t) + \frac{n_I(t)}{2}$$

Average power of demodulated signal is

$$P'_{as} = \left(\frac{A_m A_c}{4\sqrt{2}}\right)^2 = \frac{A_m^2 A_c^2}{32}$$

Average power of noise at the output is

$$P = \frac{WN_0}{4}$$

$$(SNR)_{o,SSBSC} = \frac{\text{Average Power of demodulated Signal}}{\text{Average Power of noise at o/p}}$$

$$= \left(\frac{A_m^2 A_c^2}{32}\right) \Big/ \frac{WN_0}{4} = A$$

$$= \frac{A_m^2 \cdot A_c^2}{8WN_0}$$

Figure of merit

$$F = \frac{(SNR)_{o,SSBSC}}{(SNR)_{i,SSBSC}}$$

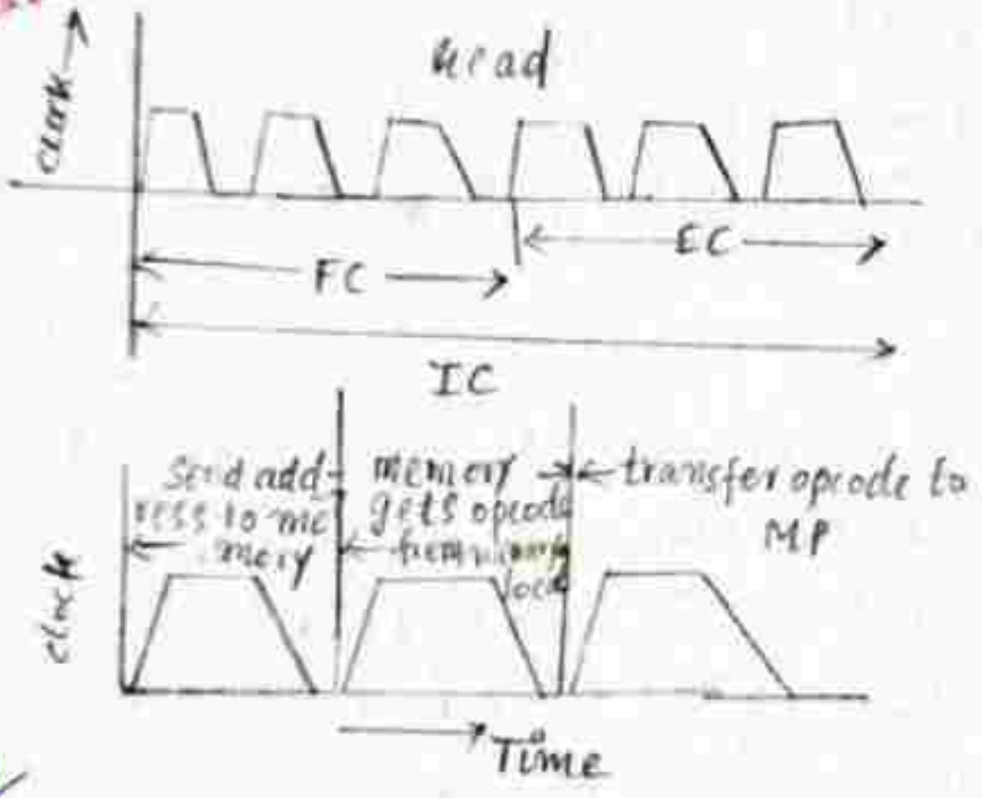
$$= \frac{A_m^2 A_c^2}{8WN_0} \Big/ \frac{A_m^2 A_c^2}{8WN_0}$$

$$= 1$$

∴ the figure of merit of SSBSC receiver is 1

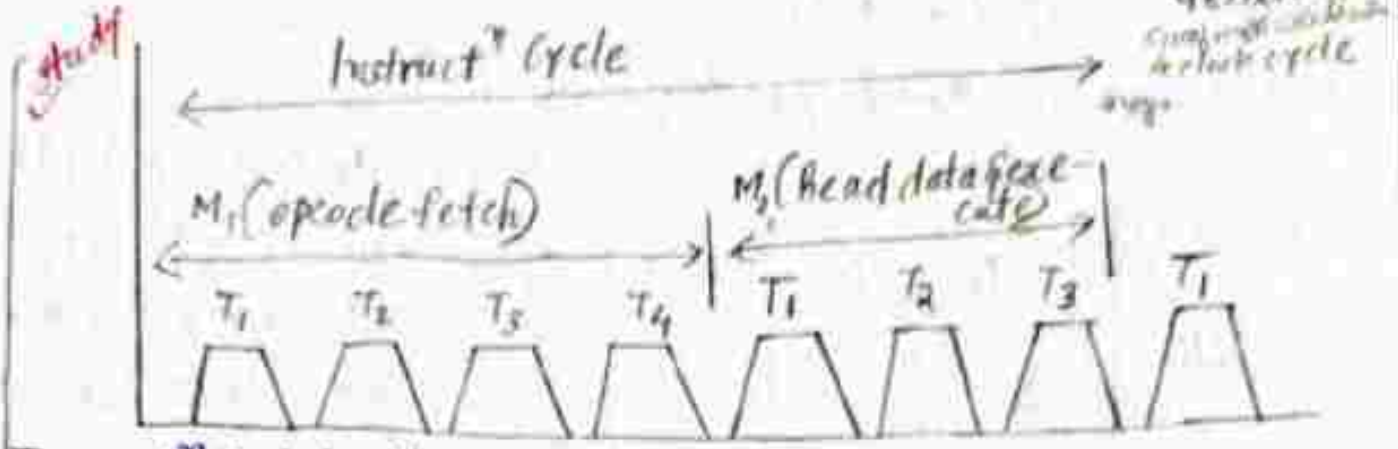
Single to Noise Ratio : It is the ratio of the Signal Power to noise power. The higher value of SNR the greater will be the quality of the receiver output.

purpose register execut" is immediately performed. Time taken in executing the execut" is one clock cycle. If an instruct" contains data or operand address which are still in memory CPU has to perform some READ operat" to get the desired data. After receiving the data it perform execut". A READ cycle is similar to FETCH cycle. In some instruct" WRITE operat" is performed. In WRITE cycle data send from CPU is to memory or o/p device.



MACHINE CYCLE & STATE

The necessary steps carried out to perform the operat" of accessing either memory or i/o device, constitute a machine cycle. In other words necessary steps carried out to perform a fetch, a read or a write operat" constitute a machine cycle. In machine cycle, basic operat"s are opcode fetch, memory read, memory write, I/O read & I/O write. One subdivis" of an operat" performed in one clock cycle is called T-state. So one clock cycle of system clock is called a state.



Instruct" & data flow

In the beginning of fetch cycle, content of pcgm counter is transferred to a special register known as Memory address register or simply address register. The content of " " is transferred through to memory through address bus. By sending certain ctrl signals MP indicates that it wants to read the content of memory. The decoded circuit of memory is activated & memory sense opcode to MP through databus.

Opcode 1st comes in memory data register or simply data register. Opcode is then placed in instru" register instru" is decoded by Inst" decoder & it is executed. Finally the content of pcgm is implemented.

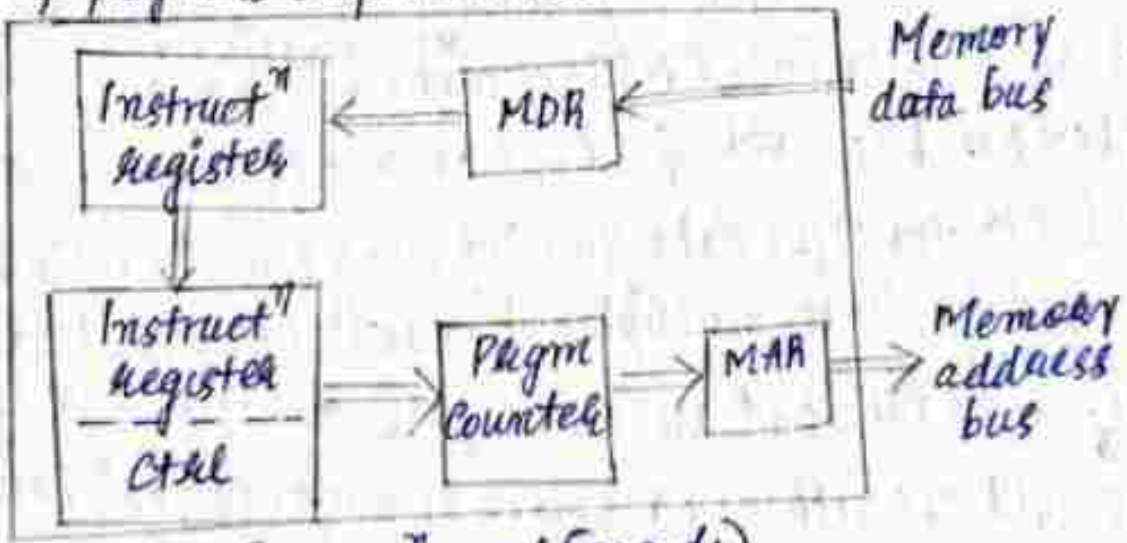


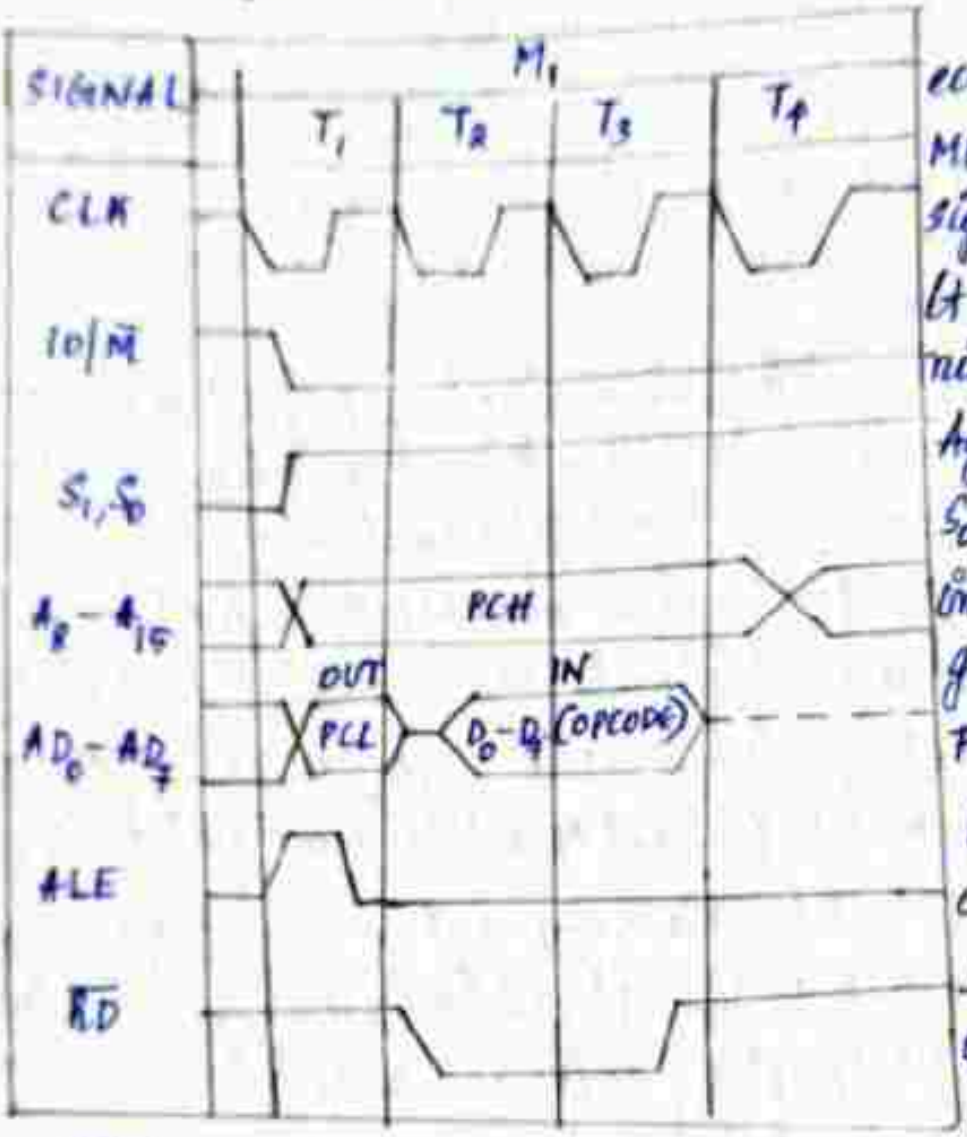
Fig → Flow of instruct" word (opcode)

TIMING DIAGRAM

Necessary steps which are carried out in a machine cycle can be represented graphically. Such a graphical representat" is

called Timing diagram.

Timing diagram for opcode fetch cycle



T_1, T_2, T_3, T_4 are consecutive 4 clock cycles. MP issues a low IO/M signal to indicate that it wants to communicate with memory. Again MP send high S_0 & S_1 signals to indicate that it is going to perform FETCH operation. During the 1st clock cycle T_1, MP send out address of memory location where opcode is available. 16 bit memory address is send through address bus and IO/data bus. 8 MSBs of memory address are send over address bus & 8 LSBs over AD bus. Since AD bus is needed to transfer data during subsequent clock cycles, it is used in time multiplexed mode. It carries data during T_2 & T_3. So, the MP send an ALE signal to latch 8 LSBs of memory address either in memory or an external latch. So that complete 16 bit memory address is available in subsequent clock cycles.

During T_2, AD bus becomes ready to carry data. In T_2, MP

makes $\overline{RD}$ low. Memory gets opcode from specified memory location & place it on the data bus. During T_3, opcode is placed in instⁿ register. Fetch cycle is completed by T_3. Opcode is decoded in T_4.

Sem - IV

Electrodynamics II

Dynamics

Faraday's Law

Dates

$\nabla \times \vec{E} = 0$ (Coulomb)

$\nabla \times \vec{B} = \mu_0 \vec{J}$ (Ampere's law)

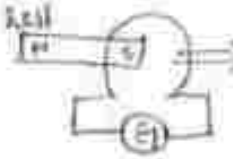
$\nabla \cdot \vec{E} = \rho/\varepsilon_0$ (Gauss law or Coulomb's law)

$\nabla \cdot \vec{B} = 0$ (No magnetic monopole)

Experiment 1

pull a loop of wire to right through a magnetic field.

→ A current observed in the loop.



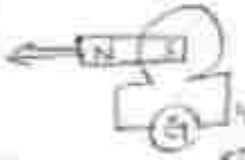
$\vec{v}$ (loop is pulled)

Magnetic force (Lorentz force)

$\vec{F}_m = q(\vec{v} \times \vec{B})$

Experiment 2

Move the magnet to left holding loop still, with same speed.



→ Same current is observed in the loop.

Electric force

" Change in magnetic field (coulomb's law) induced an electric field."

Experiment 3

Both loop and magnet are at rest. Now change the strengths of field using electromagnet.

→ Current flows in the loop.



From this 3 experiments Faraday concluded Varying current that: "whenever there is a change in magnetic flux associated with a closed circuit or loop an EMF is always induced."

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Reasons (Explanation)

Exp-1

Coil moves ∴ magnetic force acting on moving charge constitutes the current. $F_m = q(\vec{v} \times \vec{B})$

Exp-2

Charges are stationary, ∴ will not experience magnetic force. An electric field required to exert a force on a charge at rest. "A change in magnetic field induces an electric field." → Faraday's law.

This induced electric field is responsible for current in experiment 2 and 3.

Faraday's law (first write the following for a Question)

"A change in magnetic field induces an electric field."

Induced emf = $\mathcal{E} = \oint \vec{E} \, d\vec{l}$

[definition of emf : work done by electric field, $\vec{E}$ to move unit +ve charge over a closed path]

Faraday experimentally found that,

$$\boxed{\mathcal{E} = -\frac{d\Phi}{dt}}$$

Φ - magnetic flux.

Where, magnetic flux, $\Phi = \int \vec{B} \, d\vec{a}$

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$$\oint \vec{E} \cdot d\vec{l} = -\frac{d\Phi}{dt}$$

$$= -\frac{d}{dt}\int_S \vec{B} \cdot d\vec{a}$$

→ both are w.r.t different variables hence $\frac{\partial}{\partial t}$ & $\int_S$ are interchangable

$$\boxed{\oint \vec{E} \cdot d\vec{l} = -\int_S \frac{\partial \vec{B}}{\partial t} \cdot d\vec{a}}$$

↳ Integral form of Faraday's law.

Using Stoke's Theorem on L.H.S,

$$\int_S (\nabla \times \vec{E}) d\vec{a} = -\int_S \frac{\partial \vec{B}}{\partial t} \cdot d\vec{a}$$

$$\int_S \left[(\nabla \times \vec{E}) + \left(\frac{\partial \vec{B}}{\partial t}\right)\right] \cdot d\vec{a} = 0$$

$$\boxed{\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}}$$ → differential form of Faraday's law

Curl of Electric field

Not diverging

There are two types of electric fields :-

1. Those Attributed directly to electric charges:

$$\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$$

2. Those associated with change in $\vec{B}$ (induced Electric field).

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

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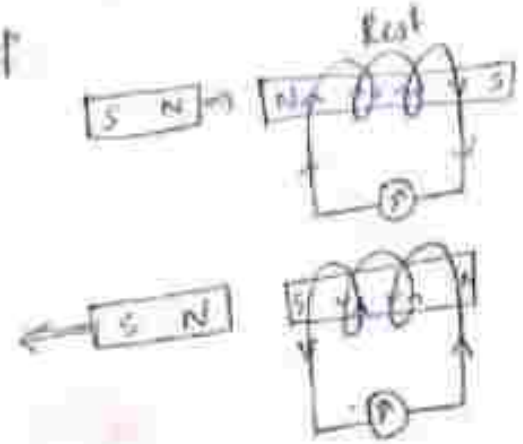
Direction of induced emf

Lenz's law :- "Nature abors change in flux."

The direction of induced emf in such as to oppose the cause that producing it

N → S

Exp



Electrodynamics before Maxwell

(1) $\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$ (Gauss's law)

(2) $\nabla \cdot \vec{B} = 0$ (No magnetic monopoles)

(3) $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ (Faraday's law)

(4) $\nabla \times \vec{B} = \mu_0 \vec{J}$ (Ampere's law)

Maxwell's Correction to Ampere's law

Mathematically, $\nabla \cdot (\nabla \times \vec{A}) = 0$ (for any vector $\vec{A}$)

Taking the divergence of Faraday's law, we get,

$$\nabla \cdot (\nabla \times \vec{E}) = \nabla \cdot \left(-\frac{\partial \vec{B}}{\partial t}\right)$$

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$$= -\frac{\partial}{\partial t}(\nabla \cdot \vec{E}) \quad \text{as variable of differentiation is different.}$$

using equation → (2)

$$\therefore \quad -\frac{\partial}{\partial t}(\nabla \cdot \vec{B}) = 0$$

So faraday's law is mathematically consistant.

Taking the divergence of Ampere's law,

$$\nabla \cdot (\nabla \times \vec{B}) = \nabla \cdot (\mu_0 \vec{J})$$

$$= \mu_0 (\nabla \cdot \vec{J})$$

in dynamics $\vec{J}$ is not constant.

$\nabla \cdot \vec{J} = 0$ for magnetostatics.

But beyond magnetostatics Ampere's law cannot be right.

in general, in dynamics

$$\nabla \cdot \vec{J} \neq 0.$$

How Maxwell fixed Ampere's law

Using continuity equation and the gauss's law maxwell rewrite the offending term $\nabla \cdot \vec{J}$, so that divergence of RHS = 0.

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Continuity equation,

$$\nabla \cdot \vec{J} + \frac{\partial \rho}{\partial t} = 0$$ → conservation law.

Gauss's law,

$$\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$$

$$\nabla \cdot \vec{J} = -\frac{\partial \rho}{\partial t} = -\frac{\partial}{\partial t}(\varepsilon_0 \nabla \cdot \vec{E})$$

$$= -\nabla \cdot \left(\varepsilon_0 \frac{\partial \vec{E}}{\partial t}\right) \rightarrow (5)$$

Maxwell rewrite Ampere's law as,

$$\nabla \times \vec{B} = \mu_0 \left(\vec{J} + \varepsilon_0 \frac{\partial \vec{E}}{\partial t}\right) \rightarrow (6)$$

Now take the divergence of eqn (6),

$$\nabla \cdot (\nabla \times \vec{B}) = \nabla \cdot \mu_0 \vec{J} + \nabla \cdot \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$$

$$= \nabla \cdot \mu_0 \vec{J} + \mu_0 \cdot \nabla \cdot \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$$

Using (5),

$$\nabla \cdot (\nabla \times \vec{B}) = \nabla \cdot \mu_0 \vec{J} - \nabla \cdot \mu_0 \vec{J}$$

$$= 0$$

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∴ Hence mathematically consistent.

Eqn (4) → $\nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$

(Ampere's law with maxwell's correction.)

This modification changes Nothing in Magnetostatics

∵ $\vec{E}$ constant ∴ $\frac{\partial \vec{E}}{\partial t} = 0$

Hence, $\nabla \times \vec{B} = \mu_0 \vec{J}$.

Maxwell's explanation to $-\varepsilon_0 \frac{\partial \vec{E}}{\partial t}$.

A change in Electric field can induced a magnetic field.

To preserve homogenity, $\varepsilon_0 \frac{\partial \vec{E}}{\partial t}$ is defined as $\vec{J}_d$ the displacement current (Current without motion of charges).

There are two types of $\vec{B}$ One due to $\vec{J}$ and the other due to $\vec{J}_d = \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$

usually, $\vec{J}_d << \vec{J}$.

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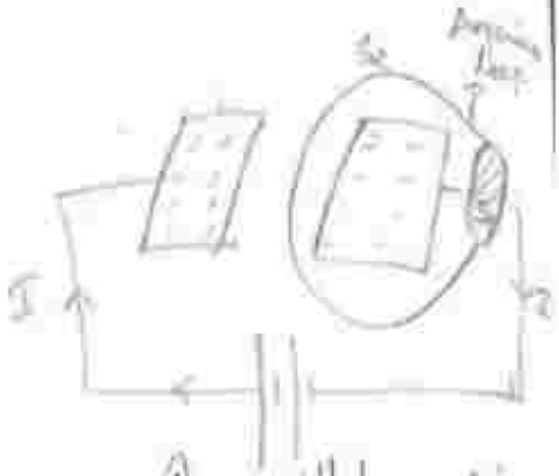
Paradox in the charging of a capacitor



There will be only a transient current which flows until the capacitor is fully charged.

Ampere's law,

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{enc}$$

Surface S_1, $I_{enc} = I$

Surface S_2, $I_{enc} = 0$

Stoke's theorem

$$\oint_l = \int_S$$

where the line l is the boundary of S.

But here, for S_1 $\vec{B}$ will have a value and S_2 $\vec{B}$ will be zero.

This means Ampere's law has some flaws.

$$\int_S (\nabla \times \vec{B}) \cdot da = \int_S \mu_0 \vec{J} \cdot da + \mu_0 \varepsilon_0 \int_S \frac{\partial \vec{E}}{\partial t} \cdot d\vec{a}$$

Stoke's theorem,

Integral form $\Leftarrow$

$$\oint_l (\vec{B} \cdot d\vec{l}) = \mu_0 I_{enc} + \mu_0 \varepsilon_0 \int_S \frac{\partial \vec{E}}{\partial t} \cdot d\vec{a}$$

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How maxwell's correction to Ampere's law resolved the Paradox (capacitor)

Electrodynamics
Maxwell's equations

$\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$ (Gauss's theorem)

$\nabla \times \vec{E} = 0 - \frac{\partial \vec{B}}{\partial t}$ (Faraday)

$\nabla \cdot \vec{B} = 0$ (magnetic monopole)

$\nabla \times \vec{B} = \mu_0 \left(\vec{I} + \varepsilon_0 \frac{\partial \vec{E}}{\partial t} \right)$ (Ampere's law with maxwell's correction)

The electric field between the parallel plates of the capacitor.

$$\vec{E} = \frac{\sigma}{\varepsilon_0} = \frac{1}{\varepsilon_0} \frac{Q}{A}$$

$$\frac{\partial \vec{E}}{\partial t} = \frac{1}{\varepsilon_0 A} \frac{\partial Q}{\partial t} = \frac{1}{\varepsilon_0 A} I \rightarrow (1)$$

σ - Surface charge density
Q - Total charge on plate
A → Area of the plate

Integral form of corrected Ampere's law is given by,

$$\oint \vec{B} \cdot \vec{dl} = \mu_0 I_{enc} + \mu_0 \varepsilon_0 \int_S \frac{\partial \vec{E}}{\partial t} \cdot \vec{da}$$

Case I Flat surface S_1 (outside the capacitor)

$\vec{E} = 0$ $\quad I_{enc} = I$

electric field outside the capacitor is zero

Modified Ampere's law,

$$\oint \vec{B} \cdot \vec{dl} = \mu_0 I + \mu_0 \varepsilon_0 \times 0$$

$$\boxed{\oint \vec{B} \cdot \vec{dl} = \mu_0 I} \rightarrow (2)$$

Case II balloon shaped surface S_2 (going between the plates of the capacitor).

$I_{enc} = 0$ $\quad \vec{E} \neq 0$

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$$\int_S \frac{\partial \vec{E}}{\partial t} \cdot d\vec{a}$$

using, ①

$$\int \frac{\partial \vec{E}}{\partial t} \cdot d\vec{a} = \int_S \frac{1}{\epsilon_0 A} I \cdot d\vec{a}$$

$$\Rightarrow \frac{I}{\epsilon_0 A} \int da = \frac{I}{\epsilon_0} \rightarrow ③$$

$\int da$ is the area of the surface. The current passed only in the Area (A) of the plate in the surface S_2 hence $\int da = A$

$$\oint \vec{B} \cdot d\vec{a} = 0 + \mu_0 \epsilon_0 \frac{I}{\epsilon_0} = \mu_0 I$$

$$\boxed{\oint \vec{B} \cdot d\vec{a} = \mu_0 I} \rightarrow ④$$

Equations ① and ④ imply the answer is same for either surfaces and hence solve the paradox.

For Case I it is the genuine current and in Case II the current is displacement Current $\vec{J}_d$.

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Symmetry of Maxwell's equations (Magnetic charges)

Maxwell's equations in free space ($\rho = 0, \vec{J} = 0$) can be written as,

$$\nabla \cdot \vec{E} = 0 \qquad \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} \longrightarrow \text{Set I}$$

$$\nabla \cdot \vec{B} = 0 \qquad \nabla \times \vec{B} = \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t} \longrightarrow \text{Set II}$$

There is a pleasing symmetry about Maxwell's equations in free space. If we replace $\vec{E} \to \vec{B}$ and $\vec{B} \to -\mu_0 \varepsilon_0 \vec{E}$

$$\text{I} \longrightarrow \text{II}$$

Maxwell's equation demands ρ_m (magnetic charge) and $\vec{J}_m$ (magnetic current) for the complete symmetry. But inspite of deligant search none has ever found out. (Not) Magnetic charges do not exist only current can produce magnetic field. Nature does not consider $\vec{E}$ and $\vec{B}$ on equal footings.

$\rho_m \to \eta$

$\vec{J}_m \to \vec{K}$

Maxwell's eqns inside matter

Material → electric, magnetic polarisation

→ bound charges and currents

The division of charge and current into free and bound.

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Static case

Electric polarisation → bound charge density

$$\rho_b = -\nabla \cdot \vec{P} \rightarrow (5)$$

$$\rho_{total} = \rho_f + \rho_b$$

Magnetic polarisation → bound current

$$\vec{J}_p = \nabla \times \vec{M} \rightarrow (6) \quad J_{total} = \vec{J}_f + \vec{J}_b$$

Non Static case (time varying)

change in $\vec{P}$ → change (flow) of bound charges ρ_b

$\Rightarrow \vec{J}_p$, polarisation current.

$$\therefore \vec{J}_{total} = \vec{J}_f + \vec{J}_b + \vec{J}_p$$

Expression for $\vec{J}_p$

$$\sigma_b = \vec{P} \cdot \hat{n}$$

$$\sigma_b \, da = \vec{P} (da \, \hat{n})$$

$$= \vec{P} \cdot d\vec{a} = P \, da_{\perp x}$$



As P changes σ_b changes $\Rightarrow$ Current

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$$d_I = \frac{\partial}{\partial t}(\sigma_b \, da)$$

$$= \frac{\partial}{\partial t}(P \, da_\perp) = \frac{\partial P}{\partial t} \, da_\perp$$

$$\frac{dI}{da_\perp} = \frac{\partial P}{\partial t} = J_p^0 \longrightarrow \text{polarisation current} \longrightarrow (7)$$

J_p is a result of linear motion of charges when electric polarisation changes.

Note:

$$\nabla \cdot \vec{J_p} = \nabla \cdot \frac{\partial \vec{P}}{\partial t} = \frac{\partial}{\partial t}(\nabla \cdot \vec{P})$$

$$= \frac{\partial}{\partial t}(-\rho_b)$$

i.e., $$\boxed{\nabla \cdot \vec{J_p} = -\frac{\partial \rho_b}{\partial t}}$$ continuity equation

Bound charges are conserved.

$$\rho = \rho_f + \rho_b$$

$$\rho = \rho_f - \nabla \cdot \vec{P} \longrightarrow (8)$$

$$\vec{J} = \vec{J_f} + \vec{J_b} + \vec{J_p}$$

$$= \vec{J_f} + (\nabla \times \vec{M}) + \frac{\partial \vec{P}}{\partial t} \longrightarrow (9)$$

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(8) in (1) (Gauss's law)

$$\Rightarrow \quad \nabla \cdot \vec{E} = \frac{1}{\varepsilon_0}\left(\rho_f - \nabla \cdot \vec{P}\right)$$

$$\nabla \cdot \varepsilon_0 \vec{E} = \rho_f - \nabla \cdot \vec{P}$$

$$\nabla \cdot \left(\varepsilon_0 \vec{E} + \vec{P}\right) = \rho_f$$

$$\boxed{\nabla \cdot \vec{D} = \rho_f}$$

Displacement current

$$\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$$

(9) in (4)

Modified Ampere's law,

$$\nabla \times \vec{B} = \mu_0\left(J_f + \nabla \times \vec{M} + \frac{\partial \vec{P}}{\partial t}\right) + \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$$

$$\nabla \times \frac{\vec{B}}{\mu_0} = J_f + \nabla \times \vec{M} + \frac{\partial}{\partial t}\underbrace{\left(\vec{P} + \varepsilon_0 \vec{E}\right)}_{\vec{D}}$$

$$\nabla \times \left(\frac{\vec{B}}{\mu_0} - \vec{M}\right) = \vec{J}_f + \frac{\partial \vec{D}}{\partial t}$$

$$\boxed{\nabla \times \vec{H} = \vec{J}_f + \frac{\partial \vec{D}}{\partial t}}$$

$$\vec{H} = \frac{\vec{B}}{\mu_0} - \vec{M}$$

Auxiliary field.

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Maxwell's eqn inside matter

$\nabla \cdot \vec{D} = \rho_f$ ← Free charge density

$\nabla \times \vec{E} = \frac{-\partial \vec{B}}{\partial t}$

$\nabla \cdot \vec{B} = 0$

$\nabla \times \vec{H} = \vec{J}_f + \frac{\partial \vec{D}}{\partial t}$

$\vec{P} = \varepsilon_0 \chi_e \vec{E}$ $\quad \varepsilon = \varepsilon_0 (1 + \chi_e)$

$\vec{M} = \chi_m \vec{H}$ $\quad \mu = \mu_0 (1 + \chi_m)$

$\boxed{\vec{D} = \varepsilon \vec{E}}$ $\quad \boxed{\vec{H} = \frac{\vec{B}}{\mu}}$

$\varepsilon = \varepsilon_0 (1 + \chi_e) \rightarrow (1)$

$\vec{P} = \varepsilon_0 \chi_e \vec{E} \rightarrow (2)$

$\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$

using (2) $= \varepsilon_0 \vec{E} + \varepsilon_0 \chi_e \vec{E}$

$= \varepsilon_0 (1 + \chi_e) \vec{E}$

using (1) $\vec{D} = \varepsilon \vec{E}$

$\mu = \mu_0 (1 + \chi_m) \rightarrow (1)$

$\vec{M} = \chi_m \vec{H} \rightarrow (2)$

$\vec{H} = \frac{\vec{B}}{\mu_0} - \vec{M}$

using (1) $= \frac{\vec{B}}{\mu_0} - \chi_m \vec{H}$

$\vec{H} + \chi_m \vec{H} = \frac{\vec{B}}{\mu_0}$

$\mu_0 (1 + \chi_m) \vec{H} = \vec{B}$

using (2), $\vec{H} \mu = \vec{B}$

$\vec{H} \vec{B} = \frac{\vec{B}}{\mu}$

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Integral form of maxwell's eqns

$$\oint_S \vec{D}\cdot d\vec{a} = Q_{f\,enc} \quad \rightarrow (1)$$

$$\oint_S \vec{B}\cdot d\vec{a} = 0 \quad \rightarrow (2)$$

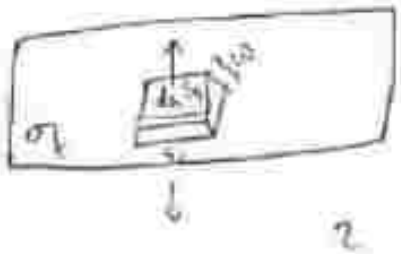
$$\oint_l \vec{E}\cdot d\vec{l} = -\frac{d}{dt}\int_S \vec{B}\cdot d\vec{a} \quad \rightarrow (3)$$

$$\oint_l \vec{H}\cdot d\vec{l} = I_{f\,enc} + \frac{d}{dt}\int_S \vec{D}\cdot d\vec{a} \quad \rightarrow (4)$$

These equations are the starting points of Boundary conditions

Boundary condition for $\vec{D}$

$\vec{da} = da\,\hat{n}$



$$\oint_S \vec{D}\cdot d\vec{a} = Q_{f\,enc}$$

$w \to 0$

$$\int_{S_1} \vec{D_1}\cdot d\vec{a} - \int_{S_2} \vec{D_2}\cdot d\vec{a} + \int_{side} = \sigma_f\, da$$

$$\vec{D_1}\cdot d\vec{a} - \vec{D_2}\cdot d\vec{a} = \sigma_f\, da$$

$$D_{1\perp}\, da - D_{2\perp}\, da = \sigma_f\, da$$

$$D_{1\perp} - D_{2\perp} = \sigma_f$$

$$\boxed{D_{1\perp} = D_{2\perp} + \sigma_f}$$

$D_\perp$ is discontinuous by an amount σ_f

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2) BC for $B_\perp$

$$\oint_S B \cdot da = 0$$

$\vec{D} \to \vec{B} \Rightarrow B_{1\perp} - B_{2\perp} = 0$

$$B_{1\perp r} = B_{2\perp r}$$

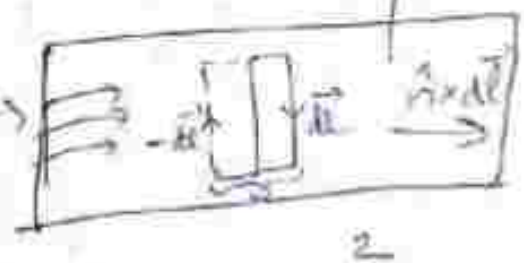
$\therefore B_{\perp r}$ is continuous across the boundary.

$\perp^r$ component of $\vec{B}$ is continuous.

3) BC for $\parallel$ of $\vec{E}$

$$\oint \vec{E} \cdot d\vec{l} = -\frac{d}{dt}\int_S B \cdot da \qquad \left(\nabla \times \vec{E} = 0,\ \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}\right)$$

$$\int_{l_1} \vec{E_1} \cdot d\vec{l} - \int_{l_2} \vec{E_2} \cdot d\vec{l} + \iint_{l_3 l_4} \vec{K_s} \cdot \hat{n} \times d\vec{l}$$



$$= -\frac{d}{dt}\int_S \vec{B} \cdot d\vec{a} = \phi$$

$\hookrightarrow = 0$ as $w = 0$

when $w \to 0$ $\quad \vec{E_1} \cdot d\vec{l} - \vec{E_2} \cdot d\vec{l} = 0.$

$$E_{1\parallel} dl - E_{2\parallel} dl = 0$$

$$E_{1\parallel} = E_{2\parallel}$$

$\parallel$ Component of $\vec{E}$ is continuous

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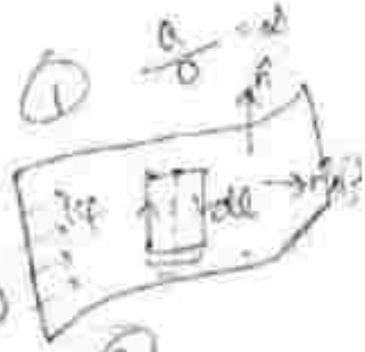
4) ∥ component of $\vec{H}$ $\qquad \frac{a}{\delta} = 0$

$$\oint \vec{H} \cdot d\vec{l} = I_{enc} + \frac{d}{dt} \int \vec{D} \cdot d\vec{a}$$



$\omega \to 0$; $I_{enc} = \vec{K}_f \cdot (\hat{n} \times d\vec{l}')$

$$\int \vec{H}_1 \cdot d\vec{l} - \int \vec{H}_2 \cdot d\vec{l} = \vec{K}_f \cdot (\hat{n} \times d\vec{l}) + 0 \quad (1)$$

$$H_{1\parallel} dl - H_{2\parallel} dl = (\vec{K}_f \times \hat{n}) \cdot dl \quad (2)$$

$$= |\vec{K}_f \times \hat{n}| \, dl \cos 0^\circ$$

$$H_{1\parallel} - H_{2\parallel} = (\vec{K}_f \times \hat{n})$$

$\therefore$ ∥ component of $\vec{H}$ is discontinuous

$\vec{K}_f = \frac{I}{dl_\perp}$

here, dl is not an infinitesimal length it is the total length

Note

$$\nabla \cdot D = \oint \frac{\partial}{\partial t} \int \vec{D} \cdot da = 0$$

as $\omega \to 0$. flux of $\vec{D} \to 0$.

$\int \vec{H}_1 \cdot dl = H_1 \cdot dl$ as dl is the total length

B.C in term of $\vec{E}$ and $\vec{B}$ alone

$$D = \varepsilon E \qquad H = \frac{B}{\mu}$$

$$\varepsilon_1 E_1^{\perp} - \varepsilon_2 E_2^{\perp} = \sigma_f$$

$$B_1^{\perp} - B_2^{\perp} = 0$$

$$E_1^{\parallel} - E_2^{\parallel} = 0$$

$$\frac{B_1^{\parallel}}{\mu_1} - \frac{B_2^{\parallel}}{\mu_2} = |K_f \times \hat{n}|$$

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Inductance

Inductance is a property that opposes any change in current in a closed circuit.

By Biot-Savart's law,

$$\vec{B} = \frac{\mu_0 I}{4\pi} \oint \frac{d\vec{l} \times \hat{r}}{r^2}$$

$\vec{B} \propto I$ and hence flux $\phi = \vec{B} \cdot \vec{da}$ associated with the loop is also proportional to current. $\phi \propto I$.

Self Inductance

Self Inductance is a phenomenon that opposes any change in current in a closed circuit by induced emf developed in the **same coil**.

Self inductance is quantitatively measured in terms of L.

L - coefficient of self inductance.

Self inductance is a measure of Electrical inertia ↓ inertia to change current in a circuit or coil

SI Unit is Henry (H)

The magnetic flux linked with a closed circuit with current I is given by $\phi = \int \vec{B} \cdot d\vec{a}$

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Since, $\vec{B} \propto I$ according to Biot-Savart's law

$$\phi \propto I$$

$$\text{or } \phi = LI$$

$$L = \frac{\phi}{I}$$

Mutual Inductance — M = coefficient of Mutual inductance.

Consider two coils 1, and 2 kept close to each other. I_1 and I_2 are the currents and N_1 and N_2 are the no. of turns in coil 1 and coil 2 respectively.



When current through coil 1 changes it produces a change in magnetic flux, Φ_{21} in the region of coil 2. This induces an emf in coil 2.

Φ_{21} is the change in flux in the region of coil 2 due to coil 1.

Let $N_2\Phi_{21}$ is the flux linked with the second coil. When current through coil 1 is I_1.

ie, $N_2\Phi_{21} \propto I_1$

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$$N_2 \phi_{21} = M_{21} I_1$$

$$M_{21} = \frac{N_2 \phi_{21}}{I_1}$$

Similarly $M_{12} = \frac{N_1 \phi_{12}}{I_2}$

we can show that $M_{12} = M_{21} = M$

when, $I_1 = 1$ Ampere

$$M = N_2 \phi_{21}$$

" The mutual Inductance of two coils may be defined as the total flux linkage produced in one coil when the current through other coil is one Ampere. "

M - Henry (H)

Mutual Inductance and Neumann formula



$$B_1 = \frac{\mu_0 I_1}{4\pi} \oint_l \frac{d\vec{l} \times \vec{r}}{r^2} \longrightarrow (1)$$

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The magnetic flux linked with the loop C_2

$$\phi_{2\leftarrow 1} = \int_{S_2} \vec{B_1} \cdot d\vec{a_2} \longrightarrow (2)$$

$\downarrow$

flux in C_2 due to I_1

where S_2 is the surface bounded by loop 2,

$$B_1 \propto I_1$$

$$\therefore \phi_{2\leftarrow 1} \propto I_1 \longrightarrow (3)$$

$$\phi_{2\leftarrow 1} = M_{21} I_1 \longrightarrow (4)$$

$\downarrow$

mutual inductance of the two loops

Similarly,

$$\phi_{1\leftarrow 2} = M_{12} I_2$$

Rewriting eqn (2) interms of magnetic vector potential, $(\vec{B} = \nabla \times \vec{A})$;

$$\phi_{2\leftarrow 1} = \int_{S_2} (\nabla \times \vec{A_1}) \cdot d\vec{a_2}$$

following Stoke's theorem,

$$\phi_{2\leftarrow 1} = \oint_{C_2} \vec{A_1} \cdot d\vec{l_2}$$

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vector potential due to line current I_1 is,

$$\vec{A_1} = \frac{\mu_0}{4\pi} \oint_{C_1} \frac{I_1}{r} d\vec{l_1}$$

$$\phi_{2 \leftarrow 1} = \frac{\mu_0 I_1}{4\pi} \oint_{C_2} \left[\oint_{C_1} \frac{d\vec{l_1}}{r} \right] \cdot d\vec{l_2} \rightarrow (5)$$

$$\phi_{2 \leftarrow 1} = M_{21} I_1 \rightarrow (4)$$

equating (4) & (5)

$$M_{21} I_1 = \frac{\mu_0 I_1}{4\pi} \oint_{C_2} \left[\oint_{C_1} \frac{d\vec{l_1}}{r} \right] \cdot d\vec{l_2}$$

$$M_{21} = \frac{\mu_0}{4\pi} \oint_{C_2} \left[\oint_{C_1} \frac{d\vec{l_1}}{r} \right] \cdot d\vec{l_2} \rightarrow (6)$$

This is called Neumann's formula for Mutual inductance.

$$M_{21} = \frac{\mu_0}{4\pi} \oint_{C_2} \oint_{C_1} \frac{d\vec{l_1} \cdot d\vec{l_2}}{r}$$

Significance of this formula,

(1) It is clear that Mutual inductance depends on the size, shape and relative position of two loops

(2) Also the integral remains unchanged when loops are interchanged $M_{12} = M_{21} = M$ (Neumann formula is symmetric w.r.t. two circuits)

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$$\phi_{1\leftarrow 2} = M_{12} I_2 \; ; \; \phi_{2\leftarrow 1} = M_{21} I_1$$

for $I_1 = I_2$,

Magnetic flux through loop 1 is equal to Magnetic flux through loop 2.

ie, If the current through two nearby loops are same, then irrespective of the shapes and relative position of the loops, the magnetic flux through loop 1 equals magnetic flux through loop 2.

$$\phi_{1\leftarrow 2} = \phi_{2\leftarrow 1}$$

Coefficient of coupling

Consider two loops through which current I_1 and I_2 flow. L_1 and L_2 are the self inductances of the two loops and M the mutual inductance between them.

$$L_1 = \frac{\phi_1}{I_1} \text{ and } L_2 = \frac{\phi_2}{I_2}$$

Where ϕ_1 and ϕ_2 are the magnetic flux through the loops respectively,

$$L_1 L_2 = \frac{\phi_1 \phi_2}{I_1 I_2} \longrightarrow (1)$$

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$\phi_{2\leftarrow 1}$ $L_2 = \frac{\phi_2}{I_2}$

$\phi_{2\leftarrow 1}$ $L_1 = \frac{\phi_1}{I_1}$

$M = M_{21} = M_{12}$

$= \frac{\phi_{2\leftarrow 1}}{I_1} = \frac{\phi_{1\leftarrow 2}}{I_2}$

If the whole magnetic flux due to loop 1 is linked to loop 2, then $\phi_{2\leftarrow 1} = \phi_1$

similarly, $\phi_{1\leftarrow 2} = \phi_2$

$$M = \frac{\phi_1}{I_1} = \frac{\phi_2}{I_2}$$

$$M^2 = \frac{\phi_1 \phi_2}{I_1 I_2} \rightarrow (3)$$

$M^2 = L_1 L_2$ from (1) & (2)

$M = \sqrt{L_1 L_2}$

In practical cases, it is not possible to link the whole loop flux of one loop to the other. Some flux is lost between inter-linking.

$$\boxed{M = k\sqrt{L_1 L_2}}$$

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k is called coefficient of coupling, with its value lying between 0 & 1. Its maximum value is 1 when there is no leakage of magnetic flux. Inductances in general are measured in Henries.

Eg 1 A short solenoid lies on the axis of a very long solenoid as shown. What is the flux through the long solenoid and mutual inductance between the two solenoids.



Ans. Here the property of a pair of coupled coils having some mutual inductance is considered to solve the problems. Assume that current I is flowing through the long solenoid. Magnetic field inside the very long solenoid is, $B = \mu_0 N_2 I$

Flux through the single loop of the short solenoid is, $\phi = B\pi R^2 = \mu_0 N_2 I \pi R^2$

∴ Total flux through the short solenoid,

$\phi_{total} = \phi \times$ total no. of turns

$\phi_{total} = (\mu_0 N_2 I \pi R^2) N_1 F$

Energy stored in magnetic field

(a) In terms of current flowing.

To maintain current flow work is to be done by the external voltage source against the induced (back emf) electric field. This work done is stored as potential energy, which can be recovered when the current is turned off. This is the energy stored in the magnetic field.

Work done in taking unit charge along a closed circuit once is, $= -\epsilon$ (work against induced Emf, taken -ve since work is done by source)

If the current is I then total work done per unit time (power)

$$\frac{dW}{dt} = -\epsilon I = -\left(\frac{-d\phi}{dt}\right) I$$

$\epsilon = -\frac{d\phi}{dt}$, $\phi = LI$

$$= I \frac{d(LI)}{dt} = I L \frac{dI}{dt}$$

considering that current is build up from 0 to I

Then work done,

$$dW = I L \frac{dI}{dt} dt$$

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$$W = \int_0^I dW = \int_0^I LI\,dI$$

$$W = \frac{1}{2} L I^2 \rightarrow (1)$$

Above work is stored as the energy in the magnetic field surrounding the closed conducting loop.

Note: W does not depends on t (how long we taked to reach I) It depends only on the geometry of loop (through L) and max I.

b) In terms of magnetic field

Magnetic flux through a loop is given by,

$$\Phi = \int_S \vec{B} \cdot d\vec{a} \rightarrow (2)$$

$$= \int_S (\nabla \times \vec{A}) \cdot d\vec{a} \rightarrow (3)$$



Here 'S' is the surface bounded by the closed loop, following Stoke's theorem.

$$\Phi = \oint_C \vec{A}\, d\vec{l} \rightarrow (4)$$

$$\Phi = LI \rightarrow 5$$

On comparing eqn (4) & eqn (5)

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$$LI = \oint_C \vec{A} \cdot d\vec{l} \rightarrow (6)$$

eqn (6) in eqn (1), when $d\vec{l}$ and $\vec{I}$ have same direction

$$W = \frac{1}{2} \oint_C \vec{A} \cdot d\vec{l} \rightarrow (7)$$

or $W = \frac{1}{2} \oint_C (\vec{A} \vec{I}) d\vec{l} \rightarrow (8)$

expanding eqn (8) for volume distribution of currents with volume current density, $\vec{J}$,

$$W = \frac{1}{2} \int_V (\vec{A} \cdot \vec{J}) d\tau$$

$$J = \frac{\nabla \times \vec{B}}{\mu_0}$$

$$W = \frac{1}{2\mu_0} \int_S \vec{A} \cdot (\nabla \times \vec{B}) d\tau$$

Product rule

$$\nabla \cdot (\vec{A} \times \vec{B}) = \vec{B} \cdot (\nabla \times \vec{A}) - \vec{A} (\nabla \times \vec{B})$$

$$= \vec{B} \cdot \vec{B}' - \vec{A} (\nabla \times \vec{B})$$

$$A \cdot (\nabla \times \vec{B}) = B' - \nabla \cdot (\vec{A} \times \vec{B})$$

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$$\therefore W = \frac{1}{2\mu_0}\left[\int_V B^2 d\tau - \int_V \nabla\cdot(\vec{A}\times\vec{B}')\,d\tau\right]$$

using Gauss's divergence theorem,

$$W = \frac{1}{2\mu_0}\left[\int_V B^2 d\tau - \oint_S (\vec{A}\times\vec{B}')\,d\vec{a}\right]$$

comparing equns.,

$$\frac{1}{2}\int_V (\vec{A}\cdot\vec{J})\,d\tau = \frac{1}{2\mu_0}\left[\int_V B^2 d\tau - \oint_S (\vec{A}\times\vec{B}')\,d\vec{a}\right]$$

LHS - is a constant whatever be the amount of volume integration as long as the volume includes the given current distribution. But as Volume increases contributions from the volume integral in the rhs of eqn increases. while surface integral's contribution decreases. If integration is taken for whole space, surface integral vanishes.



for V_1 or V $\vec{J}$ is const

$$W = \frac{1}{2\mu_0}\int_{\text{all space}} B^2 d\tau$$

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Energy density in a magnetic field given by,

either $\frac{B^2}{2\mu_0}$ or $\frac{1}{2}\vec{A}\cdot\vec{J}$

following gives a comparison of energy densities in electric and magnetic fields.

Energy density (electric) $= \frac{1}{2}V\rho = \frac{1}{2}\epsilon_0 E^2$

Energy density (Magnetic) $= \frac{1}{2}\vec{A}\cdot\vec{J} = \frac{B^2}{2\mu_0}$

The Continuity Equation



Continuity equation is the mathematical representation of conservation of charge. As per conservation of charge in a localized bounded volume, the change in total amount of charge must be equal to the charge flown thro the bounding of the volume (in or out). Instantaneous total charge in volume V is,

$$Q(t) = \int_V \rho(\vec{r}, t)\, dv$$

ρ = charge density at $\vec{r}$ at time t

The rate of flow of charge from the time Volume bounded by the surface S, is,

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$$I = \frac{dQ}{dt} = -\int_{\text{surface}} \vec{J} \cdot d\vec{a}$$

-ve sign shows that the charge flows out & decrease in charge in the bounded volume.

$$Q(t) = \int_V \rho(t)\, d\tau$$

$$I = \frac{dQ}{dt} = \boxed{\int_V \frac{\partial \rho}{\partial t}\, d\tau = -\int_{\text{surface}} \vec{J} \cdot d\vec{a}}$$

↓

Integral form.

Converting RHS of eqn into volume integral using divergence theorem.

$$\int_V \frac{\partial \rho}{\partial t}\, d\tau = -\int_V (\nabla \cdot \vec{J})\, d\tau$$

$$\boxed{\frac{\partial \rho}{\partial t} = -\nabla \cdot \vec{J}}$$ → differential form

This is the continuity equation.

eg. for steady current $\frac{\partial \rho}{\partial t} = 0 \Rightarrow \nabla \cdot \vec{J} = 0$

⇒ The net current leaving a junction is zero ⇒ Kirchoff current law $\sum I = 0$



$$I = I_1 + I_2$$

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Solved examples

2. Find the self inductance per unit length of a long solenoid, of radius a, carrying N turns per unit length.

Sol: Magnetic field inside long solenoid is,

$$B = \mu_0 N I$$

where N = No. of turns per unit length. Flux through each turn of the solenoid is given by,

$$\phi = BA = B\pi a^2 = \mu_0 N I \pi a^2$$

∴ Total flux through the solenoid,

$$\phi_{total} = (\mu_0 N I \pi a^2) \times N l$$

$$= \mu_0 N^2 I \pi a^2 l$$

$$\phi = LI$$

∴ Self inductance $= \frac{\phi}{I}$

$$L = \mu_0 N^2 \pi a^2 l$$

Self inductance per unit length $= \frac{L}{l}$

$$L' = \mu_0 N^2 \pi a^2$$

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Poynting's Theorem



Known as the work energy theorem in electrodynamics

Consider a bounded volume containing some charge & current distribution generating instantaneous electromagnetic fields $\vec{E}$ and $\vec{B}$.

Work done by electromagnetic forces on charge 'q' moving within a time interval dt can be obtained from Lorentz force law as,

$$dW = \vec{F} \cdot d\vec{l} = q\left(\vec{E} + \vec{v} \times \vec{B}\right) \cdot d\vec{l}$$

$$dW = q\left(\vec{E} + \vec{v} \times \vec{B}\right) \cdot \vec{v}\, dt \qquad \left(\vec{v} = \frac{d\vec{l}}{dt}\right)$$

$$dW = dq\, \vec{E} \cdot \vec{v}\, dt \qquad (\vec{v} \times \vec{B}) \cdot \vec{v} = 0$$

The rate of work done, (work done per unit time)

$$\frac{dW}{dt} = q\vec{E} \cdot \vec{v}$$

$$= \int_V \rho\left(\vec{E} \cdot \vec{v}\right) d\tau \qquad \left(q = \int_V \rho\, d\tau\right)$$

$$\frac{dW}{dt} = \int_V \left(\vec{E} \cdot \vec{J}\right) d\tau \qquad \left(\vec{J} = \rho\vec{v}\right)$$

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This gives the work done per unit time by electromagnetic forces on the whole charge 'q' in the bounded volume. Consequently $\vec{E}\cdot\vec{J}$ is the work done per unit time per unit volume of charge - current distribution.

Eqn $\vec{E}$ and $\vec{B}$ terms eliminating $\vec{J}$, using Maxwell's modified Ampere's law:

$$\nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$$

$$\vec{J} = \frac{\nabla \times \vec{B}}{\mu_0} - \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$$

$$\vec{E}\cdot\vec{J} = \frac{\vec{E}\cdot\nabla\times\vec{B}}{\mu_0} - \varepsilon_0 \vec{E}\cdot\frac{\partial \vec{E}}{\partial t}$$

From product rule $\nabla\cdot(\vec{E}\times\vec{B}) = \vec{B}\cdot(\nabla\times\vec{E}) - \vec{E}\cdot(\nabla\times\vec{B})$

$$\vec{E}\cdot(\nabla\times\vec{B}) = \vec{B}\cdot(\nabla\times\vec{E}) - \nabla\cdot(\vec{E}\times\vec{B})$$

$$\nabla\times\vec{E} = -\frac{\partial \vec{B}}{\partial t} \quad \text{(Faraday's law)}$$

$$\vec{E}\cdot(\nabla\times\vec{B}) = -\vec{B}\cdot\frac{\partial \vec{B}}{\partial t} - \nabla\cdot(\vec{E}\times\vec{B})$$

Substituting for $\vec{E}\cdot(\nabla\times\vec{B})$ in eqn, *

$$\therefore \vec{E}\cdot\vec{J} = \frac{-1}{\mu_0}\vec{B}\cdot\frac{\partial \vec{B}}{\partial t} - \frac{\nabla\cdot(\vec{E}\times\vec{B})}{\mu_0} - \varepsilon_0 \vec{E}\cdot\frac{\partial \vec{E}}{\partial t}$$

$$\vec{B}\cdot\frac{\partial \vec{B}}{\partial t} = \frac{1}{2}\frac{\partial B^2}{\partial t} \quad \text{and} \quad \vec{E}\cdot\frac{\partial \vec{E}}{\partial t} = \frac{1}{2}\frac{\partial}{\partial t}E^2$$

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$$\vec{E}\cdot\vec{J} = -\frac{1}{2}\frac{\partial}{\partial t}\left[\varepsilon_0 E^2 + \frac{B^2}{\mu_0}\right] - \frac{1}{\mu_0}\nabla\cdot(\vec{E}\times\vec{B})$$

Substituting for $\vec{E}\cdot\vec{J}$ in eqn,

$$\frac{dw}{dt} = -\frac{d}{dt}\int_{Vol}\frac{1}{2}\left[\varepsilon_0 E^2 + \frac{B^2}{\mu_0}\right]d\tau$$

$$-\int_{Vol}\frac{\nabla\cdot B(\vec{E}\times\vec{B})}{\mu_0}d\tau$$

Converting volume integral involving $\vec{E}\times\vec{B}$ of eqn into surface integral,

$$\frac{dw}{dt} = -\frac{d}{dt}\int_{Vol}\frac{1}{2}\left[\varepsilon_0 E^2 + \frac{B^2}{\mu_0}\right]d\tau - \int_{Vol}\nabla\cdot\frac{(\vec{E}\times\vec{B})}{\mu_0}d\tau$$

$$\boxed{\frac{dw}{dt} = -\frac{d}{dt}\int_{Vol}\frac{1}{2}\left[\varepsilon_0 E^2 + \frac{B^2}{\mu_0}\right]d\tau - \int_{Surf}\frac{(\vec{E}\times\vec{B})}{\mu_0}da}$$

This is the poynting's theorem.

First Integral term is the total electromagnetic energy stored per unit time in the volume containing the charge current. second integral represents the rate of flow of energy through the surface bounding the volume.

Poynting's theorem

"The work done on the charges by the electromagnetic force is equal to the decrease in energy stored

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in the field, less the energy that flowed out through the surface containing charge current distribution."

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UNIT-03

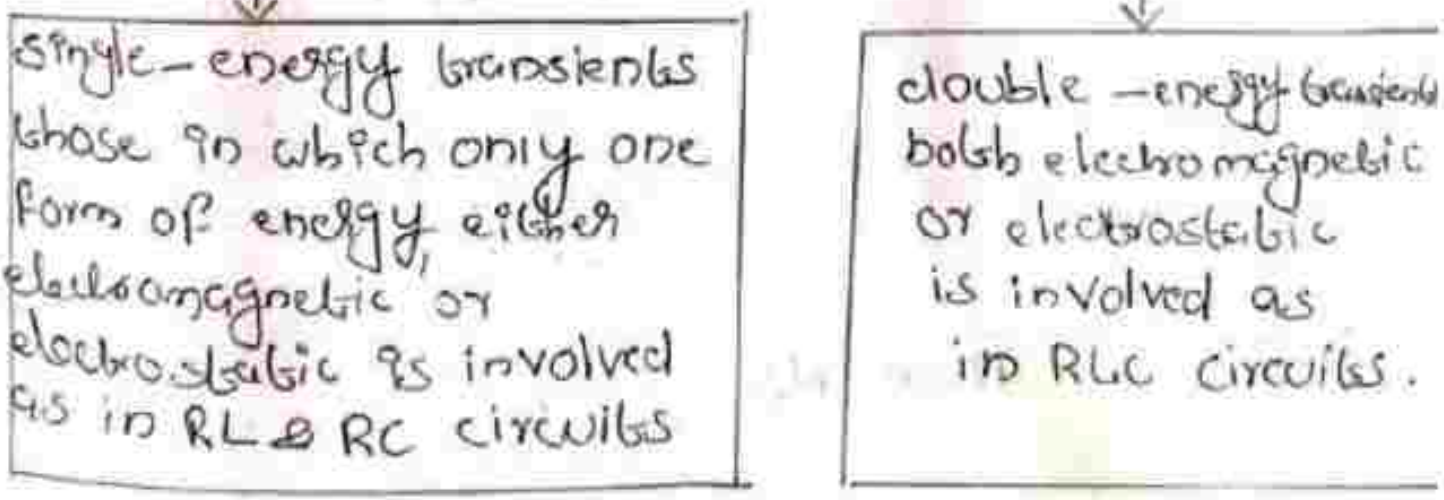
Transient Currents

⇒ In general transients disturbances are produced whenever.

a) an appliance or circuit is suddenly connected to or disconnected from the supply.
b) a circuit is shorted and.
c) there is a sudden change in the applied voltage from one finite value to another.

Types of Transients

⇒



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⇒ a) Initiation Transients : These are produced when a circuit, which is originally dead is energised.

b) Subsidence Transients : These are produced when an energised circuit is rapidly de-energised and reaches an eventual steady-state of zero current or voltage as in the case of short-circuiting an R-L or R-C circuit suddenly.

c) Transition Transients : These are due to sudden but energetic changes from one steady state to another

d) Complex Transients : These are produced in a circuit which is simultaneously subjected to two transients ~~due~~ due to two independent disturbances or when the disturbing force producing the transients is itself variable

e) Relaxation Transients : In these transients the transition occurs cyclically towards states which when reached become unstable themselves.

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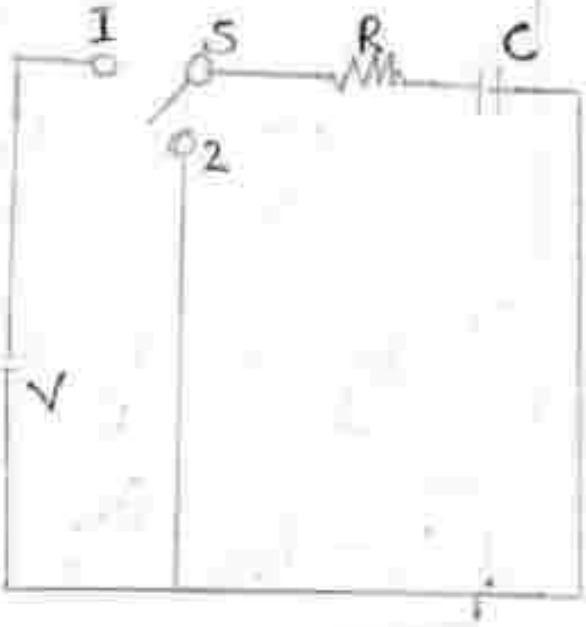
Transients in RC series circuits (DC)



When a d.c voltage V is suddenly applied to an R-C series circuit, the voltage V_c across the capacitor rises from zero value to the steady-state value V. If V_c is the voltage across capacitor V_{cb} the transient voltage then,

$$V_c = V + V_{cb}$$

The charging current is maximum at the beginning but then is reduced to zero so that there is no steady-current but a transient one. Since the transient current is not associated with any applied voltage, hence.

$$i_b R + V_{cb} = 0 \rightarrow V_{cb} = -i_b R$$

Now capacitor voltage $V_{cb} = q_b/C$

$$i_b R + \frac{q_b}{C} = 0$$

$$i_b R + \frac{q_b}{C} = 0$$

$V = \frac{Q}{C}$

$V_{cb} = q_b/C$

$Q = CV$ $\quad V = IR$

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or

$$R \cdot \frac{di_t}{dt} + \frac{1}{C} \cdot \frac{dq_t}{dt} = 0$$

$$\therefore \quad \frac{di_t}{i_t} = -\frac{dt}{CR}$$

or $\frac{di_t}{dt} = -\frac{1}{CR}\frac{dq_t}{dt} = -\frac{1}{CR} i_t$ $\quad (dq_t/dt = i_t)$

$$\boxed{i_t = I_0 e^{-t/CR} = I_0 e^{-t/\lambda}}$$

where $CR = \lambda$ = time constant The reciprocal $1/CR$ is known as damping coefficient

$$\int \frac{di_t}{dt} = \int -\frac{dt}{CR}$$

$$\ln i_t = -\frac{1}{CR} t + C$$

$t = 0, \; i_t = I_0$

$$\ln I_0 = 0 + C$$

$$C = \ln I_0$$

$$\ln i_t = \frac{-t}{CR} + \ln I_0$$

$$\ln i_t - \ln I_0 = \frac{-t}{CR}$$

$$\ln\left(\frac{i_t}{I_0}\right) = \frac{-t}{CR}$$

$$\frac{i_t}{I_0} = e^{-t/CR}$$

$$\Rightarrow i_t = I_0 e^{-t/CR}$$

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Charging current

When $t=0$, transient current $i_t = I_0$ so that from $V_{Rt} = -I_0 R$ moreover, when $t=0$ $V_c = 0$ hence from $V_{Rt} = -V$

$$i_t = I_0 e^{-t/\tau} = \frac{V}{R} e^{-t/\tau}$$ RC circuit

$$I_0 = V/R$$

The transient voltage across the resistor R is given by

$$i_R = \frac{V}{R} e^{-t/\tau} \times R$$

$$= V e^{-t/\tau}$$

$$V_{Rt} = -i_R R = -V e^{-t/\tau}$$

transient voltage across the capacitor is becomes

$$V_c = V + V_{Rt}$$

$$V_c = V - i_R R = V - V e^{-t/\tau}$$

$$V_c = V(1 - e^{-t/\tau})$$ → Total voltage across capacitor.

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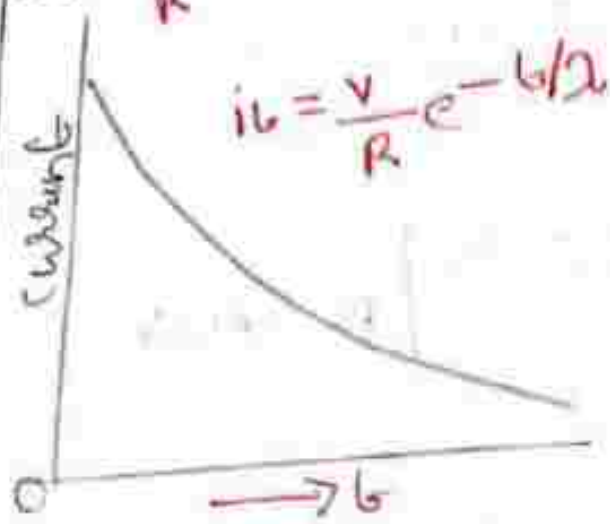
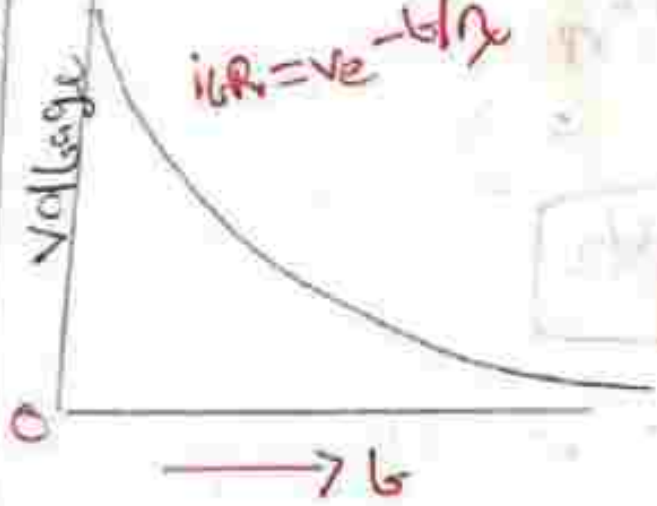
a) $I_0 = \frac{V}{R}$



$i_t = \frac{V}{R} e^{-t/\lambda}$

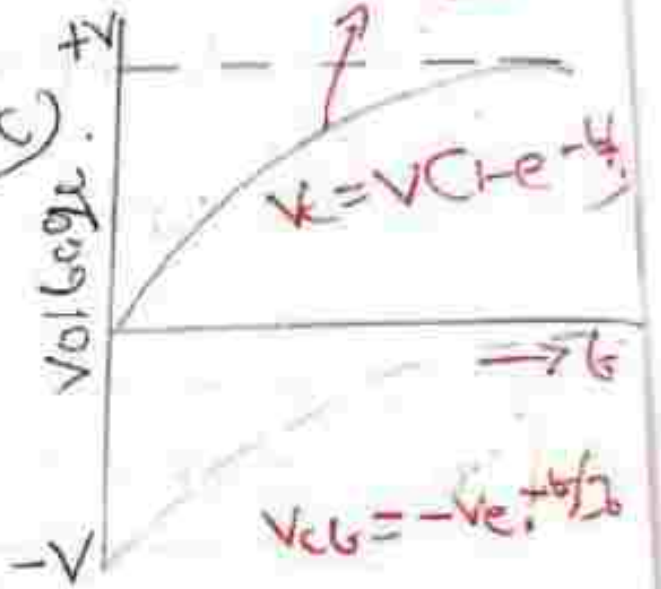
$V = IR$

b)



$i_R = Ve^{-t/\lambda}$

c)



$V_c = V(1-e^{-t/\lambda})$

$V_{ct} = -Ve^{-t/\lambda}$

The charge across the capacitor is

$q = v = CV(1-e^{-t/\lambda})$

or $q = Q(1-e^{-t/\lambda})$

$\therefore Q(\lambda) \quad \therefore (Q = CV)$

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$q = CV_c$

$q = Q(1 - e^{-t/\tau})$ Q – maximum charge and stored in the capacitor

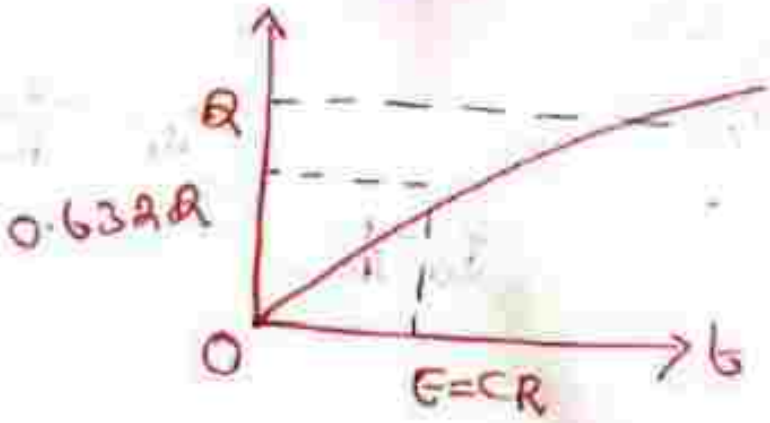
when $t = \tau = CR$

$q = Q(1 - e^{-1}) = 0.632$ $Q = 63.2\%$ of Q

$$\boxed{q = 0.632Q}$$

CR – time constant / capacitive time constant.

Time taken by the capacitor to charge to 0.632 times or 63.2% of its maximum value.



iv) Discharge current

When the capacitor has become fully charged so that charging current has ceased. then the R-C circuit is short-circuited by shifting the switch S from position 1 to position 2.

$I_0 = -V/R$

$$i_t = \frac{-V}{R} e^{-t/\tau}$$

i) charging

$t = 0$, $V_c = 0$

ii) discharge

$t = 0$ $V_c = V$

$V_c = V_{ct} = V$

$-I_0 R = V$

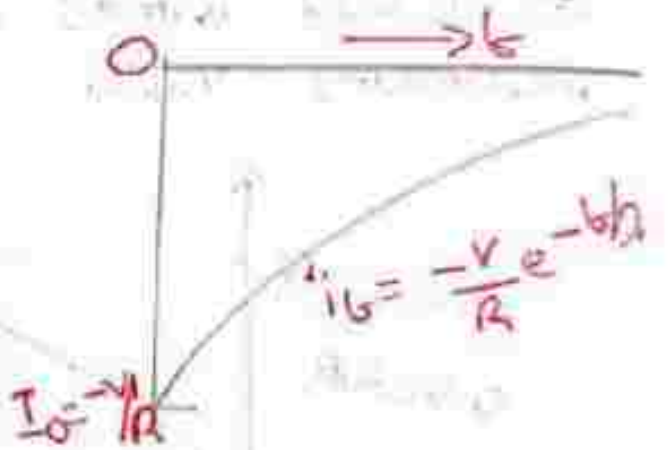
$I_0 = -V$

$V_{ct} = -i_t R = V e^{-t/\tau}$

$q = CV_c = CV_{ct}$

$= CV e^{-t/\tau}$

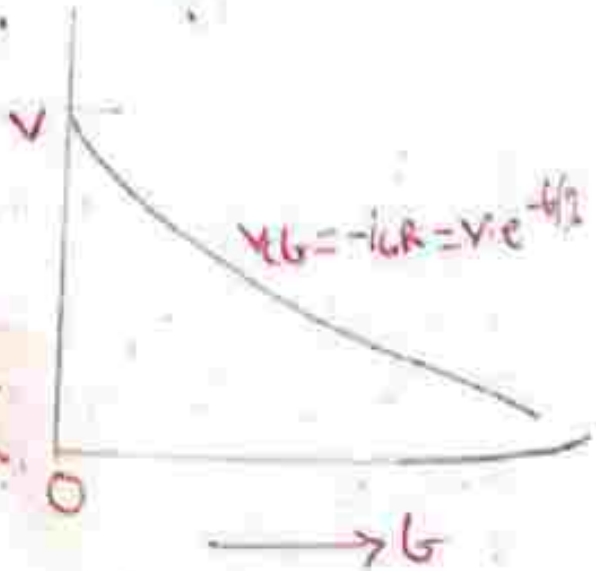
$$q = Q e^{-t/CR}$$



For $t = CR$,

$q = Qe^{-1}$

$q = 0.368\,Q$ → 36.8 %



Time constant (CR) of the circuit is defined as the time taken by the charge to fall from maximum to 0.368 of max. value.

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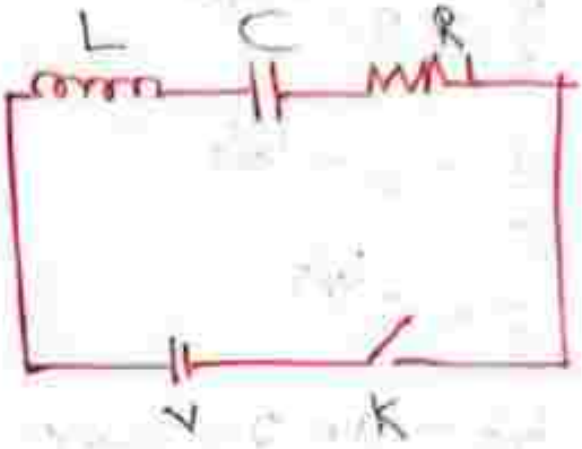
Rate of ~~chan~~ decay of charge.

$$q = Qe^{-t/CR}$$

$$\frac{dq}{dt} = \frac{d}{dt}\left(Qe^{-t/CR}\right)$$

$$\frac{dq}{dt} = Q \times e^{-t/CR} \times \frac{-1}{CR}$$

$$\frac{dq}{dt} = \frac{-Q}{CR} e^{-t/CR}$$



RC

$\frac{dq}{dt} \uparrow$ discharging

=> RL circuit
RC circuit
$\Rightarrow$ single – energy transients

Double energy transient => LCR

Q) A condenser of capacity 0.5 μF is discharged through a resistance of 10 mega ohms. Find the time taken for half the charge on the condenser to escape.

Ans:

RC circuit $R = 10\,M\Omega$
$C = 0.5\,\mu F$

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$q = Q e^{-t/CR}$

$\boxed{q = \frac{Q}{2}}$

$\frac{Q}{2} = Q e^{-t/5}$

$\frac{1}{2} = e^{-t/5}$

$2 = e^{t/5}$

$t/5 = \ln 2 = 0.693$

$t = 0.693 \times 5 = 3.475$

$R = 10\ M\Omega = 10 \times 10^6\ \Omega$

$C = 0.5\ \mu F = 0.5 \times 10^{-6}\ F$

$RC = 10 \times 10^6 \times 0.5 \times 10^{-6}$

$= 5 \times 10^0$

$= 5$

~~$\lambda = 10\ \text{Å}$~~

~~$= 10 \times 10^{-10}\ m$~~

⇒

centi -10^{-2} — (c)

milli -10^{-3} — (m)

micro -10^{-6} — (μ)

nano -10^{-9} — (n)

Angstrom -10^{-10} — (Å)

Pico -10^{-12} — (p)

femto -10^{-15} — (f)

Killo $= 10^3$ — (k)

mega $- 10^6$ — (M)

giga $- 10^9$ — (G)

tera $- 10^{12}$ — (T)

$\boxed{1\text{Å} = 10^{-10}\ m}$

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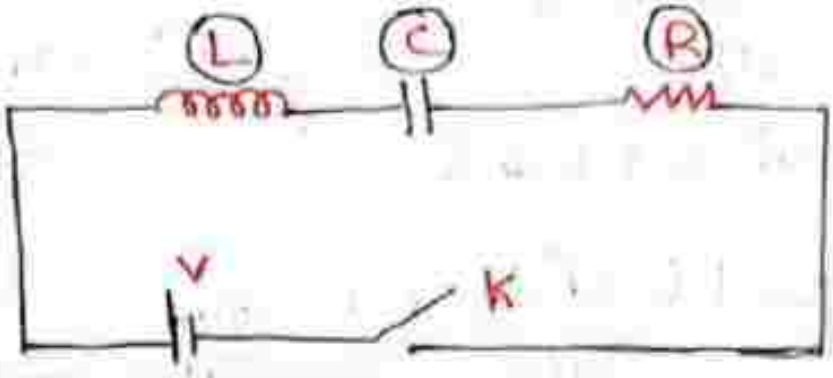
Double Energy Transients



q_t — charge on the capacitor

i_t — current at any instant of time during charging.

Parameters	L	C	R
Transients voltages	$L\frac{di_t}{dt}$	$\frac{q}{C}$	$i_t R$

$\Phi \propto I$

$q = CV$

$V = \frac{q}{C}$

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Double Energy Transients

$$i_6 R + L\frac{di_6}{dt} + \frac{q_6}{C} = 0 \longrightarrow (1)$$ eqn of transient voltages.

diff eqn (1) w.r.t t,

$$R\frac{di_6}{dt} + L\frac{d^2 i_6}{dt^2} + \frac{1}{C}\frac{dq_6}{dt} = 0$$

$$R\frac{di_6}{dt} + L\frac{d^2 i_6}{dt^2} + \frac{i_6}{C} = 0$$

$$L\left(\frac{d^2 i_6}{dt^2}\right) + R\frac{di_6}{dt} + \frac{i_6}{C} = 0$$

$$\boxed{\frac{d^2 i_6}{dt^2} + \frac{R}{L}\frac{di_6}{dt} + \frac{i_6}{LC}} = 0 \longrightarrow (2)$$

$$\frac{d^2 i_6}{dt^2} + \frac{R}{L}\frac{di_6}{dt} + \frac{1}{LC} i_6 = 0$$

Solu $\Rightarrow$

$$\boxed{i_6 = k_1 e^{\lambda_1 t} + k_2 e^{\lambda_2 t}} \longrightarrow (3)$$

k_1, k_2 - constants $\rightarrow$ values can be found out from

$$\lambda = \frac{-R}{2L} \pm \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}}$$

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$$\lambda_2 = \frac{-R}{2L} - \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}}$$

Case 1 Loss – free circuits ($R=0$) (Undamped)

$$\lambda_1 = \frac{-R}{2L} + \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}}$$

$R=0$, $\lambda =$

$$\sqrt{\frac{-1}{LC}} = j\sqrt{\frac{1}{LC}}$$

$\lambda_1 = j\omega$

$$\lambda_2 = \frac{-R}{2L} - \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}}$$

$$= -\sqrt{\frac{-1}{LC}}$$

$$= -j\omega$$

$\sqrt{-1} = i$

$\boxed{\sqrt{-1} = j}$

$\omega^2 = \frac{1}{LC}$

$\omega = \frac{1}{\sqrt{LC}}$

$LC\omega = 1$

$\omega^2 LC = 1$

$\omega^2 = \frac{1}{LC}$

$\omega = \sqrt{\frac{1}{LC}}$

$\lambda_1 = j\omega$, $\lambda_2 = -j\omega$

$i_L = k_1 e^{\lambda_1 t} + k_2 e^{\lambda_2 t}$

$i_L = k_1 e^{j\omega t} + k_2 e^{-j\omega t}$

$i_L = k_1 e^{j\omega t} + k_2 e^{-j\omega t}$ ⟶ (4)

$e^{j\omega t} = \cos\omega t + j\sin\omega t$

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$e^{-j\omega t} = \cos\omega t - j\sin\omega t$

$i_6 = k_1(\cos\omega t + j\sin\omega t) + k_2(\cos\omega t - j\sin\omega t)$

$= (k_1+k_2)\cos\omega t + j(k_1-k_2)\sin\omega t$

$A = k_1+k_2 \quad ; \quad B = j(k_1-k_2)$

$i_6 = A\cos\omega t + B\sin\omega t$

$i_6 = A\cos\omega t + B\sin\omega t$

$i_6 = I_m \sin(\omega t+\phi)$

$A = I_m \sin\phi \qquad B = I_m\cos\phi$

$i_6 = I_m\sin\phi\cos\omega t + I_m\cos\phi\sin\omega t$

$= I_m[\sin\phi\cos\omega t + \cos\phi\sin\omega t]$

$\sin A\cos B + \cos A\sin B = \sin(A+B)$

$A^2 = I_m^2\sin^2\phi$

$B^2 = I_m^2\cos^2\phi$

$A^2+B^2 = I_m^2(\sin^2\phi + \cos^2\phi)$

$A^2+B^2 = I_m^2$

$I_m = \sqrt{A^2+B^2}$

$\boxed{i_6 = I_m\sin(\omega t+\phi)}$ — (5)

Transient current is sinusoidal wave if $R=0$

$$\frac{A}{B} = \frac{I_m\sin\phi}{I_m\cos\phi} = \tan\phi = \frac{A}{B}$$

$$\phi = \tan^{-1}\frac{A}{B}$$

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=> Difference between critical damping, over damping, under damping.

* critical damping returns the system to equilibrium as fastes possible without over shooting

* An underdamped system will oscillate to the equilibrium position. It is the condition in which damping of an oscillator causes the amplitude of oscillations to decrease over time eventually approach zero.

* An overdamped system moves more slowly to under equilibrium than one that is critically damped. This is the condition in which damping of an oscillator causes it to return to equilibrium without oscillating.

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Case 2 : Low-loss circuit $\left[\frac{R^2}{4L^2} < \frac{1}{LC}\right]$
Underdamped

$$i_1 = k_1 e^{\lambda_1 t} + k_2 e^{\lambda_2 t}$$

$$\lambda_1 = \frac{-R}{2L} + \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}}$$

$\sqrt{-1} = j$

$$= \frac{-R}{2L} + \sqrt{\left[-\frac{1}{LC} - \frac{R^2}{4L^2}\right]}$$

$$\lambda_1 = \frac{-R}{2L} + j\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$$

$$\lambda_2 = \frac{-R}{2L} - j\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$$

Let $\alpha = \frac{R}{2L}$ and $\omega = \sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$

$\lambda_1 = -\alpha + j\omega$ and $\lambda_2 = -\alpha - j\omega$

$$i_L = k_1 e^{(-\alpha + j\omega)t} + k_2 e^{(-\alpha - j\omega)t}$$

$$= e^{-\alpha t}\left(k_1 e^{j\omega t} + k_2 e^{-j\omega t}\right)$$

$$i_L = I_m e^{-\alpha t} \sin(\omega t + \phi) \quad \rightarrow (6)$$

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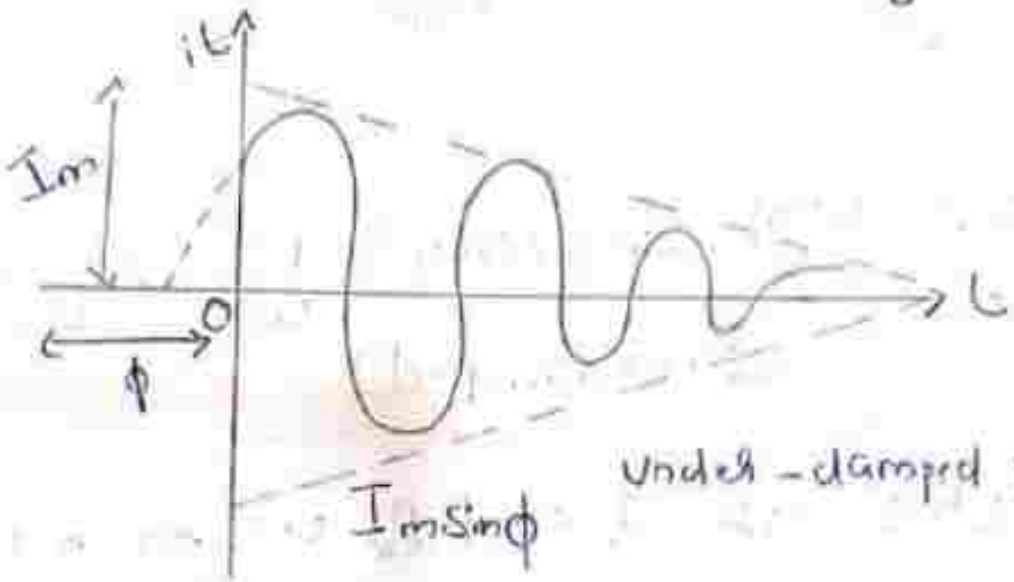
In this equation $e^{-\alpha t}$ is the exponentially decaying function which represents the underdamped transients oscillating currents.



Under-damped case

$e^{-\alpha t}$ is called decay factor / damping factor OR decrement

Logarithmic decrement $= \frac{\alpha}{f}$

$= \frac{R}{2Lf}$

It is the ratio of two successive amplitudes

f — frequency of oscillating.

$\omega = 2\pi f$ for underdamped oscillation

$\omega = \sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$ is called angular frequency.

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$\frac{R^2}{4L^2} \ll \frac{1}{LC}$

$f = \frac{1}{2\pi\sqrt{LC}}$

$\omega = \frac{1}{\sqrt{LC}}$

case 3. High-loss circuit $\frac{R^2}{4L^2} > \frac{1}{LC}$

$\Rightarrow$ (overdamped)

In this case λ_1 and λ_2 will be real numbers

$\lambda_1 = \frac{R}{2L} + \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}} = -\alpha + \gamma$

$\lambda_2 = \frac{-R}{2L} - \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}} = -\alpha - \gamma$

Here $\gamma \rightarrow$ Damping

$\therefore i_L = K_1 e^{(-\alpha+\gamma)t} + K_2 e^{(-\alpha-\gamma)t}$

$= e^{-\alpha t}(K_1 e^{\gamma t} + K_2 e^{-\gamma t})$

$e^{\gamma t} = \cosh\gamma t + \sinh\gamma t$

$e^{-\gamma t} = \cosh\gamma t - \sinh\gamma t$ (by Hyperbolic functions)

$\therefore i_L = e^{-\alpha t}((K_1+K_2)\cosh\gamma t + (K_1-K_2)\sinh\gamma t)$

$i_L = e^{-\alpha t}(A\cosh\gamma t + B\sinh\gamma t) \rightarrow (3)$

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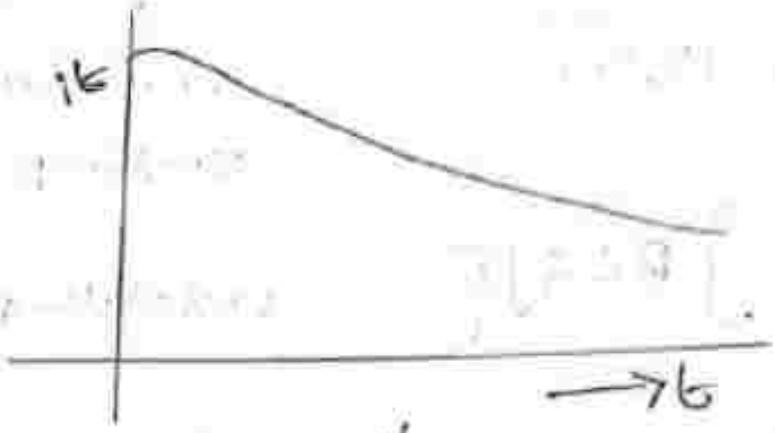

$i_c = e^{-\alpha t}(A\cosh\beta t + B\sinh\beta t)$

overdamped.

case 4. $\frac{R^2}{4L^2} = \frac{1}{LC}$ critical damping.

$\Rightarrow$

In this case $\lambda_1 = \lambda_2 = \frac{-R}{2L} = -\alpha$

Hence the general solution

$$(i_c = k_1 e^{\lambda_1 t} + k_2 e^{-\lambda_2 t})$$

$$i_c = (k_1 + k_2) e^{\frac{-R}{2L}t}$$

OR $i_c = (k_1 + k_2) e^{-\alpha t}$

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⇒	condition	Transient Current
1)	$R = 0$	Undamped Sine wave
2)	$R^2 < \frac{4L^2}{LC}$ } $R < 2\sqrt{\frac{L}{C}}$	underdamped, oscillatory
3)	$R > 2\sqrt{\frac{L}{C}}$	over damped, non oscillatory slowly reach equilibrium
4)	$R = 2\sqrt{\frac{L}{C}}$	critical damping: non oscillatory quickly reach equilibrium.

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Department of Chemistry

FUELS FROM PETROLEUM INDUSTRY

BY ANJANA PS

PETROLEUM

- Greek:petra=rock,Latin:oleum=oil
- Dark viscous oily liquid
- Occurring deep below earth's crust entrapped under rocky strata.
- Complex mixture of hydrocarbon including alkanes and cycloalkanes along with some unsaturated hydrocarbons,aromatic hydrocarbons and small quantities of nitrogen,Sulphur,oxygen compounds.
- Exact composition varies with place of orgin.

NATURAL GAS

- Gaseous mixture
- Occurs a cover of gaseous mixture over the petroleum deposit occurring below the rocky strata.
- Consists of mainly low boiling Alkanes, the chief constituent (60-90%)being methane(along with some ethane,propane,butane,etc and some other gases such as CO2, H2s,N^2).
- Used as a domestic fuel and also as an automobile(CNG is compressed natural gas)

REFINING OF PETROLEUM-PETROLEUM DISTILLATION

- Since petroleum contain thousand of hydrocarbons separation of the pure compounds is not feasible or even necessary.
- The crude petroleum, called crude oil is obtained from oil wells is subjected to fractional Distillation to remove associated impurities and to get various useful fractions.
- Fraction obtained from Distillation of petroleum are still mixtures of hundreds of hydrocarbons and are called petroleum fractions.
- The process of removal of undesirable impurities and the separation of petroleum into different useful fractions by fractional Distillation is called refing of petroleum

through the process is refractionated are, in fact, refractionated ... to get various products. Some of the chief fractions and their approximate composition, along with their boiling ranges and uses, are given in Table 7.1.

Table 7.1: Fractions obtained from petroleum distillation

No.	Name of fraction	Approximate composition	Boiling range	Uses
1	Petroleum gas (Gaseous hydrocarbons)	C_1 to C_4	Up to 30°C	As fuel gas, in the production of carbon black and H_2.
2	Crude naphtha Refractionated into the following fractions:	C_5 to C_{10}	30–150°C	
	(a) Petroleum ether	C_5 to C_7	30–70°C	As a solvent for rubber, fats, oils, varnishes, etc. and in the laboratory.
	(b) Gasoline or Petrol	C_7 to C_9	70–120°C	As an automobile fuel, for dry cleaning.
	(c) Benzine	C_9 to C_{10}	120–150°C	For dry cleaning
3	Kerosene oil	C_{11} to C_{15}	150–300°C	As a fuel in stoves, for making oil gas, as illuminant.
4	Diesel oil or Fuel oil or Heavy oil	C_{16} to C_{20}	300–350°C	As a fuel in diesel engines (trains, automobiles and tractors), electric generators and thermal power plants, for the production of gasoline

5	Lubricating oil	C_{21} to C_{24}	350–400°C	For lubrication
6	Paraffin wax	C_{25} to C_{29}	Above 400°C (Cooling gives solid wax with m.p ~50-55°C)	For making candles, ointments, waxed papers, varnishes, paints, and toilet soaps.
7	Asphalt, pitch, petroleum coke, bitumen	C_{30} and up	(Black tarry residue)	For water proofing, in paints, for road surfacing.

THANK YOU

CHEMISTRY PRESENTATION

Topic- Water Pollution

Presented by Kalathinkal Sojiya Joy

WATER POLLUTION





Pollutants of water and their toxic effects

1. Water Pollution by sewage
2. Water pollution by industrial effluents



1. Water pollution by sewage

Sewage- organic or inorganic waste matter of the community carried by water.

1% solids:	99% water
70% organic materials:	proteins, carbohydrates, fats, etc
30% inorganic materials:	grit, salts, metals, etc

Domestic sewage:– Toxic effects

Domestic sewage are discharge into nearby water bodies.

Toxic effects:

1. Indues foul odor or stench to water, imparts colour to it and causes turbidity
2. Carrier of several pathogenic microorganisms.
3. Causes dissolved oxygen depletion.
4. Leads to Eutrophication.



Sewage treatment before discharge

Sewage treatment process involves various steps:

1. Primary treatment : removes settleable solids physically or chemically.
2. Secondary or Biological treatment: aerobic and anaerobic microorganisms removes organic matter.



2. Water Pollution by industrial effluent

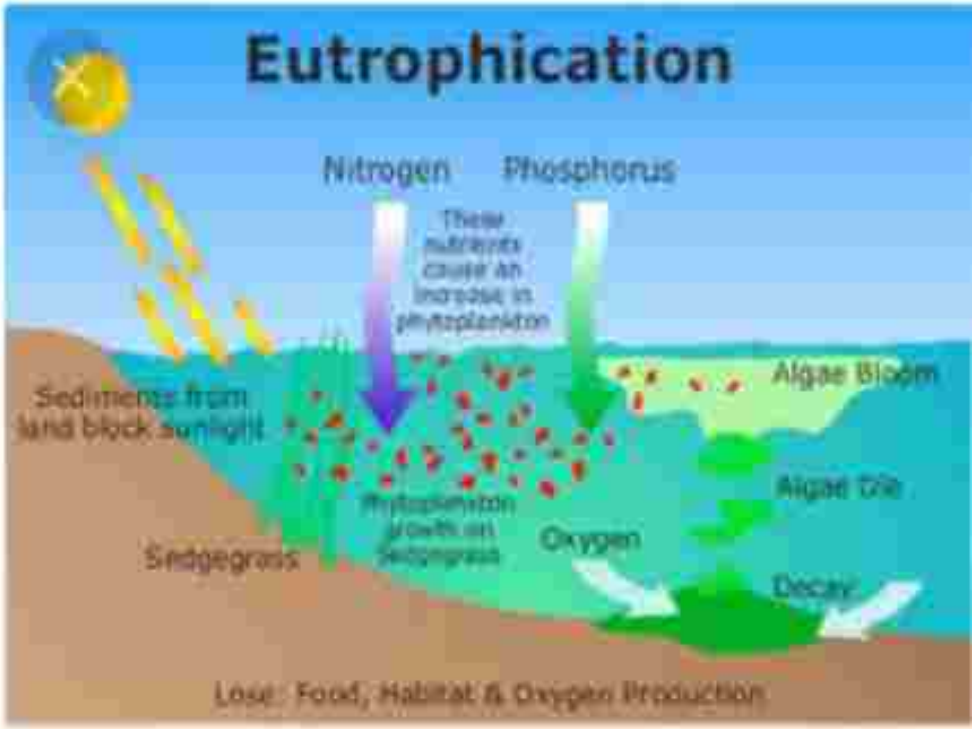
Industrial effluents discharged into fresh water bodies have the greatest potential to pollute water.

Industrial effluents: simple nutrients, organic matter and complex substances



Industrial effluents: - Toxic effects

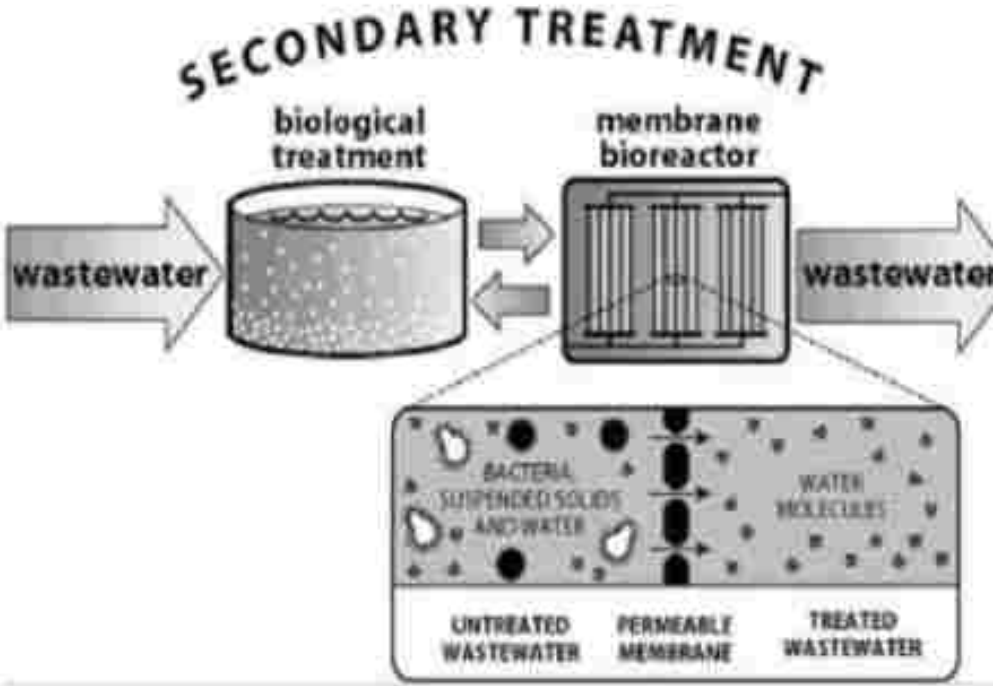
1. Causes oxygen depletion and are highly poisonous to aquatic and terrestrial living organisms.
2. Causes Eutrophication
3. Metal plating Industries effluents are extremely toxic to all organisms
4. Chemical industries effluents make water corrosive
5. Paper mills release effluents are highly poisonous and carcinogenic
6. Radioactive effluents cause radiation pollution.
7. Tanneries wastes contain pathogenic bacteria.



Industrial effluents treatment

Industrial effluents treatment involves:

1. Primary and Chemical treatment- neutralization coagulation, oxidation, etc
2. Secondary treatment uses microorganisms.
3. Tertiary treatment - advanced biological, chemical and physical methods and recycling.




FOOD COLOURS

Food colours or food colourants are coloured substances added to food during or after its processing to impart a colour, the purpose of which may be to maintain, restore or improve its appearance.

- Permitted colours
- Non -permitted food colours

Only those colours that have been approved for safe use after stringent evaluation regarding their safety by the concerned Government Agencies of the respective countries can be used as food additives.

Safety limits prescribed by Government Agencies about 200 mg /kg of the finished product, these substance are called permitted colours.

- Natural colourants
- Synthetic colourants

Natural colourants

Pigments derived from natural sources such as vegetables or animals.

▫□ Anatto extract (yellow), from annatto seeds
▫□ Canthaxanthin(violet), a terpenoid from mushroom, algae.
▫□ Caramel (yellow to tan), a complex polysaccharide.
▫□ Beta-carotene(yellow to orange), from carrots and a variety of plants.▫□ curcumin(yellow-brown), from turmeric

- Saffron (a hybrid of orange and yelow) a carotenoid from dried stigma of the Crocus Sativus Linnaeus, a perennial plant.

Synthetic colourants

These are man made colours. They are intense, less expensive, and easily create a variety of hues with uniformity.

- Fast Green FCF, a green triarylmethane dye.
- Indigo Carmine, a blue indigoid dye.
- Brilliant Blue FCF, a blue triarylmathane dye.
- Sunset Yellow FCF, a yellow azo dye.

Non-permitted food colours

Those colours that are banned from use as food additives on account of their toxic characters are referred to as non - permitted colours.

- Rhodamine B:a red dye

Cause degenerative changes in the liver and kidney.

Retardation of growth and haemolysis of red blood cells.

- Orange II:An orange dye

Cause haematological changes and retardation of growth.

- Metanil Yellow:A yellow dye

Cause degenetative changes in stomach, kidneys and liver as well as in the reproductive system.

- Malachite green :A green dye

Capable of damaging liver, kidney, heart, and spleen as well as causing lesions of skin, eyes, lungs and bones.

- Auramine:a yelow dye

Damage kidney, liver as well as as cause retardation of growth.

▫□ Sudan dyes

Sudan I, II, III, IV, a group of red dyes, cause kidneys lesions as well as damage of liver.

ENVIRONMENTAL POLLUTION

INTRO

- The word 'environment', derived from Greek, literally means 'surroundings'. It includes the surrounding objects, regions, conditions and especially circumstances of life of all living beings.
- Environment can be defined as the sum total of all social, economic, biological, physical and chemical factors which constitute the surroundings and influence the life of a living organism in its natural habitat.
- Environmental studies deal with the sum total of all social, economic, biological, physical and chemical interrelations between the living beings and their surroundings.
- 'Environmental Chemistry' deals with the study of chemical phenomena in the environment. It includes the study of the origin, transport, reactions, effects and fates of chemical species in the environment.
- In his attempt to modify the environment and improve the quality of his life, man has interfered constantly with the environment and this has raised very many environmental issues; one of them is Environmental Pollution.

SEGMENTS OF ENVIRONMENT

- The environment consists of the following four segments.

1. ATMOSPHERE : Atmosphere is the protective cover of gases, consisting mainly of N_2 and O_2, along with some CO_2, Ar and O_3 as well as traces of He, Ne, CH_4, etc. It absorbs all the harmful solar radiations and allows only the near UV, near IR and radiofrequency waves to pass through it towards the Earth. It absorbs part of the IR radiation emitted by the sun and also that re-emitted by the Earth, and thereby maintains the thermal balance of the Earth.

2. HYDROSPHERE : Hydrosphere includes all types of water resources — ~97% of Earth's water is in the oceans~2% of it is tied up in the polar ice caps and glaciers, and ~1% of It is available in fresh water bodies like the rivers, lakes, streams, etc. and as ground water.

3. LITHOSPHERE : Lithosphere is the outer mantle of solid Earth, consisting of minerals occurring in the Earth's crust in the form of soil, rocks, etc.

4. BIOSPHERE : Biosphere denotes the realm of living organisms (plants, animals etc) where they live together being dependent on each other and also interact with the other segments of the environment.

ENVIRONMENTAL POLLUTION

POLLUTION AND POLLUTANTS

Environmental pollution is the contamination of any part of our environment, particularly through human activities, by any undesirable substance or factor detrimental to the environment; it means affecting undesirable changes in our surroundings that have harmful effects on plants, animals and human beings.

- Any solid, liquid or gaseous substance present in greater concentration than in natural abundance, or any agent like heat, radiation or noise, produced due to human activities or natural happenings and is ultimately harmful to the environment (and there from to the living systems) is called POLLUTANT.

- In short, a substance or agent or factor which causes environmental pollution is called a POLLUTANT.

TYPES OF POLLUTION

There are various types of environmental pollution and they are classified in different ways; only a few are mentioned here.

One board way of classification is on the basis of the type of environment being polluted — air, water or soil.

1. AIR POLLUTION : Air pollution means the contamination of the air in our atmosphere by undesirable substances by gases or particles of liquids or solids.
2. WATER POLLUTION : Water pollution means the contamination of the water bodies and the ground water by undesirable substances or organisms or agents like heat.
3. SOIL POLLUTION : Soil pollution means the contamination of the soil by any undesirable substance, organism or agent that adversely affects the quality of the soil.

- Certain kinds of pollution are named after the agents or factors that cause them. Eg., Noise pollution, Thermal pollution and radiation pollution are respectively caused by the agents noise, heat and radiation (from radioactive ssubstances.

- Similarly, on the basis of the type of pollutant involved, we may have sulphur dioxide pollution, Fluoride pollution, Carbon monoxide pollution, Smoke pollution, Lead pollution, Mercury pollution, Solid waste pollution, Pesticide pollution, Fertilizer pollution, and so on.

TYPES OF POLLUTANTS

- Pollutants may be Air pollutants, Water pollutants, Soil pollutants, etc. e.g., Gases such as CO, SO2, NO2, etc. are Air pollutants; pesticides, Fertilizers, detergents, etc. are Water pollutants; Metals and their compounds, plastics, fertilizers, pesticides etc. are soil pollutants. It is obvious that the same substance may pollute air, water and soil at the same time.
- Pollutants may broadly be classified also into the following types.

1. DEGRADABLE OR NON-PERSISTENT POLLUTANTS are those which are degradable by natural processess, e.g., discarded vegetables, domestic sewagt, etc.
2. SLOWLY DEGRADABLE OR PERSISTENT POLLUTANTS are those which remain in the environment in an unchanged form for many decades, e.g., pesticides such as dichlorodiphenyltrichloroethane (DDT), plastics, many chemicals, nuclear wastes, etc.
3. NON-DEGRADABLE POLLUTANTS are those that are not broken down by natural processess, e.g., toxic metals like lead, cadmium, mercury, etc.

THE MAJOR REGIONS OF ATMOSPHERE

The protective cover of gases surroundings the earth is called Atmosphere. It extends to about 1600 km above the Earth's surface.

In order to consider atmospheric pollution, it is required to have a basic knowledge about the major regions of the atmosphere, at least about the two regions ——Troposphere & Stratosphere —— existing immediately above the Earth.

The atmosphere has the 5 concentric layers or regions

1. TROPOSPHERE: The lowest region of atmosphere in which living organisms exist is called Troposphere. It extends up to the height of ~8km at the poles and ~18 km near the equator. It's temperature decreases with height. The gases present in it are mainly N2 and O2, a lot of water vapour, some CO2 and Ar, and traces of He, Ne, CH4, etc. It is a turbulent region of air movement and cloud formation.
2. STRATOSPHERE: The region above the troposphere, extending up to a height of ~50 km above sea level, is called Stratosphere. Its temperature ranges from -55°C to 5°C. It contains N2, O2, ozone and some water vapour. The presence of ozone ('Ozone Umbrella') in the stratosphere prevents about 99.5% of the sun's harmful UV radiations from reaching the Earth's surface, thereby protecting the living organism of the Earth from the harmful effects of such radiation.
3. MESOSPHERE: The region above the stratosphere, between 59 and 80 km above sea level, is called Mesosphere. It contains N2, O2, Ozone, etc. It's temperature is very low and drops to about –100°C at a level of 80 km from Earth.

4. IONOSPHERE : The region above Mesosphere up to ~500 km is called Ionosphere. It contains ionized gas molecules (O_2, O^+, NO^+, etc), atoms and free electrons. It's particles reflect the radiowaves signaled from the Earth back to the Earth surface and thus enables the transmission of radio messages around the world.

5. EXOSPHERE : The region above Ionosphere extending up to ~1600 km and merging with space is called Exosphere. It contains atomic hydrogen and helium. It has a very high temperature due to solar energy.

THANK YOU

The main disadvantage of CNG is its low energy density compared with the liquid fuels like gasoline. CNG vehicles therefore require big, bulky fuel tanks; consequently, CNG usage is practical mainly for large vehicles such as buses and trucks.

PHARMACEUTICALS

Introduction

Chemists and biochemists have long been interested in developing methods to fight diseases. Most importantly, remarkable progress has been made in recent years in understanding the chemical reactions that regulate biological processes. This accumulation of knowledge is, in fact, the first line of defense for man against diseases. Thanks to better immunization and nutrition, coupled with prevention and treatment of infectious diseases that could be achieved by making use of such knowledge, the average life expectancy of man has increased steadily during the past few decades. For example, in India, the average life expectancy used to be below 50 years in the

are called *prescr*
potentially dang
specific medical
are examples.

Chemical name

Any drug has

The **chemical**
should be able to

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name.

The **generic**
for its actual che

early 1900s; it has steadily climbed to 67.3 years and 69.6 years respectively for males and females by 2015.

With chemistry as the framework, we take a look in this Section at the most important classes of chemicals available to treat diseases — *i.e.*, the *compounds manufactured for use as medicinal drugs* — namely, *pharmaceuticals*.

Drugs

A ***drug*** is a chemical, normally of low molecular mass (~100–500u), which when absorbed into the body of a living organism interacts with macromolecular targets and produces a biological response.

When the biological response of a drug is healing and beneficial, it is called a ***medicine*** and is used in diagnosis, prevention and treatment of disease(s).

A chemical substance used in the treatment, cure, prevention, or diagnosis of disease or used to otherwise enhance physical and/or mental well-being is called a ***medicine*** or a ***pharmaceutical drug***.

The treatment of diseases by destroying the *invading organism* without damaging the cells of the host by the use of chemicals is known as *chemotherapy*. In general, the use of chemicals for therapeutic effect is called *chemotherapy*.

Drugs that can be bought in any drug store or general store or supermarket without the prescription of a medical practitioner are called ***over-the-counter drugs***. Aspirin, paracetamol, antacids, most cough syrups, etc. are examples.

Drugs that can be bought only with the prescription of a medical practitioner are called ***prescription drugs***. In general, a prescription drug is one that has potentially dangerous side effects and hence should be used only by people with specific medical problems under a doctor's care. Antibiotics and narcotic analgesics are examples.

Chemical names, generic names and trade names of drugs

Any drug has a chemical name, a generic name and a trade name.

The **chemical name** of a drug is that systematic name for it from which a chemist should be able to write its complete structure.

The systematic chemical names of drugs are often too complicated for normal use. So, each drug generally has a commonly used name which is normally somewhat related to its actual chemical name; such a name for a drug is called its *generic name*.

"The **generic name** of a drug is that name which is the generally accepted substitute for its actual chemical name."

Different manufacturers generally use different names for the same drug when they sell it in the market: such names are called the *trade names* for that drug.

"The **trade name** (or **brand name**) of a drug is the manufacturer's name for it in the medicinal market."

Let us illustrate the above naming process with two simple examples.

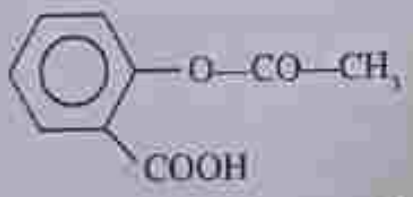
1. *N*-(4-hydroxyphenyl)ethanamide [or *N*-(4-hydroxyphenyl)acetamide], also commonly called 4-acetamidophenol, is a drug widely used for reducing fever (*i.e.*, as an antipyretic) and also for relieving pain (*i.e.*, as an analgesic). *N-(4-hydroxyphenyl)ethanamide* or *4-acetamidophenol* is its chemical name. Its generic name is *paracetamol* (in Britain, India, etc.) or *acetaminophen* (in USA, Japan, etc). Different manufacturers sell it under different trade names. It is sold in India under the trade names Crocin, Calpol, Metacin, Dolo, etc.



Chemical name: *N*-(4-hydroxyphenyl) ethanamide or 4-acetamidophenol
Generic name: Paracetamol or acetaminophen
Trade (brand) names: Crocin, Calpol, Metacin, Dolo, etc.

Fig. 7.1: Paracetamol

2. *2-acetoxybenzoic acid*, also commonly called *acetylsalicylic acid*, is a drug widely used to prevent platelet coagulation (and thereby prevent heart attack, stroke and blood clot). It is also used (though less frequently now a days) to reduce fever, pain and inflammation. *2-acetoxybenzoic acid* or *acetylsalicylic acid* is its chemical name. Its generic name is *aspirin*. It is sold in India under the trade names Aspin, Alpyrin, ASA, Aspidor, Ascad, etc.



Chemical name: 2-acetoxybenzoic acid or acetylsalicylic acid
Generic name: Aspirin
Trade (brand) names: Aspin, Alpyrin, ASA, Aspidor, Ascad, etc.

Fig. 7.2: Aspirin

ENVIRONMENTAL POLLUTION

AIRP POLLUTION BY OXIDES OF NITROGEN.

- The oxides of nitrogen mainly along with some no2 ,n2o ,n2o3 and n2o5 are major air pollutants present in automobile exhaust and effluent gases from electric power industry, fertilizer industry, explosive industry and gold jewellery works.
- No is formed by the high temperature combination of N2 and O2 is slowly oxidized to NO2 and other oxides.
- No although not a major direct health hazard producers. NO2 which is fairly toxic to humans.
- NO2 has an irritating effect on mucus membrane and in higher doses causes severe bronchitis and respiratory problems.

- In a concentration of 3 ppm for 1 hour it causes bronchoconstriction in man and short exposure at 150 to 220 ppm levels produces Fibrotic changes in the lungs with fatal results.
- NO_2 disrupts some cellular enzyme systems. It is a pulmonary irritant and causes pulmonary hemorrhage and pulmonary edema leading to death.
- High levels of NO_2 also cause gum inflammation, pneumonia, internal bleeding and lung cancer.
- Cigarette smoke contains high levels of NO_2 which causes lung diseases and lung cancer to active smokers as well as to passive smokers.

- Oxides of nitrogen involves in various photochemical reaction with hydrocarbon in the atmosphere this give rise to photochemical smog which is characterized by brown hazy fumes which irritate eyes ,nose throat and lungs.
- This smog is a regular feature of some of the major cities of the world.
- Automobile exhaust are the major culprits in the formation of photochemical smog which is also known as the los Angeles type smog in memory of the terrable smog experienced in Los Angeles in 1944.
- Nitrogen oxides also cause the precipitation of nitric acid in the atmosphere and leads to the detrimental phenomenon called acid rain.

Formation of photochemical smog

At high concentrations of the nitrogen oxides, a photochemical chain reaction occurs in which nitric oxide (NO) is converted into nitrogen dioxide (NO_2).

$$2NO(g) + O_2(g) \longrightarrow 2NO_2(g)$$

NO_2, in turn, photochemically decomposes into nitric oxide and free oxygen atom.

$$NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$$

The reactive oxygen atoms thus produced combine with O_2 to form *ozone*.

$$O(g) + O_2(g) \rightleftharpoons O_3(g)$$

This ozone oxidizes the NO formed in the previous reaction to regenerate brown NO_2 which is a major contributor to the brown haze of the smog.

$$NO(g) + O_3(g) \longrightarrow NO_2(g) + O_2(g)$$

Both NO_2 and O_3 are strong oxidising agents and can react with the unburnt hydrocarbons in the polluted air to produce various chemicals such as *formaldehyde* (HCHO), *acrolein* (CH_2=CH–CH=O) and *peroxyacetyl nitrate* (PAN, CH_3–CO–ONO_2).

e.g.,
$$3CH_4(g) + 2O_3(g) \longrightarrow \underset{\text{Formaldehyde}}{3HCH{=}O} + 3H_2O$$

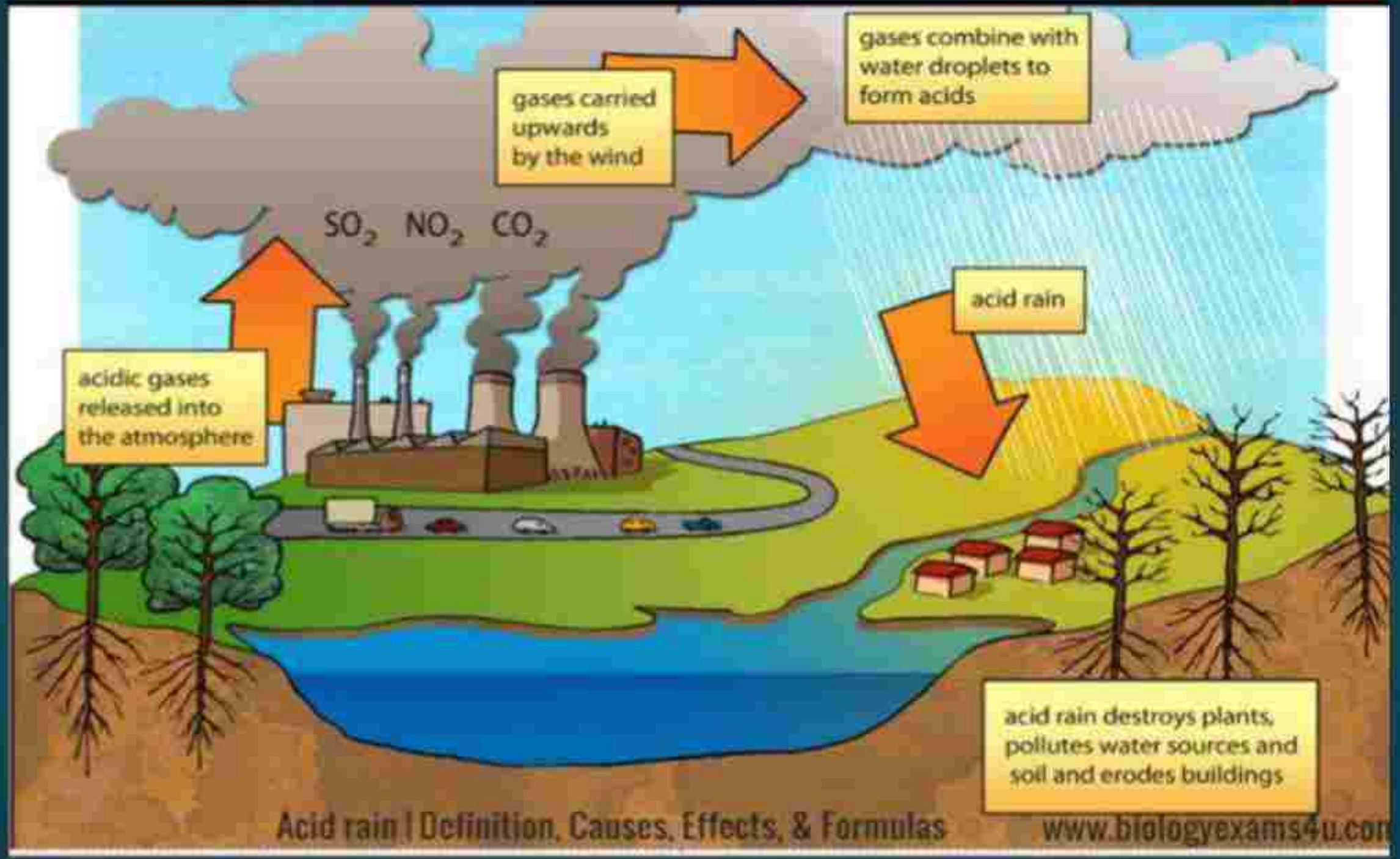
These linger in the atmosphere producing smog.

AIR POLLUTION BY THE OXIDES OF SULPHUR.

- The oxides of sulphur SO2 and so3 are produced as a result of the burning of high sulphur content fuels in thermal power plants and industries.
- so2 and so3 are present in automobile exhaust also.
- Even at very low levels SO2 and so3 cause irritation of eyes and damage the respiratory tract producing cough and chocking in humans.
- Inhalation of SO2 at the level of 5 Ppm for 1 hour can cause construction of the bronchial tubes while inhalation at a level of 10 ppm for 1 hour can coast severe respiratory distress.

- Inhalation of SO_2 at higher levels leads to bronchitis emphysema chronic asthma and even cancer.
- Inhalation at very high levels causes death by suffocation.
- SO_2 is a major factor which causes the formation of sulphurous smog.
- Not only is it a major irritant of eyes nose throat and lungs but also causes pneumonia bronchitis and allied respiratory problems.
- This is also called London smog in memory of terrible smog that London experienced in December 1952. The smog had then prevailed in the city for 5 days and had cause to the death of 4000 to 5000 inhabitants also making thousands ill.

- Sulphurous smog also called classical smog occurs in cool humid climate and his particularly found in winter mornings in many countries.
- It is a mixture of smoke , fog and Sulphur dioxide.
- Classical smog is chemically a reducing mixture and so it is also called the reducing smog.
- The sulphur oxides cause the precipitation of sulphuric acid in the atmosphere leading to the phenomenon acid rain.
- Which is highly detrimental to living organisms and destroys buildings and sculptures.


gases carried upwards by the wind
gases combine with water droplets to form acids
SO_2 NO_2 CO_2
acidic gases released into the atmosphere
acid rain
acid rain destroys plants, pollutes water sources and soil and erodes buildings
Acid rain | Definition, Causes, Effects, & Formulas
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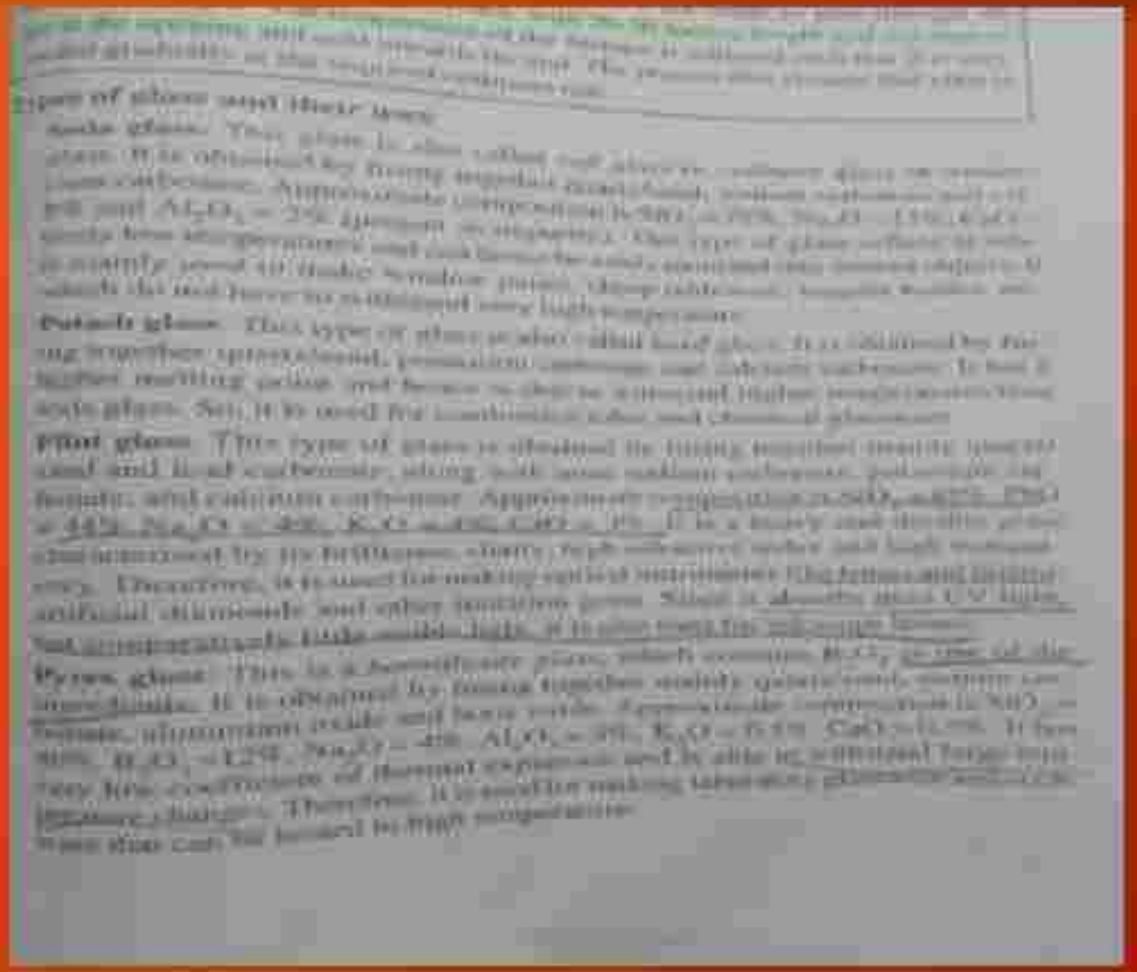
- The sulphur oxides adversely affect plants also.
- They are absorbed through the stomata into the mesophyll of the leaves which inactivate the cells.
- This leads to tissue collapse , bleaching of leaves, dwarfing, stiffness of flower buds and eventual destruction of the plants.

CHEMISTRY IN DAILY LIFE

Glass

- Glass is a transparent material obtained when a complex mixture of highly viscous molten silicates, upon moderately rapidly cooling solidifies to an amorphous Rigid body without crystallisation .
- it is essentially a super cold liquid.
- Upon heating it gradually soft and into a loose mass over a range of temperature and can be moulded or Blown into any desired shape enabling the manufacture of a variety of differently shaped article



Jena glass

- This glass was the forerunner of pyrex glass and is a Boro silicate class obtained by fussing Silica with sodium magnesium aluminium and zinc oxides as well as some Boron trioxide.
- it is a fine quality glass with improved resistance to heat and shock as well as to Chemicals.
- it is used for making thermometers me sharing message optical ware etc.

Crookes glass

- 21 Glass that contains also Phosphorus and lead oxides along with some cerium oxide.

It is a soft s glass with low melting point and capable of absorbing uv radiations.

- it is used for making lenses of spectacles and other optical instruments.

- Thank you

ANTIBIOTICS

- Many microorganisms

Produce certain chemical which inhibit the growth or metabolism of some other disease causing

Microorganisms.many of these can be made partly or completely by synthesis too.

Such chemical compounds are Known as antibiotics.it helps the immune system by either destroying invaders or preventing their multiplication.



- Ampicillin and amoxycillin are antibiotics that are synthetic modification of pencillin
- Eg:- Tetracyline,ciproflaxcin,aminoglycosides

Antacids

- The drugs that provide relief from the ailment symptoms of hyperacidity are known as Antacids. The most common ingredients in antacids drugs available are Hydrogen carbonate,calcium carbonate , magnesium hydroxide.etc Often in combination with other drugs like simethicone to help breakdown gas bubbles in your stomach .The antacid are available in tablets and syrup forms.These drugs neutralise excess acid in the stomach and raise pH to appropriate level.



Some Antacids are:-

- Cimetidine
- Ranitidine
- Omeprazole
- Oesmoperazole
- Rabeperazole

- The walls of human stomach contains thousands of cells that secrete HCl acid.The main purpose of which are to kill Microorganisms and to acid digestion.
- Hyperacidity is the condition in which the level of acid in gastric juice is excessive causing discomfort.it also leads to ulcers in stomach.

Antiseptics

- Chemicals which are used to prevent the growth of or kill Microorganisms are called antiseptics.They are not harmful to living tissues and hence can be safely applied on cuts,wounds, ulcers etc.



Some familiar examples

- Dettol is an antiseptic ,it is a mixture of chloroxylenol and terpineol
- Bithional is added to soaps to impart antiseptic properties.
- Iodine is a power ful antiseptic,it's 2-3% solution in alcohol water mixture is known as tincture of iodine.it is applied on wounds.
- Boric acid in dilute aq solution is a weak antiseptic for eyes.



CETANE NUMBER

The cetane number or cetane rating is an arbitrary scale for rating the relative ignition properties of diesel oil samples when they are used in a standard test engine.

- Diesal engines function differently from petrol engines.
- In a petrol engine, the air fuel mixture is compressed upto about 1/8 th to 1/12 th of its original volume and then ignited by means of a spark(from a spark plug).
- Unlike gasoline engines, a diesel engine has no spark plug to bring about ignition. They use high compression of air (upto about $1/14^{th}$ to $1/25^{th}$ of its original volume). To generate the high temperatures required for auto ignition of the fuel.
- In this respect, among the diesel oil range (C16 to C 20) of hydrocarbons, it has been found that straight – chain hydrocarbons are better fuels than branched- chain, alicyclic and aromatic hydrocarbons.



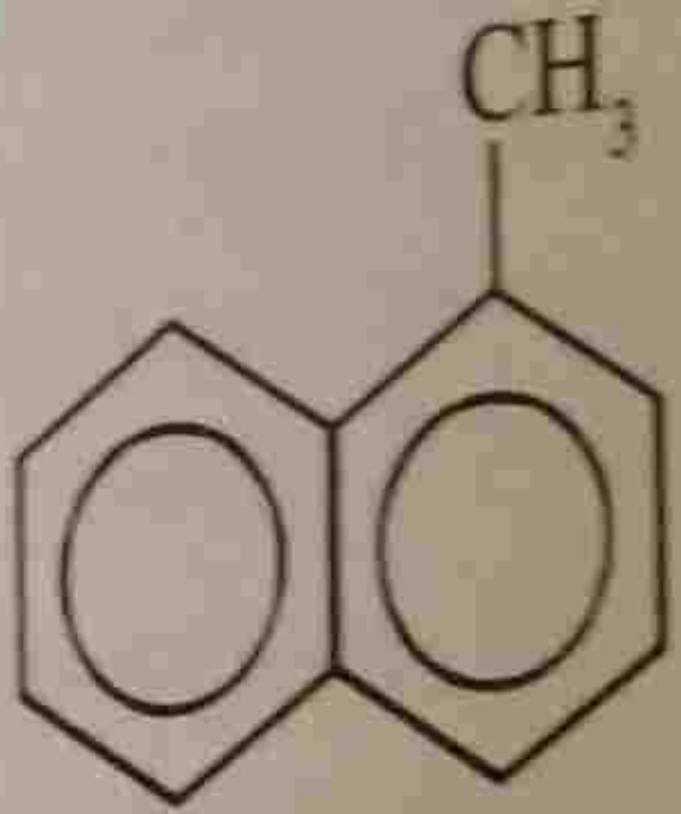
- The straight chain alkane *hexadecane (common name: n-hexadecane or cetane)*

And the aromatic hydrocarbon 1-*methylnaphthalene(common name:alpha methylnaphthalene), are taken as the standards for the purpose of cetane rating. Cetane which ignites rapidly is assigned a cetane number of 100 while alpha-methylnaphthalene which iginites slowly is assigned a cetane number of zero.*

thylnaphthalene which ig

$CH_3(CH_2)_{14}CH_3$

Hexadecane
(*n*-Hexadecane)
Cetane no. = 100



1–Methylnaphthalene
(α -Methylnaphthalene)
Cetane no. = 0

✦“The cetane number or cetane rating of a sample of diesel is defined as the percentage of cetane present in a mixture of cetane and alpha-methylnaphthalene which has the same ignition characteristics as the fuel sample under consideration when examined in the test engine under the same conditions.“

- Thus, if a diesel oil sample has the same ignition characteristics as a mixture of 46% cetane and 54% alpha- methylnaphthalene, it is assigned a cetane number of 46.This is generally the cetane number for regular diesel fuels at present.

- The higher the cetane number of diesel fuels, the better is the ignition characteristic of the fuel. Premium diesel fuels Containing additives known as cetane enhancers (eg. 2 – ethyl hexyl nitrate) can have a cetane number as high as 60.


WATER
QUALITY
PARAMETERS

- **Physical, chemical, microbial analysis** - Essential
- Usually expressed in:- **colour, taste, turbidity, pH, salinity, electrical conductivity, etc..**

Three of the parameters commonly used to express water quality

- **Dissolved oxygen**
- **Biochemical oxygen demand**
- **Chemical oxygen demand**

) DISSOLVED OXYGEN (D.O)

- *Fundamental requirement for maintenance of life for aquatic population.*
- *Important parameter of :- Extent of water purity or The extent of population associated with it.*

- In most waters, varying concentrations of dissolved oxygen are found.
- Because the amount depends upon the solubility of oxygen in each type of water.

- It is influenced by temperature, pressure, salinity etc...
- D.O is expressed as the weight of oxygen in milligrams present per litre of water or as parts per million.
- The optimum value of D.O for good water quality is 4-6 mg/L.

- Oxygen demanding substance present in water, their oxidation by micro organisms consumes the D.O and its level falls
- D.O level falls below critical value indicates **pollution of water**

DETERMINATION OF D.O

- Usually determined iodometrically.
- D.O react with KI, liberate I
- Which then titrated with standard sodium thiosulphate solution.

- D.O 1st treated with Mn^{2+}, precipitate MnO_2
- Then estimated iodometrically in acid medium.

2) BIOCHEMICAL OXYGEN DEMAND

- B.O.D of a sample of water is the amount of dissolved oxygen used up by suitable aquatic microorganisms for the oxidation of organic matter present in a well-aerated sample of water incubated

- It is usually expressed in mg of oxygen /litre or as parts per million.
- For pure water B.O.D value is 1-3mg/L
- Higher B.O.D value indicates pollution.

DETERMINATION OF B.O.D

- It is determined by finding out the amount of D.O in it before and after its incubation for 5 days in the dark at 20°C.The difference between initial and final values is the actual B.OD

- Before incubating the sample, it is well aerated to ensure that oxygen is present throughout the period of incubation.
- In domestic waste water or surface waters, microorganisms will be sufficiently present, but if the sample is deficient in microorganisms, they have to to introduced before incubation.

- This is usually done by adding settled domestic waste water stored for 24-36 hours at 20°C
- B.O.D test is empirical and semi-quantitative although the result could be considered as an indication of the quality of water source.

- The selection of microorganisms used as seed is very important and the results are often not reproducible.

3) CHEMICAL OXYGEN DEMAND

- C.O.D is the amount of oxygen used for the oxidation of organic matter in water determined with help of a strong chemical oxidant, usually potassium dichromate in acid

- C.O.D is useful for waste water studies
- C.O.D value is always higher than B.O.D value
- Any C.O.D value higher than

  250 ppm is regarded as indicative of pollution

- COD test involves boiling the water sample for two hours with excess of standard potassium dichromate in presence of sulphuric acid.
- The unreacted potassium dichromate is then determined by titration against standard ferrous ammonium sulphate.

- And the oxygen equivalent of the reacted dichromate calculated

Thank you

Flash point

The flash point of a particular liquid fuel is the minimum temperature at which it gives off enough flammable vapour to ignite in air giving a flash, when an ignition source is brought near its surface.

The flash point of a sample of fuel depends upon the proportion of volatile hydrocarbons present in it.

Whether a fuel is flammable or not at a certain temperature is determined by its vapour pressure or volatility.

In order to prevent fire-hazard, it is important that a fuel should not be too volatile

Government of each country fixes a certain temperature below which the oil must not give sufficient vapours to form an explosive mixture with air, this temperature is called flash point.

LPG

Liquefied petroleum gas

Liquefied at 15° c and pressure 1.7-7.5bar

Stored in steel cylinders

By-product of natural gas processing, petroleum refining& petroleum cracking.

Components :hydrocarbons containing three or four carbon atoms, mainly propane, butane.

A sulphur- based odourant added to facilitate leak detection.



Uses of LPG:

1) as a domestic fuel for cooking and heating purposes,

2) in scientific laboratories for heating purposes. 3) as an automobile fuel (as it is more energy efficient, is cheaper, and causes

much less pollution than other fuels like gasoline or diesel).
4) as a fuel for heating purposes in industry (e.g paper and food-processing
industries),

5) as a refrigerant.

CNG

CNG is compressed natural gas (compressed to about 1% of the original volume), stored in high-pressure tanks at 200-250 atm. It is produced using the natural gas drawn from gas wells or oil wells in conjunction with crude oil production.

CNG consists mainly (60-90%) methane along with some ethane, propane, butane, etc. And some other gases such as CO_2, H_2S, N_2, etc.. A sulphur-based odourant (like a mercaptan) is normally added to CNG to facilitate leak detection.



Uses

Used as a fuel in automobiles such as buses and trucks. It is also used as a fuel in locomotives.

The main advantage

CNG vehicles emit far less carbon monoxide, nitrogen oxides (NO), and particulates.

#less pollution. Further,

unlike LPG, it is lighter than air,

minimizing the risk of a fire-hazard upon leakage

The main disadvantage of CNG is its low energy density compared with the liquid fuels like gasoline CNG vehicles **therefore require big, bulky fuel tanks** consequently, CNG usage is practical mainly for large vehicles such as buses and trucks.

Thankyou.....



CHEMISTRY IN DAILY LIFE

RATING OF FUELS USED IN INTERNAL COMBUSION ENGINES

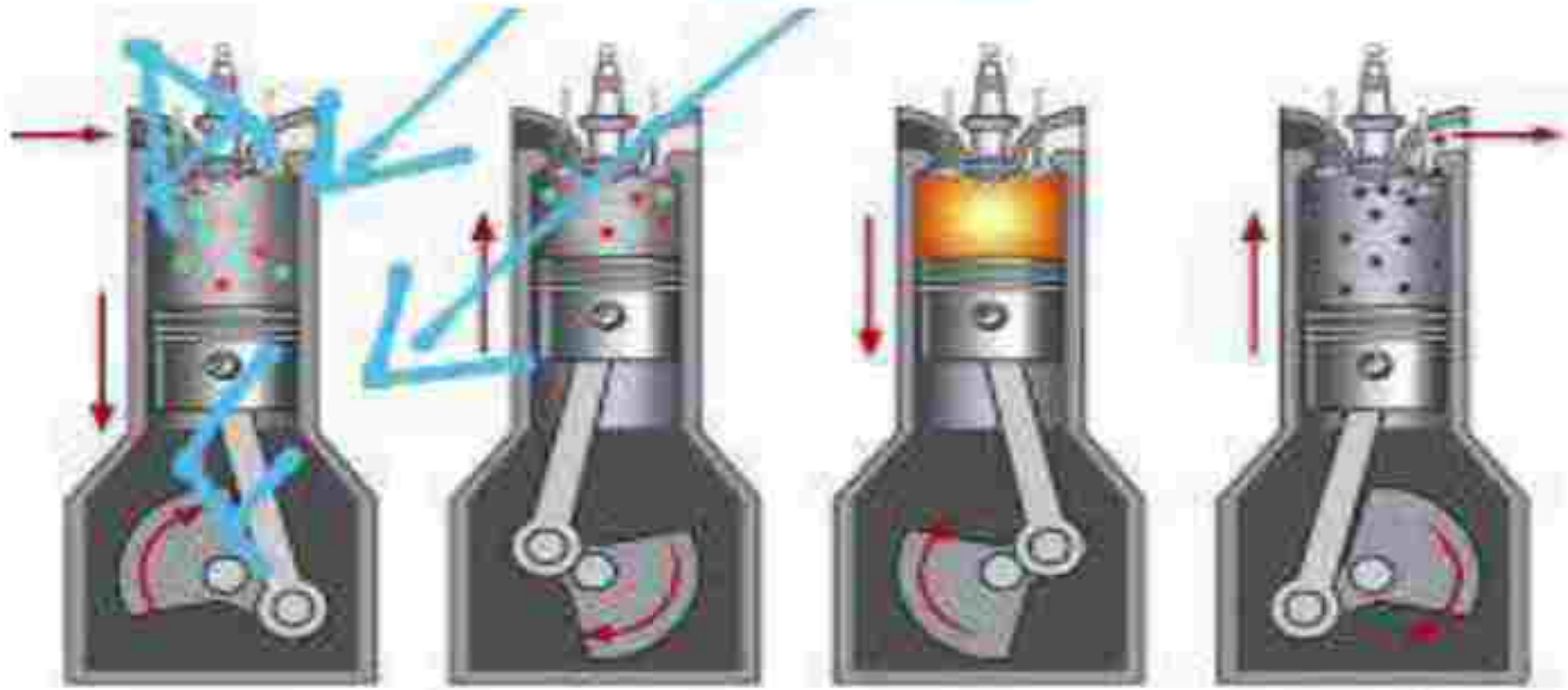
In an internal combustion engine using gasoline as fuel the gaseline air mixtures is first compressed and then ignored by means of spark In the cylinder of the engine.

The products of combustion of keypad a much greater volume than the original gasoline and air and this larger expansion cause the movement of the piston.

Efficiency of of the engine depends upon the compression to which the fuel air mixer is subjected to at the time of combustion the greater the compression the greater is the efficiency.

- But beyond a certain compression limit the mixture burns suddenly and rapidly.
- This Rapid burning causes uncontrolled explosion of the fuel causing a violent jerk against the Piston, as evidenced by a knocking or pinging sound in the engine. This is called a knocking just reduces engine power and may damage the engine.

- The nature of the fuel determines the limiting or critical compression at which knocking ensurence a better fuel has better and the knocking properties


1.Intake
2.Compression
3.Fuel power
4.Fuel Exhaust

- The antiknocking properties of a sample of gasoline are measured in terms of a parameter called Octane number or octane rating.
- Diesel engines utilise diesel oil as fuel but function in a manner different from petrol engines.
- The ignition Qualities of a simple of diesel oil are measure in terms of a parameter called centane number or centane rating

OCTANE NUMBER

- The burning properties of hydrocarbons depend on their structure.
- In fact with regard to the gasoline range (C7 to C9) of hydrocarbons plant chain hydrocarbons have greater and antiknocking properties than straight chain hydrocarbons.
- Octane is an arbitrary scale of rating the relative knocking properties of gasoline when they are used in a standard test engine.
- namely the straight chain alkane heptane and the branched chain alkane 224 trimethyl pentane commonly called isooctane,are taken as the standards.

- Heptane which Knox considerable considerably is assigned an octane number 0.
- 224-trimethylpentane which burns smoothly is assigned an octane number of 100.
- The octane number of a gasoline sample is determined by first using the gasoline in a standard engine and recording its knocking properties.
- The test results are then compared with the behaviour of mixtures of in n heptane and isoctane and the percentage of isooctane in the mixture with identical knocking properties is called the octane number or octane rating of the gasoline.

- Octane number or octane Rating of a sample of gasoline is defined as the percentage of isooctane present in a mixture of n heptane and Isooctane which has the same knocking characteristics as the fuel sample under consideration when examined in the test engine.

- Thus, if a gasoline sample has the same knocking characteristics as a mixture of 13%heptane and87% Isooctane,it is assigned an octane number of87.This is generally the octane number for regular fuels at present.

- The following are the observation in respect of the octane numbers of different types of hydrocarbons :-
- 1) Straight- chain hydrocarbons have rather low octane number. Octane number further decreases with increase in the length of the carbon chain.
- 2) Branched – chain hydrocarbons have higher octane numbers than isomeric straight chain hydrocarbons.
- 3)Alkenes, cyclohexane a and aromatic hydrocarbons have higher octane numbers than branched –chain alkanes.

Antiknock agent

- Addition of certain compounds called octane enhancers to gasoline can increase its octane number. Typical Examples are the antiknock agents.

- An antiknock agent or antiknock compound is a gasoline sample additive used to reduce engine knocking and increase the fuel s octane rating.

- Thank you

SOME CLASSES OF Drugs

Hishamol.pk

Antipyretics

- Antipyretics are drugs that reduce fever.i.e drugs that reduce the body temperature in fever.
- Example:-paracetamol. chemical name :N-(4-hydroxyphenyl)acetamide.
- It also functions as an anelgesic.(pain-reliver).
- Another typical example for an antibiotic is aspirin. Acetylsalicylic acid.
- * It has analgesic as well as and inflammatory properties too.
- Another example is phenacetin. Chemical name: N-(4-ethoxyphenyl) acetamide.

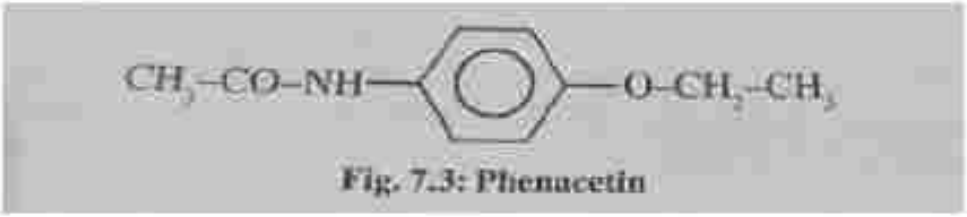


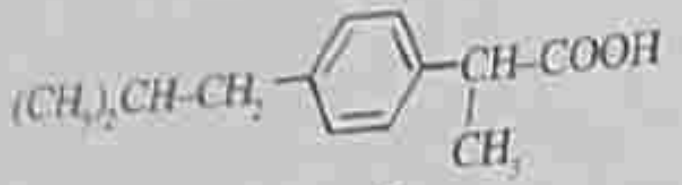
Fig. 7.3: Phenacetin

Antipyretics

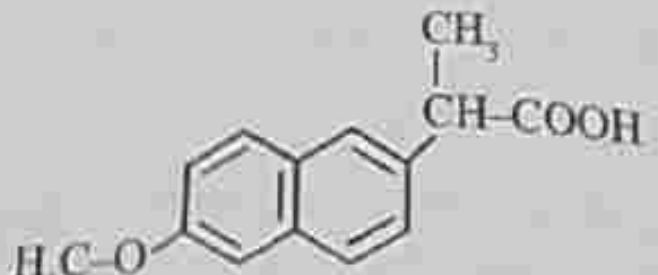
- Other example include ibuprofen, and naproxen as well as the Salicylates like choline Salicylate, magnesium Salicylate and sodium Salicylate. Like aspirin these too have Anti-inflammatory properties and thereby belong to the class of non-steroidal anti-inflammatory drugs.(NSAIDs)

Analgesics

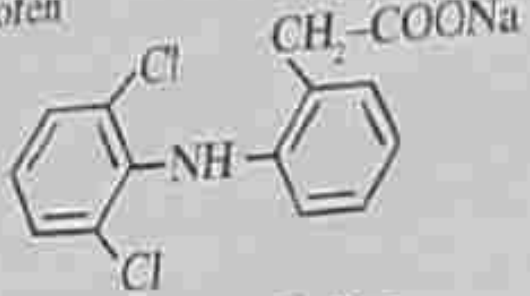
- Analgesics are drugs that relive pain.
- It is classified into non-narcotic(non-addictive) analgesics and narcotic analgesics.
- Non narcotic analgesics.
- These are analgesics that neither produce sleep/unconsciousness nor addiction in any person using them. Paracetamol is the most familiar example
- Aspirin and other non steroidal anti inflammatory drugs including ibuprofen, etoricoxib,diclofenac,aceclofenac and naproxen belong to the class of non-narcotic analgesics.



Ibuprofen



Naproxen



Diclofenac Sodium

Fig. 7.4: Some non-steroidal anti-inflammatory drugs (NSAIDs) which act as analgesics

Narcotic analgesics

- These are the drugs that are potentially addictive which, when administered in medicinal doses, relieve pain and produce sleep. These are mainly used for relief of post-operative pain,cardiac pain,obstetric pain and terminal cancer pain
- Morphine, codeine Etc are typical example for narcotic analgesics.
- In higher doses, these analgesics produce unconsciousness in much higher doses,these produce stupor,coma, seizures and ultimately death.



Thank you



Department of Economics

വിനോദസഞ്ചാരത്തിന്റെ ചികിത്സന - സ്ഥിതി നാലവസ്ഥ.

ഗ്രാമപഞ്ചായത്തിന്റെ സൂചകങ്ങളും പാരിസ്ഥിതിക സവിശേഷതകളും

സ്ഥിതി ഇടിവിലെ ചാലകമായ പഞ്ചായത്തിന്റെ പേരിലാണ് നമ്മൾ ഗ്രാമപഞ്ചായത്ത് സ്ഥിതി ചെയ്യുന്നത്. സ്വപ്രയത്ന രിയോഗ് പഞ്ചായത്തായ നമ്മുടെയിലെ പ്രദേശങ്ങൾ നമ്മൾ കിഴക്കുഭാഗം, ഭരിക്കുന്ന നമ്മൾക്കുറി ഏതാണ് നിലയ്ക്കുന്നതിൽ ഉൾപ്പെടുന്നു. 19 വാർഡുകളാണ് നമ്മുടെയിൽ ഉടനീളം പരിസ്ഥിതി സംരക്ഷിത പ്രദേശിയ സ്വത്തുക്കളിലേക്ക് ശ്രദ്ധിക്കുന്ന രാജ്യങ്ങളുടെയും ഒരു സമഗ്ര സമൂഹമാണ്. സൂചകങ്ങൾ താഴെപറയുന്നു നമ്മൾ ഗ്രാമപഞ്ചായത്തിനെ 4 തരം പ്രദേശങ്ങളായി തരം തിരിക്കാം.

1. ഉയർന്ന തുണിൽ പ്രദേശം
2. ലാറ്റനൈറ്റ് മലകൾ ഉയർന്ന പ്രദേശം
3. കുന്നിടുകൾ
4. സമതലപ്രദേശം

സമുദ്രനിരപ്പിൽ നിന്നും ഏകദേശം 800 മീറ്റർ ഉയരത്തിലാണ് ഈ പ്രദേശങ്ങൾ സ്ഥിതി ചെയ്യുന്നത്. പഞ്ചായത്തിന്റെ ഏകദേശം 41 ചതുരശ്ര കിലോമീറ്റർ വിസ്തൃതിയിലാണ് ഉയർന്ന പ്രദേശങ്ങൾ കുടികൊള്ളുന്നത്. ഈ പ്രദേശങ്ങളിൽ

റബർ, നാണ്യവിളകളായ തെങ്ങ്, കുരുമുളക് എന്നിവയും ചില വ്യവസായങ്ങളായ തേയില, പ്ലൈവുഡ് നിർമ്മിക്കുന്നവയും കണ്ടുവരുന്നു.

തെന്മല പഞ്ചായത്തിന്റെ വിസ്തീർണ്ണത്തിൽ 50 ശതമാനത്തോളം ഭൂപ്രകൃതി കൊണ്ട് ഉയർന്ന പ്രദേശമാണ്. വലുതും ചെറുതുമായ നിരവധി കുന്നുകൾ കാണുവാനാകും. ഇവിടങ്ങളിൽ തെങ്ങ്, വാഴ, കൊക്കോ, ജാതിക്ക എന്നിവകാണ് മുഖ്യവിളകൾ. തെങ്ങ് കൃഷി താരതമ്യേന കുറവായി കണ്ടുവരുന്നു. കാറ്റ് വീശുമ്പോൾ തെങ്ങുകൾ ചെറുതായി ആടിക്കൊണ്ടിരിക്കുന്നതായി കാണുവാനാകും. ഇവിടങ്ങളിൽ നിന്നും ചിൽ നിരീക്ഷിക്കുന്നതിനായി ഇന്ന പ്രദേശങ്ങളിൽ വേനൽക്കാലങ്ങളിൽ കുടിവെള്ളത്തിനും ലഭ്യമല്ലാത്ത സ്ഥിതിയും ഉണ്ടാകുന്നു. ഇവിടങ്ങളിൽ നിലവിലുള്ള തോടുകളും, കുളങ്ങളും വറ്റുന്ന അവസ്ഥയാണ്. പഞ്ചായത്തിന്റെ തെക്കുഭാഗത്തായി വിസ്തീർണ്ണത്തിന്റെ 15 ശതമാനത്തോളം ചരിവുകൾ വരുന്ന പ്രദേശമാണ്. കുന്നുകളുടെ ചെരുവുകൾ ചിലതും വാഴകൃഷി നടത്തുന്നതിനായി ചരൽ കലർന്ന ചെങ്കല്ല് മണ്ണാണ് മുകൾഭാഗത്തിൽ കാണുന്നത്. ഇവിടങ്ങളിൽ ചിതലുകളും തെങ്കുകളും വസിച്ചും കാണപ്പെടുന്നു.

പഞ്ചായത്തിന്റെ ചിലഭാഗങ്ങളിൽ ഉപ്പുവെള്ളം കയറിയതായി പരാതികൾ ഉണ്ട്. ഇത് ഏകദേശം 23 ശതമാനം വിസ്തീർണ്ണം വരും. ഫലഭൂയിഷ്ഠമായ മേൽമണ്ണ് നഷ്ടപ്പെടുന്നതാണ് ഇതിന്റെ ഒരു ദോഷം. ജലം കിനിഞ്ഞിറങ്ങുന്നതുകൊണ്ട് ഭൂഗർഭജലനിരപ്പ് ഉയരുന്നതുകൊണ്ട് കിണറുകളിലെ ജലം ഉപയോഗശൂന്യമാകുന്നു.

ജലവിനിയോഗം

പഞ്ചായത്തിലെ കൃഷി പ്രധാനമായും നെൽകൃഷിയാണ്. കൂടാതെ തെങ്ങ്, കമുക്, തോട്ടങ്ങൾ എന്നിവയെ ആശ്രയിച്ചും കൃഷി ചെയ്യുന്നുണ്ട്. നെൽകൃഷി കൂടുതലുള്ളത് വേനൽക്കാലത്താണ്. ഈ സമയങ്ങളിൽ കനാൽ വഴിയും കിണറുകൾ വഴിയും ജലസേചനം നടത്തുന്നു. വേനൽക്കാലത്ത് ജലദൗർലഭ്യം ഉണ്ടാകുന്നതിനാൽ കനാലുകളിലും തോടുകളിലും നിശ്ചിത ഇടവേളകളിൽ തടയണകൾ കെട്ടി വെള്ളം തടഞ്ഞുനിർത്തുന്നു. ഇങ്ങനെ തടഞ്ഞുനിർത്തുന്ന വെള്ളം പമ്പുകൾ ഉപയോഗിച്ച് കരയിലെത്തിച്ച് കൃഷിയിടങ്ങളിൽ നനയ്ക്കുന്നു. കിണറുകളിൽ നിന്നുള്ള ജലസേചനത്തിനും പമ്പുകൾ ഉപയോഗിക്കുന്നു. തോടുകളിൽ നിന്നുള്ള ജലസേചനത്തിനും കിണറുകളിൽ നിന്നുള്ള ജലസേചനത്തിനും ഡീസൽ പമ്പുകളും വൈദ്യുത പമ്പുകളും ഉപയോഗിക്കുന്നു. ഇവയുടെ പ്രവർത്തനത്തിനായി ഡീസലും വൈദ്യുതിയും ഉപയോഗിക്കുന്നു.

ഉൾപ്പെടുന്നതാണ്. പെരുമ്പുഴ, നെടുമ്പാശ്ശേരി, രണ്ടാർ-കാട് പ്രദേശം, തോട്ടുവ പ്രദേശത്തെ തോട്, ഇടിക്കുന്നാട്, വാഴക്കുളം തോട്, തൊട്ടിൽപ്പാലം തോട് തുടങ്ങിയവയാണ് നിലവിലുള്ള പ്രധാന തോടുകൾ. പ്രധാന കനാലായ പാലക്കാടി ചെറുതുരുത്തി കനാലിൽ നിന്നും കനാൽ വഴിതിരിച്ചുവിടുന്നത്. ഇതിന്റെ വടക്കൻ കനാലിൽ നിന്നും പ്രാദേശികമായുള്ള കനാലുകൾ 15 ദിവസത്തിലൊരിക്കൽ മാത്രമാണ് വെള്ളം തിരിച്ചുവിടുന്നത്. ഇത് തൊഴിൽ പ്രവർത്തനത്തിനും കൃഷിയിടങ്ങളിലേക്കും കുടിവെള്ളം ലഭ്യമാക്കുന്നതിനും ബുദ്ധിമുട്ടുണ്ടാക്കുന്നു. ഇത് തരണം ചെയ്തുകൊണ്ട് കൃഷിയിടങ്ങളിലേക്കും കുടിവെള്ളത്തിനുമായി കിണറുകൾ, നീരുറവകൾ, കുടിവെള്ള പദ്ധതികൾ തുടങ്ങിയവയെയാണ് പ്രദേശവാസികൾ ആശ്രയിക്കുന്നത്. വേനൽക്കാലത്ത് ഈ സ്രോതസ്സുകൾ വറ്റിവരണ്ടുപോകുന്നതിനാൽ കുടിവെള്ളത്തിനും കൃഷിയിടങ്ങളിലേക്കും ജലലഭ്യത കുറയുന്നു. പ്രദേശത്തെ കുടിവെള്ള പദ്ധതികൾ പലതും പ്രവർത്തനരഹിതമാണ്. ഉള്ളവയിൽ നിന്നുതന്നെ കുടിവെള്ളം കിട്ടുന്നത് ആഴ്ചയിൽ ഒരിക്കൽ മാത്രമാണ്.

മനുഷ്യ - പ്രകൃതി വിഭവങ്ങൾ

കാലടി ഗ്രാമപഞ്ചായത്തിന്റെ 2011 ലെ ജനസംഖ്യ 32523

രുന്നു. പുരുഷൻമാർ 15893 ഉം സ്ത്രീകൾ 16670 രുമാണ്. ഇടുക്കിയിലെ ജനസംഖ്യയുടെ ഏകദേശം മൂന്നിലൊന്ന് 30 വയസ്സിനു താഴെയുള്ളവരാണ്. ഇവരിൽ കർഷകർ കോളി, കമ്പനി തൊഴിലാളികൾ, ചെറുകിട വ്യവസായം നടത്തുന്നവരെ കണ്ടെത്തുന്നതിനായി സ്ത്രീകളുടെ ഇടയിൽ നടത്തിയ പഠനത്തിൽ 95.42 ശതമാനവും സാക്ഷരതയുടെ കാര്യത്തിൽ പുരുഷൻമാർ 92.98 ശതമാനവുമാണ്. ബിരുദവും സാങ്കേതിക വിദ്യാഭ്യാസ യോഗ്യതയുമുള്ളവരും പുതിയ തലമുറയിൽ കൂടുതലാണെങ്കിലും കാര്യമായ തൊഴിലോ വരുമാനമോ ഇവരുടെ ഈ പഠനങ്ങളിലൂടെ നിന്നും നൂറുകണക്കിന് യുവാക്കൾ തൊഴിലന്വേഷകരായി മാറിക്കൊണ്ടിരിക്കുന്നു. അതിൽ നല്ലൊരു പങ്ക് സർക്കാർ ഓഫീസുകളിലും അതേപോലെ തന്നെ കമ്പനി, സ്വകാര്യ സ്ഥാപനങ്ങളിലുമാണ്. ഇത് മൂലം വിദേശ ധനം കൊണ്ടുവരുന്ന ഒരു സ്രോതസ്സിന്റെ കുറവ് ഉണ്ടാകുന്നുണ്ടെങ്കിലും അവരുടെ സ്ഥാനത്ത് ഇതര സംസ്ഥാന തൊഴിലാളികൾ കടന്നുവരുന്നുണ്ട്. ഇവർ ചെറുകിട വ്യവസായങ്ങൾ, കൃഷി, കെട്ടിട നിർമ്മാണം തുടങ്ങിയ മേഖലകളിൽ ജോലി ചെയ്യുന്നു. ഇവരുടെ സാന്നിധ്യം കൊണ്ട് ഇടുക്കിയിലെ തൊഴിൽ രംഗത്ത് വരുത്തുന്ന മാറ്റങ്ങൾ

വെള്ളിച്ചുന്നിൽ കുടുംബശ്രീ അയൽകൂട്ടങ്ങൾ, ചിപ്പ്. ഫിഷ്. ടി, തുടങ്ങിയ വിവിധ പ്രവർത്തനങ്ങൾ മുഖേന വരുമാനം കണ്ടെത്തുന്നതിന് സഹായകമായിട്ടുണ്ട്. നിർണ്ണയ പരിപാലനത്തിന്റെ ഭാഗമായി ആവാസ വ്യവസ്ഥ കേന്ദ്രീകരിച്ച് തൊഴിലുറപ്പ് പദ്ധതിയുടെ വിവിധ ജനകീയ പ്രവർത്തനങ്ങൾ ചെയ്തുവരുന്നു.

ജനകീയ സൂക്ഷ്മണനിരീക്ഷണത്തിന്റെ അടിസ്ഥാനത്തിൽ കഴിഞ്ഞ 4 വർഷത്തിനുള്ളിൽ പക്ഷികളുടെ എണ്ണത്തിൽ ഗണ്യമായ വർദ്ധനവും ഫലപ്രദമായ പ്രജനനവും നടന്നിട്ടുണ്ട്. ഇതിന് പ്രധാന കാരണം കുടിവെള്ളത്തിന്റെ ലഭ്യതയും ആവാസവ്യവസ്ഥയുടെ സംരക്ഷണവുമാണ്. ഇതിനായി കണ്ടൽ ചെടികൾ നട്ടുപിടിപ്പിക്കുന്നതിനും കണ്ടൽ തൈകൾ സൗജന്യമായി വിതരണം ചെയ്യുന്നതിനും കണ്ടൽ ചെടികൾ നശിപ്പിക്കുന്നതിനെതിരെ ബോധവൽക്കരണം നടത്തുന്നതിനും കഴിഞ്ഞിട്ടുണ്ട്. ഇത് കൂടാതെ കുടിവെള്ളം, കൊതുകുവല, കുടിവെള്ളം, കൊതുകുവല, കുടിവെള്ളം, കൊതുകുവല,

വേട്ടുവനാടുമുതൽ 4 പേരുകളിലെ 5 ഗ്രാമങ്ങളെ ഒരുമിപ്പിച്ചിരുന്നു. ഭരണനിർവ്വഹണം, വഴിവിളക്കുകൾ സ്ഥാപിക്കൽ, റോഡുകൾ സൂചികരിക്കൽ, റോഡുകൾ നന്നാക്കൽ തുടങ്ങിയ പ്രവർത്തനങ്ങൾക്കും കുടിവെള്ള സൗകര്യങ്ങൾക്കും വേണ്ടിയാണ് ഗ്രാമപഞ്ചായത്ത് നിലവിൽ വന്നത്. അന്ന് 1952-ൽ ഈ പഞ്ചായത്തിൽ വന്നപ്പോൾ തിരഞ്ഞെടുക്കപ്പെട്ട 7 അംഗങ്ങൾ ഉണ്ടായിരുന്നു. അന്ന് സ്വന്തമായി കെട്ടിടം ഇല്ലാതിരുന്ന പഞ്ചായത്ത് ഇങ്ങനെ തൊട്ടി സഹകരണ ബാങ്കിന്റെ കെട്ടിടത്തിലാണ് പ്രവർത്തിച്ചു വന്നിരുന്നത്. 1973-ൽ 10 വാർഡും 1988-ൽ 11-വാർഡും 1995-ൽ 12 വാർഡുകളും ഉണ്ടായി. 1952-ൽ തൊട്ടി പഞ്ചായത്തിൽ റോഡ് സൗകര്യം വളരെ കുറവായിരുന്നു. ഇങ്ങനെ ടാറിട്ട പ്രധാനപ്പെട്ട സ്ഥാനത്ത് മാത്രം പേരുള്ള പ്രധാന വഴികളായിരുന്നു. നടുങ്കാട് റോഡ്, മുണ്ടയാട്ടുമല റോഡ്, പുഴിങ്ങാവ് റോഡ്, അമ്പുപാറ റോഡ്, കുടുപ്പാറ റോഡ് എന്നീ വഴികൾ ഉണ്ടായിരുന്നുവെങ്കിലും അവയെല്ലാം തുണിനിർമ്മിതമായിരുന്നു. അതുകൊണ്ട് മഴക്കാലത്ത് 700 ഓളം വീടുകളിൽ 5000 മുതൽ 6000 വരെ ആളുകൾ താമസിച്ചിരുന്നു. തൊട്ടി പ്രദേശത്ത് വരുന്ന ആളുകൾ താമസിച്ചിരുന്നത് ചെറിയ ഒരു ഷെഡിലായിരുന്നു.

ഇതിന് കുടുംബിധി വരെ പിടി ഹാരം തനതെന്നിലത്ത് ചാലിടി
ഇടനിരെ തനാലിനൽ ഉത്ഭവതെന്നാണ് ഇതിനെ
വിശ്വസിക്കുന്നു. ഇതിന്റെ തന്നിൽ നിന്നും മലബാറിൽ നാട്ടു, മരുന്ന് കഴി
ലിനി, ചിരട്ട, തിരുമുട്ടുകൾ, മുതിര, മുളക്, പഞ്ഞിപ്പുല്
ഇഞ്ചിപുല്ല്. തിപ്പലി, വൻപുണ്ടകൾ, ചുക്ക്, ചുണ്ണാമ്പ് മുതലായവ
തിരി ചേർത്തിരുന്നു. ചെരുപ്പിനോട്, കടുവാ ചോടം നോട്
ചുടുപുല്ല് നോട്, തണ്ണിനോപ്പ് നോട്, തുണ്ടണ ചോടം നോട്
ചേർന്നി തോടുകളിലെ ജലത്തെ തുടിപ്പിച്ചുചിരുന്ന
ഔഷധി തൻകുടി ചേർത്തിരുന്നു.

ചന്ദനത്തൈലത്തിൽ വാണിരുന്നത് തൈലം
സുഗന്ധത്തിനല തുടുവാനൻമാരായിരുന്ന രാവരായിരുന്നു
ഇവിടത്തെ നാടുവാഴികൾ ടിപ്പുവിനൻ്റെ പടയോട്ടം താമസിപ്പി-
ച്ചു ഇത പ്രദേശത്തിനൻ്റെ വടക്കേ അതിരിൽ കുടുതോട്ട
തൈലം ചിരുന്നവരെ അതിനൻ്റെ അവിശിഷ്ടങ്ങൾ ഇന്നും
കാണുന്നതും കടുതോട്ട എന്നാണ് ഇന്നും നാട്ടുകാർ
പറയുന്നത്. തിരുച്ചും കുടുതൈലം ഉൽപാദിപ്പിരുന്ന തൊഴി
ലാളികളായിരുന്നു. 1962-ൽ തിരുതൈലം ഉൽപാദനം
നിർത്തി. ചിന്തിപ്പിക്കുന്നവർ ഇന്നും ഇതിനെ
പറ്റി വിശദമായി തൈലത്തിൽ തുടർച്ചയായി പഠനം നടത്തിയിട്ടുണ്ട്
1963-ൽ ഉൽപാദനം പുനരാരംഭിച്ചു. 1965-ൽ ഗവൺമെന്റിന്റെ ഉടമസ്ഥതയിലായിരുന്ന

കിൻഫ്രാ പാർക്ക് , ഇൻഫോ പാർക്ക് തുടങ്ങിയ വ്യവസായ
സ്ഥാപനങ്ങൾ കടന്നുവരുന്നതും തൊഴിൽ രഹിത വ്യവസായിക
രാജ്യത്തിന് നിക്ഷേപകരുണ്ടായി. തൊഴിൽ ഇല്ലാത്ത കോർപ്പറേറ്റ്
പിൻതാങ്ങുന്ന ഒരു കോർപ്പറേറ്റ് രാജ്യം നിലവിൽ വന്നു.

സാമൂഹ്യനീതി ഉറപ്പുവരുത്തുന്നതിനും
രാജ്യത്തിന്റെ സമ്പത്ത് തുല്യമായി പങ്കുവയ്ക്കുന്നതിനും
വേണ്ടി പ്രവർത്തിക്കുന്ന സർക്കാരിനുപകരം സമ്പന്നർക്കുവേണ്ടി
നിലകൊള്ളുന്ന സർക്കാരുകൾ 1992 -ൽ നരസിംഹറാവു
സർക്കാരിന്റെ കാലത്ത് 73-ാം ഭരണഘടനാ ഭേദഗതി പ്രകാരം
നടപ്പിലാക്കിയ പഞ്ചായത്ത് രാജ് സംവിധാനത്തിന്റെ
സാധ്യതകൾ 11-ാം പട്ടികയും 12-ാം പട്ടികയും
ഉൾപ്പെടുത്തിയതിനുശേഷം 1994 -ൽ നടന്ന ആദ്യത്തെ
പഞ്ചായത്ത് തിരഞ്ഞെടുപ്പിൽ തന്നെ ഇടതുപക്ഷ
ജനാധിപത്യ മുന്നണി ഭൂരിപക്ഷം നേടുകയും
ഭരണത്തിലേറുകയും ചെയ്തു. ഇതിനുശേഷം
വന്ന പഞ്ചായത്ത് ഭരണസമിതികൾക്ക് ഫലപ്രദമായി
പ്രവർത്തിക്കുന്നതിന് തടസ്സമായി നിന്നത് ഉദ്യോഗസ്ഥ
മേധാവിത്തവും അവരുടെ ജനവിരുദ്ധ നിലപാടുകളുമാണ്.
ഇതിനെതിരെ ഇടതുപക്ഷ ജനാധിപത്യ മുന്നണി
ഭരണത്തിലിരുന്നപ്പോൾ ഉദ്യോഗസ്ഥ മേധാവിത്തത്തിനെതിരെ
ശക്തമായ നിലപാടുകൾ സ്വീകരിച്ചു. ഇതിനെതിരെ
ഉദ്യോഗസ്ഥ മേധാവിത്തത്തിന്റെ ഭാഗമായ ഐ.എ.എസ്
ഐ.പി.എസ് ഉദ്യോഗസ്ഥർ പരസ്യമായി രംഗത്തുവന്നു.

അഭയകേന്ദ്രമായ നമ്മുടെ ചിറ്റിലപ്പിള്ളി നിലവിൽ വരണമെന്ന് മനസ്സിൽ ആഗ്രഹിക്കുന്നതിനുപരിയായി കരുതുന്നു. ഇതിനായി വടക്കുഭാഗം ഒരു ഗ്രാമപഞ്ചായത്ത് 14 വാർഡുകൾ ഉൾപ്പെടുത്തി ഗ്രാമപഞ്ചായത്തായി നിലനിർത്തണം.

സ്പെഷ്യൽ ഗ്രേഡ് ഗ്രാമപഞ്ചായത്തായ ചിറ്റിലപ്പിള്ളി 14 വാർഡുകളുമായി തുടരുന്നതാണ്. പഞ്ചായത്തിന്റെ പ്രധാന വരുമാന മാർഗ്ഗങ്ങളായ ടൂറിസ്റ്റ് കേന്ദ്രങ്ങൾ, തണ്ണീർത്തടങ്ങൾ, കായലുകൾ, കണ്ടൽക്കാടുകൾ തുടങ്ങിയവയുടെ സംരക്ഷണത്തിനും വികസന കാഴ്ചപ്പാടിന്റെയും മാർഗ്ഗനിർദ്ദേശങ്ങൾക്കും ഉതകുന്ന തരത്തിൽ ഭരണസമിതിയുടെയും ഉദ്യോഗസ്ഥരുടെയും പ്രവർത്തനങ്ങൾ ക്രമീകരിക്കണം.

Chalakudy is a municipal town situated on banks of chalakudy river in Thrissur district of the kerala state in India. It is the headquarters of the Chalakudy taluk. It is the base camp for travellers to Athirapilly Falls and vazhachal Falls. Chalakudy lies on National Highway 544 and located about 41 km north of the city of Kochi, and 30 km south of thrissur.

The name "chalakudy" is derived from the two words "Yagashala" and koti. Once the chalakudy was famous all over India as a place for conducting sacrifises. Many rishies came to here as it was considerd as a sacred land. In order to identify these settlements, they hoisted flags next to it. Thus those entire area got its name "Yagashalakti". History also says during the second Chera dynasty, people outside kerala visited chalakudy to learn vedas and kalaripayattu from chukkikulam shala. These people lived in the banks of Chalakudy river. and this accomodation is caled kudi. The combination of these 2 words shalakudi is later modified into chalakudy. Chalakudy Municipality came into existence in the year 1920. Chalakudy is a Grade municipality chalakudy is a midregion. It is at a distance of 35 km from Thrissur.

Chalakudy River

It has one of the fish diversity, as it contains 85 species of fresh water fishes out of the 152 species known from kerala. The chalakudy river flows through the southern part of the town. The kodakara, Pariyaram, Mellor, Kallur, Vadakkumuri Lies adjacent to it.

Land Use Pattern

According to agricultural statistics the land use pattern reveals that forest occupies around 34.2 percent. The pressure for non agricultural use is increasing.

Irrigation

Optimum utilization of the water resources through appropriate conservation and mangement measures assumes critical importance in sustaining the life support system. Besides the conventional souras of irigation like tanks and wells and private canals, the district has five major Irrigation schemes namely Peechi, Chalakudy, Vazhani, Chimmoni - Mupli and Cheerakuzhy.

Buisness

Madura Casts, Geetha Flour Mill, Appollo Tyres, Cademazk, Paulson Distillery, choice foods, Amoeba Associates, Carborundum Limited, Eddie Current and Sree Shakthi paper Mills

Agriculture.

Transport

Road

Located along the national highway 544, between kochi and coimbatore. Another major road is state highway 21 which connects chalakudy to vazhathal and ends at the border of Tamil Nadu

Railways

The main rail transport system in chalakudy is operated by the Southern Railway zone of Indian Railways and comes under Trivandrum railway division

Airport

The nearest airport is cochin International Airport in Nedumbasery which is 19 km from chalakudy. All the major domestic and international flights are availiable here.

Electricity and Power

Perigalkuth and sholayar are the 2 major hydroelectric projects of the district. The Peringalkuth project across the chalakudy river has a storage capacity is 280.32 million Kwh. Sholayar is connected with chalakudy substation by the 110 Kv transmission lines.

Check Dam

The amazing beauty of koodapuzha check dam on the Chalakudy river draws hundreds of visitors daily. It was in 2011 that the construction of check dam was completed near Koodapuzha Aaratukadavu. This also helps in joining chalakudy and meloor. The storing of river water would ensure availiability of water for the people living on both sides of it.

Education

Schools

- Carmel Higher Secondary School
- C.K.M.N.S.S. Senior Secondary School
- C.M.I. Public School
- Crescent Public School
- Vyasa Vidhyanikethan School
- Government Boys High School
- Sacred Heart Convent Girls High School

Colleges

- Panampilly Memorial Government College
- Sacred Heart College
- Southern College of Engineering and Technology
- Nirmala College.

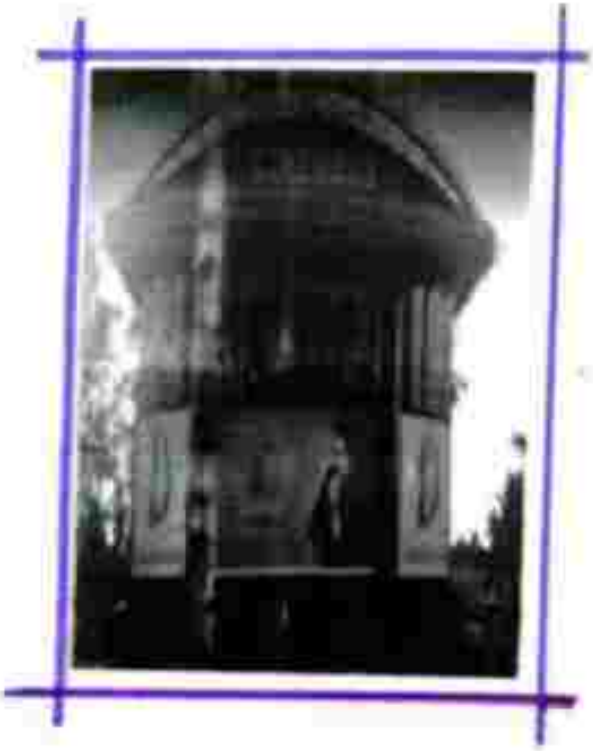
Chalakudy Market

Chalakudy market is a combination of systems, institutions, procedures, social relations or infrastructure where both buyers and sellers engage in exchange. Chalakudy market provides a major role in the increasment of revenue among the individual sellers. All most all kind of neccesory goods are available here. Fruits and vegetable shops, Textile shop, Medical store, Bakerys Footwear shop, Fish and Meat, Groceserry shops are some of them. It provides economic opportunities to the people of this society. Through this market both rural and urban economies are brought uptogether. Many farmers are able to sell their vegetables in this market. Market is one of the main income earning asset of chalakudy. It provicles a relatable amount of parking spaces. People can purchase fresh and best quality food items at discounted rate. It is a fully fledged market.

During the 2018 flood chalakudy market was badly affected. Around 3 core Loss was calculated. Grocery items Garment shops were badly affected. After few months market started to progress and was back to its normal state. Late Covid 19 Lockdown was announced. This was a great shock to the people. All the shops was closed for almost 2 months. This made a huge financial problem among the producers. Almost 1 year the situation was same. But now covid 19 restrictions had taken out. Now chalakudy market have the same crowd and supply that it had before.

Theatres

There are 2 theatres currently present in chalakudy. They are D-cinemas and Surabhi. It provide the citizen with a great visual experience along with contributing a fair percentage to the economic growth of the city.





Gov. Hospital

Taluk Head Quarters Hospital, Chalakudy is a Government hospital with facility of 186 working bed strength spread in 45 acres. On the side of National highway - 47. The institution has a strength only of 104 regular hands and 50 temporary staff. of this 21 are medical offiar, comprising Superintendent Speciality Doctors, Casuality Medical officers and General Doctors. 24 x 7 emergency Department.

Other Private hospitals include St. James Hospital, C.C.M.K hospital I-vision Hospital.

Churches and Temples

St. Mary's Forane Church
St. Joseph Church
St. Mary's Pilgrim Centre
Sree Kanampuzha Bhagavathy Temple
Sree Subrohmaniya Swami Temple
Sree Vishnu Temple
These are famous temples and churches of Chalakudy.

Ollur is a major suburban area and an old Commercial town in the city of Thrissur of Kerala state, South India. It is situated about 5KM away from Sobhraj Roundon old National Highway 47 (India) towards Kochi. From ancient time onwards, ollur was a major business centre in Thrissur district. Now this geographical area is part of Thrissur Municipal Corporation. It is situated between Kunnachira and Chalore on the National Highway. However a specific identity for this geographical region is still there due to the urban setting of this region and its important religious institutions.



Country State District	India Kerala Thrissur
Government * Mayor * Depaty Mayor	 Ajitha Jayarajan Kandamkulathy Varghese
Languages Official	 Malayalam, English
Time Zone	UTC+5:30 (IST)
PIN	680306, 680 313
Telephone Code Vehicle registration	91(0)487 KL-08
Website	www. corporationofthrissur.org

Ollur lies in the Central part of Kerala and has financial institutions, industries and a railway station around it. Vaidhyaratnam Oushadhasala, an ayurvedic pharmaceutical Company, is situated in Ollur. It is managed by Thaikkattussery Eledathu Thaikkattu family, one among the Ashtavaidhya families of Kerala. Oushadhi, another ayurvedic medicine manufacturing Company is also situated in Ollur. It is directly Contracted by Health and family Welfare Department of Kerala Government. Catholic Syrian Bank has a staff training College in Ollur for its staff.

Tile Factories

Ollur houses around 20 tiles factories. These units cater mainly to Kerala, Tamil Nadu and Karnataka. In the pre-independance period, tiles were exported from Ollur railway station to different parts of the Country by road networks.

Timber And Wooden Packing Boxes

Ollur has timber and wooden packing boxes, around 300 units of wooden packing boxes units. Before India's independence, the British used to source sleepers and wooden platforms for railways from ollur. During the first World War, wooden packing cases were built in ollur for military purpose also. The business grew and now, the wooden packing cases ollur reach all parts of India and are even used for export. The boxes are made from rubber wood, which is taken on auction from different parts of kerala. Another main business which goes with wooden packing case in the timber industry which is highly concentrated in ollur. There are many saw mills also in ollur.

Rolled Gold Ornaments

Allan Manufactures called gold ornaments sold in all over India. The rolled gold industry employee around 6,000 people and is 200 years old. The ornaments are made with designs imported from kolkata, Mumbai, chennai and other parts of India. Rolled gold jewelleries are also exported to Middle East Countries which have a large Indian diaspora. Rolled gold is a very thin sheet of gold that is laminated to a lesser metal (usually brass). The two layer of metal are heated under pressure to fuse them together. The sheet is then rolled in to a very thin sheet and then used to make jewellery or other objects.

Restaurants and Bars

- Sree Bhavan Veg Hotel
- Sree Bhavan Bar
- Kattada Restaurant and Bar
- Massland Restaurant
- Salkara Restaurant and Bar
- Mashenaai Veg Hotel
- Gift Restaurant
- Spicy Restaurant
- Soofi mandi



Sree Bhavan



SOOFI MANDI Restaurants

Banks

- ICICI Bank
- Canara Bank
- Bank OF Baroda
- Federal Bank
- Dhanalakshmi Bank
- Catholic Syrian Bank
- South Indian Bank
- State Bank OF India
- Axis Bank



Ollur fish & Vegitable Market

Transportation

Ollur is well Connected to other cities in Kerala by both rail and road. It is located 50 K.M from the new Cochin International Airport and 85 K.M from the Kozhikode International Airport. Ollur lies on old NH 47.

Both KSRTC and private bus services connect ollan to Thaissan, Ambalam, kodakara, cherpu, Irijalakuda and chalakudy, Angamaly, Ernakulam, kozhikode, Idukki, Kollam, Thiruvananthapuram and other major cities of kerala. It is well-connected to nearby cities and towns like kochi, kozhikode and Palakkad. It is also connected to chennai and other cities by private interstate buses. KSRTC super fast, A/c low floor, Limited stop, fast passenger, ordinary halts here and night time deluxe bus stops here.

Ollan Railway Station

ollan railway station traces its history to 1900, when Shoranur – Cochin railway line was built during the rule of Sir Sri Rama Varma of Cochin royal family. Now, this railway line in the Central part of Kerala is considered one of the busiest railway route in kerala and handles very high traffic intensity including passenger and goods. ollan railway station falls between Thaissur railway station and Palakkad railway station in Shoranur – Harbour section electrified railway double line.

Museums

* Vaidyanalnm Ayurveda Museum
* ST. Euphrasia Museum

Hospitals

* St. Vincent De paul Hospital . ollur
* Holy family Hospital . ollur
* E.S.I. Dispensary . ollur
* Kanjahayi Dental clinic . ollur
* Kattukaran Hospital . ollur
* Careful Dental clinic . ollur
* Maria Dental clinic . ollur
* Mandamkal Dental clinic . ollur

Colleges

* Government Arts and Science College ollur.
* Govt. B.Ed College ollur
* Sri C. Achutha Menon Govt. College . Kuttanellur . Ollur
* Vaidyaratnam Ayurvedha College . Thaikkattussery . Ollur

Schools

* Vailoppilli Sreedhara Menon Memorial Government Vocational High Secondary School, ollur
* St. Raphael's Convent Girls High School, ollur
* Holy Angel's English Medium High School, ollur
* St. Mary's Convent Girls High School, ollur
* St. Joseph's High School, Anakkallu. ollur
* Augastin Akkara Memo H.S, kottanallur, ollur
* Government High School, Anchery, ollur
* Government Upper primary School, ollur
* Government Upper primary School, Thaikkattussery, ollur
* Mission Home Lower primary School, Mariyapuram, ollur
* Asha Bhavan Deaf and Dumb School, ollur

ഇതുവരെ ചരിത്രവഴികളിലൂടെ ...

പഴയിമാട്ട പർവ്വതങ്ങളിൽ നിന്നാരംഭിച്ച് പടിഞ്ഞാറോട്ടൊഴുകുന്ന ആനമലയിലെ കാടുകളുടെ തെക്കേഭാഗത്ത് വിരിഞ്ഞ് മലയാളം മഴപ്പിലാവിലെ വളർന്നു പന്തലിച്ച് നമ്മുടെ നാടിനെ തൊട്ടുതലോടിയും മഴപ്പിയണിയിച്ചും കടന്നുപോകുന്ന ഒരു ഒറ്റപ്പെട്ട മലയോര ഗ്രാമമാണ് നമ്മുടെ പ്രിയപ്പെട്ട പാലയിടം. പാലയിടത്തിന്റെ പടിഞ്ഞാറുഭാഗത്തായി ഒഴുകിയെത്തുന്ന നന്നാങ്കുടിപ്പുഴയ്ക്കും അതിപുരാതനമായ ഒരു സംസ്കൃതി ഇവിടെ നിലനിന്നിരുന്നതിന്റെ തെളിവുകളാണ് അജ്ഞാതമായ കാരണങ്ങളാൽ അന്യംനിന്ന് പിൻതലമുറയ്ക്ക് നഷ്ടപ്പെട്ട ആലയവനിയ്ക്കുകളിലെ മനുഷ്യരും അവരുടെ ആരാധനാലയങ്ങളും. ഈ സ്ഥലത്തിന്റെ പേരിനോടൊപ്പം നിലനിൽക്കുന്ന മഹാശിലായുഗത്തിന് ശേഷം ഒരുപാടുകാലം നിലനിന്നിരുന്ന മനുഷ്യവാസത്തിന്റെ തെളിവുകൾ ഇവിടെ കാണാൻ കഴിയുന്നുണ്ട്. ഈ വിഷയത്തിൽ കൂടുതൽ പഠനങ്ങൾ നടത്തുന്നതിനായി കേരള സർവ്വകലാശാലയിലെ ചരിത്രവിഭാഗം മേധാവി ഡോ. രാജശേഖരൻ നായരുടെ നേതൃത്വത്തിൽ ഒരു സംഘം ഗവേഷകർ ഇവിടെ എത്തിച്ചേർന്നിരുന്നു. 'അധികം ആരുമറിയാതെ പോയ ഒരു പ്രദേശത്തിന്റെ ചരിത്രം പുറംലോകത്തെത്തിക്കുന്നതിൽ ഏറെ സന്തോഷമുണ്ട്' എന്നായിരുന്നു അവരുടെ പ്രതികരണം. ഈ സന്ദർഭത്തിലാണ് ഞാനും എന്റെ ഭർത്താവും ഈ ഗ്രാമത്തിൽ എത്തിച്ചേർന്നത്. 33 കൊല്ലം മുൻപ് ഇതുപോലൊരു ഫെബ്രുവരി മാസത്തിൽ തന്നെയായിരുന്നു അത്.

തലയ പബ്ലിക് ലൈബ്രറി : : :

1961 - ൽ ശ്രീ തൊല്ലുതൊണ്ണൻ ആശാസ്തി ജോസഫിന്റെ നേതൃത്വത്തിൽ രൂപീകരിച്ച തൊരൈക്കി ആർട്സ് & സ്പോർട്സ് ക്ലബ് എന്ന സംഘടന 1962 തലയ പബ്ലിക് ലൈബ്രറിയായി മാറി. തൊടക്കം 25 പുസ്തകങ്ങൾ മാത്രമേ ഉണ്ടായിരുന്നുള്ളൂ. ഇന്ന് പതിനായിരത്തിൽപരം പുസ്തകങ്ങളുള്ള 'എ' ഗ്രേഡ് ലൈബ്രറിയായി പ്രവർത്തിച്ചുവരുന്നു.

നോക്കുകുത്തിയുടെ വിശദീകരണം:

ഇത്തക്കരണ്ട് പള്ളിത്തെരുവിനും ഇല്ലിക്കൽതോട്ടി വഴി തോടലിയിലേക്ക് വെട്ടിത്തുരന്നിട്ട വഴിയാണ് ഇത്തക്കരണ്ടിലെ ആദ്യത്തെ റോഡ്. പിന്നീടുണ്ടായ വാഹനങ്ങൾ തലച്ചുമടായി ആദ്യമായി എത്തിച്ചത് ഈ വഴിയിലൂടെയായിരുന്നു. പിന്നീട് പാലത്തിലും ഇരുമ്പുപണിയിലുമായി ഈരിഞ്ഞാലക്കുട്ടി പുഴയ്ക്ക് കുറുകെ പണിതുണ്ടാക്കിയ പാലത്തിന്റെ പ്രധാന ശില്പി. 1965 ൽ ഇത്തക്കരണ്ട് പള്ളിയിലെ ചടങ്ങുകൾക്കായി മോറിസ് മ്ലൈൻ ഒട്ടുന്നതോട്ടത്തിന് നേതൃത്വത്തിൽ രൂപീകരിച്ച ഇത്തക്കരണ്ട് ഗ്രാമവികസന സമിതി ശ്രീ. മത്തായിൽ തൊരൈക്കുന്റെ നേതൃത്വത്തിൽ മാറ്റിയെടുക്കുന്ന വഴി ഇത്തക്കരണ്ട് റോഡ് നിർമ്മിച്ചു. 1976 ൽ മണ്ണിടിഞ്ഞ് അടഞ്ഞുപോയ ഭാഗം ഗ്രീൻ റോഡായി നിലനിർത്തുകയും ചെയ്തു. 1988 ലെ വെള്ളപ്പൊക്കത്തിലും പിടിച്ചുനിന്ന പാലം ഇപ്പോൾ അവഗണനയുടെ സ്മാരകമായി ഈ റോഡിൽ നിലകൊള്ളുന്നു.

മനിയുടെ മനസ്

ആൽമിയനന്മയുടെയും അവശേഷിപ്പുകൾ ചിതലരിച്ച് പോയെങ്കിലും തുരുമ്പി സാന്നിധ്യത്തിന് ഒട്ടും മനസ്സ് വരാത്ത ഒരിടം. ഇന്നും നിന്നെയും നന്മയുടെയും മെല്ലെ നാം കൊടുത്ത് വെയ്ക്കുന്ന തുരുമ്പിന്റെ സ്വന്തമായ ഒരു ചെറിയ മനസ്... അവിടുത്തെ ഒരു പാലർ മല്ല അഴിച്ച തിരിച്ചയയും നിങ്ങളുടെ സന്തോഷങ്ങൾ പങ്ക് വെക്കാൻ തുരുമ്പിനൊന്നും അറിയില്ലെങ്കിലും Archaeological Department-ന്റെ തീഴിലെ സംരക്ഷിത മേഖലയാണ് മനിയിടമിതുന്ന്, എന്നിട്ടും 11 മുനിയനാ ഇന്നായിരുന്നിടത്ത് ഒരാൾ ഇരുന്നാൽ ഒരേ എന്നും മനിയം..

വിദ്യാലയത്തിന്റെ ചരിത്രവഴികൾ ... നാടിന്റെയും ...

മലബാറിലെ പ്രധാന കച്ചവടകേന്ദ്രമായിരുന്ന കോഴിക്കോട് നഗരത്തിൽ നിന്നും ഏകദേശം 15 കിലോമീറ്റർ വടക്കുമാറി കിഴക്കോത്ത് പഞ്ചായത്തിലെ ഒരു കുഗ്രാമമാണ് ആരാമ്പ്രം. കോടഞ്ചേരിയിൽ നിന്നും കോടമലയിൽ നിന്നും 5 കിലോമീറ്റർ അകലെയായാണ് ഈ പ്രദേശം സ്ഥിതിചെയ്യുന്നത്. ആരാമ്പ്രത്തുനിന്ന് ഏകദേശം രണ്ടുകിലോമീറ്റർ കിഴക്കുമാറി ഒതയോത്ത് മലയുടെ താഴ്വാരത്തിലാണ് ഈ വിദ്യാലയം സ്ഥിതിചെയ്യുന്നത്. 1961 ജൂൺ മാസത്തിൽ ഇവിടെ ഒരു സ്കൂൾ ആരംഭിക്കുന്നതിനുവേണ്ടി ഒരു കൂട്ടം നാട്ടുകാർ ഒത്തുചേർന്നു. അവരുടെ നിരന്തരമായ പരിശ്രമത്തിന്റെ ഫലമായി 1962 ജൂൺ 1-ാം തീയതി ഈ വിദ്യാലയം പ്രവർത്തനമാരംഭിച്ചു. ഗവൺമെന്റ് എൽ.പി. സ്കൂൾ, ആരാമ്പ്രം എന്നാണ് ഈ വിദ്യാലയത്തിന്റെ ഔദ്യോഗിക നാമം. 1981-82 അധ്യയന വർഷം അവസാനിച്ചപ്പോൾ ഈ സ്കൂൾ യു.പി. സ്കൂളായി ഉയർത്തപ്പെട്ടു.

ഗവൺമെന്റ് എൽ.പി. സ്കൂൾ ആരാമ്പ്രത്തിന്റെ ചരിത്രം ഈ പ്രദേശത്ത് നിലനിന്നിരുന്ന ഒരു ഗ്രന്ഥശാലയുടെ ചരിത്രം കൂടിയാണ്. നിരക്ഷരരായിരുന്ന ഒരു ജനവിഭാഗത്തിന്റെ ഇടയിൽ അക്ഷരവെളിച്ചം പകരുന്നതിനുവേണ്ടി, പല പ്രമുഖരുടെയും നിരന്തരമായ പ്രവർത്തനങ്ങളുടെ ഫലമായി 33 അംഗങ്ങളുമായി ആരംഭിച്ച ഒരു ഗ്രന്ഥശാലയാണ് ഇന്ന് ഈ വിദ്യാലയമായി വളർന്നിരിക്കുന്നത്. ഈ പ്രദേശത്തെ ഏറ്റവും പഴക്കമുള്ള ഗ്രന്ഥശാലയും ഇതുതന്നെയാണ്. 1950-ൽ ആരംഭിച്ച ഈ ഗ്രന്ഥശാലയുടെ പ്രവർത്തനങ്ങൾ ഏകദേശം 10 വർഷത്തോളം നീണ്ടുനിന്നു. പിന്നീട് ഏതാനും വർഷങ്ങൾ പ്രവർത്തനരഹിതമായിരുന്നു. തുടർന്ന് ഈ പ്രദേശത്തെ കുറച്ചുപേർ ചേർന്ന് ഗ്രന്ഥശാലയുടെ പ്രവർത്തനം പുനരാരംഭിച്ചു. അങ്ങനെ ഗ്രന്ഥശാലയുടെ പ്രവർത്തനം തുടർന്നുകൊണ്ടിരിക്കുമ്പോഴാണ് ഇവിടെ ഒരു വിദ്യാലയം ആരംഭിക്കുന്നതിനുള്ള ശ്രമങ്ങൾ നടന്നത്.

'ഗോപാലൻനായർ' എന്നറിയപ്പെടുന്ന ശ്രീ. നടുത്തൊടി രാമൻനായരുടെ നേതൃത്വത്തിലുള്ള വിദ്യാതല്പരരായ കുറച്ചുപേരാണ് ഈ പ്രസ്ഥാനത്തിന് തുടക്കമിട്ടത്. 1950-ലുള്ള

രക്ഷിതാക്കളെ നിരന്തരമായ പരിശ്രമങ്ങളുടെ ഫലമായി
1981-82ൽ വിദ്യാലയം അഞ്ചാം തരത്തിലേയ്ക്ക് ഉയർത്തപ്പെട്ടു
നവ. പ്രസിഡന്റ് ശ്രീ. ഇ. എൻ. രാജപ്പൻ പിള്ള അവർകൾ
സെക്രട്ടറി, ഹെഡ്മാസ്റ്റർ ശ്രീ. ഇ. എൻ. രാജപ്പൻ നായർ
ട്രഷറർ, അഡ്വാൻ ഇക്കണ്ടൻ ഖജാൻജിയായി ആചാര്യൻ
ച്ച തെറ്റി നാട്ടുകാരിൽ നിന്നും സംഭാവനകൾ ശേഖരിച്ച് രണ്ട്
മുറികൂടി നിർമ്മിക്കുന്നതിലേയ്ക്കായി പ്രവർത്തിച്ചു. മറ്റൊന്ന്
തിനപത്തിയൊന്ന്, എന്നിവയുടെ SSA യിൽ നിന്നും ധനസഹാ
യത്തോടെ പുതുതായി ടോയ്ലറ്റ്, കിണർ എന്നിവ നിർമ്മിച്ചു.
കൂടാതെ പ്രഥമ ശുചിത്വത്തെ പുരോഗതി എന്നിവ സ്കൂളിന്റെ
അഭിവൃദ്ധിക്കുവേണ്ടി പ്രവർത്തിച്ചു. മിനിസ്റ്റീരിയൽ തസ്തിക
വ്യവസ്ഥ ചെയ്തു. ഇതിന്റെ അടിസ്ഥാനത്തിൽ ആദ്യമായി
സ്കൂളിലെ ഓഫീസ് ജോലികൾ ചെയ്യുന്നതിന് ഒരു ക്ലാർക്കിനെ
യും നിയമിച്ചു. ശ്രീ. ഇ. എൻ. രാജപ്പൻ നായർ ഹെഡ്മാസ്റ്റർ
ക്ലാസ് മുറികളുടെ പുനർനിർമ്മാണത്തിന് നിന്നും ഒഴിഞ്ഞു
തിനെ തുടർന്ന് ശ്രീമതി. ശ്രീമതി. ഇ. സി. ജോസഫ് ചുമതല
ഏറ്റെടുത്തു. ഇവരുടെ കാലത്ത് സ്കൂളിന്റെ പുരോഗതിക്കുവേണ്ടി
പ്രവർത്തിച്ചു. ഇവരുടെ കാലത്ത് ഒരു പാചകപ്പുര കൂടി നിർമ്മിച്ചു.
നാലാം തരത്തിലേയ്ക്ക് ഉയർത്തപ്പെട്ടു. 5000 ലിറ്റർ വെള്ളം
സംഭരിയ്ക്കുവാൻ ശേഷിയുള്ള സമ്പൂർണ്ണ സുരക്ഷിത കുടിവെള്ള
പദ്ധതിയും സ്കൂളിൽ നിർമ്മിച്ചു. കുടിവെള്ളത്തിനായി കിണർ
കുഴിച്ചു. ഇതിന്റെ പ്രവർത്തനം ഇപ്പോൾ നിലച്ചിരിക്കുന്നു.

ലൂർദ്മാതപള്ളി

പഴയിടം പള്ളിത്തിരുനാളിനോടനുബന്ധിച്ച് എന്നും ഭക്തിയുടെയും ലൂർദ്മാതപള്ളിയിലെ ലൂർദ്മാതയുടെ പേരിലുള്ള സ്വന്തമായ സ്ഥലത്ത് സ്വന്തമായി പള്ളി പണിയണമെന്ന ആഗ്രഹം ഈ ഗ്രാമവാസികളുടെ മനസ്സിൽ കിടന്നിരുന്നു. അങ്ങനെ ഇടവകയിലെ ഏതാനും കുടുംബങ്ങൾ ചേർന്ന് 1961-ൽ ഇന്നത്തെ പള്ളിയുടെ സ്ഥലം വാങ്ങിച്ചു. ഇതിനുവേണ്ടി ഇവിടെ താമസിച്ചിരുന്ന ശ്രീ. ജോസഫ് കുന്നുംപുറത്ത് അച്ചൻ ഇടവകയിലെ ഓരോ കുടുംബത്തിലും കയറിയിറങ്ങി ഓരോ കുടുംബത്തിൽ നിന്നും ഓരോ രൂപ വീതം പിരിച്ചെടുത്തു. ഈ പണം കൊണ്ടാണ് പള്ളിക്കുവേണ്ടിയുള്ള സ്ഥലം വാങ്ങിച്ചത്. ഈ സ്ഥലത്ത് ഒരു ചെറിയ ഷെഡ് കെട്ടി അതിൽ ഒരു ചെറിയ രൂപം സ്ഥാപിച്ച് അവിടെ പ്രാർത്ഥനകൾ നടത്തിയിരുന്നു. ഈ സ്ഥലത്തിന്റെ ഒരു ഭാഗത്ത് ഒരു കുരിശുപള്ളി പണിയുകയും അവിടെ ഒരു കുരിശ് സ്ഥാപിക്കുകയും ചെയ്തു. ഈ കുരിശുപള്ളിയിൽ നടത്തപ്പെടുന്ന വർഷത്തിലെ വിശേഷപ്പെട്ട ഒരു ദിവസമാണ് ലൂർദ്മാതയുടെ തിരുനാൾ ദിവസം. തൈപ്പൂയ തിരുനാളിന്റെ അതേ ഉത്സാഹത്തോടെയും ആവേശത്തോടെയും ഭക്തിയോടെയുമാണ് ഈ തിരുനാളും ആഘോഷിക്കുന്നത്. തിരുനാൾ ദിവസം രാവിലെ ഇടവകയിലെ എല്ലാ കുടുംബങ്ങളിൽ നിന്നും കൊണ്ടുവരുന്ന പാൽപായസം കുരിശുപള്ളിയിൽ വച്ച് വിശുദ്ധ കുർബാന അർപ്പിക്കുന്നു. തിരുനാൾ കുർബാനയ്ക്കുശേഷം പായസം എല്ലാവർക്കും വിതരണം ചെയ്യുന്നു. തിരുനാൾ ദിവസം വൈകുന്നേരം പള്ളിയിൽ നിന്നും പ്രദക്ഷിണമായി കുരിശുപള്ളിയിലേക്ക് തിരുസ്വരൂപം എഴുന്നള്ളിക്കുന്നു. തിരുനാൾ കുർബാനയ്ക്കുശേഷം തിരുസ്വരൂപം തിരികെ പള്ളിയിലേക്ക് പ്രദക്ഷിണമായി കൊണ്ടുവരുന്നു. ഈ പ്രദക്ഷിണത്തിൽ ഇടവകയിലെ എല്ലാ കുടുംബങ്ങളിൽ നിന്നും ഓരോ മെഴുകുതിരി വീതം കത്തിച്ചുക

പരിധിയിലാണ് ഈ സ്തൂപം. മലമ്പാമ്പ് നിറഞ്ഞ ഈ ഗ്രാമപ്രദേശത്തെ
ജനങ്ങൾ മുഴുവനും പ്രാകൃതസമൂഹങ്ങളായിരുന്നു. സ്തൂപത്തിന്റെ പരി
സരത്തിലെ സമാധിചെയ്യുന്ന സ്ഥലമായ പള്ളിത്തലക്കുന്നിൽ ഒരുവശം
നല്ല വൃക്ഷങ്ങളാൽ ഉപചയപ്പെടാത്ത സമതലങ്ങളും നിറയെ കുറ്റിച്ചെടി
കളുമാണ്. ലതുവ്വ് വരെ ഉയരം, ഞെരുക്കി നിറുത്തിയ ഇലകൾ, ഇരുണ്ട പച്ച
നിറമുള്ള സ്വാഭാവികമായ ഒരു ഗന്ധത്തിന്റെ ദല-രേണു-സംസർഗ്ഗത്തിനു
മിടയ്ക്കാണ് നൊമ്പരപ്പെടുത്തുന്ന നൽനിശ്വാസം. ഇവിടെനിന്നും സിദ്ധാർത്ഥൻ
ലിച്ച നിരവധി കഥകൾ രാജ്യങ്ങളിൽ ഒഴുകി നടന്നുവന്നു
നു. പിന്നീടും പിന്നീടുണ്ടായ രാജ്യങ്ങളിലും എത്തിപ്പെട്ടിട്ടു
ണ്ട്. രണ്ടരിലൂടെ സഞ്ചരിച്ചിരുന്ന പടിഞ്ഞാറിയും ഇവിടെ
യെത്തിയിരുന്നു. ഇങ്ങനെയുണ്ട് സഞ്ചാരികളെ ആകർഷിക്കുന്ന
ഈ ഗ്രാമത്തിന്റെ സമ്പന്നതിനു കാരണമായ നിയന്ത്രിതനാണ്.
ഇതുപോലെയുണ്ട് ഒരുപാട് കേട്ടുകഥകൾ, ഇങ്ങനെയൊക്കെ ചൈനാൻ
ഫിക്സ് കോഡ് എഴുതിവയ്ക്കാം നടിന്റെ പടിഞ്ഞാറിന് ഒരു
മോടിപിടിപ്പിക്കലാണ്. വൃത്തിയുള്ള രാഷ്ട്രീയ ആകർഷകൾ പ്രവർ
ത്തിക്കുന്ന ഈ ഗ്രാമത്തിൽ രാഷ്ട്രീയ സ്വപ്നങ്ങളോ
ആത്മീയപരമായ മറ്റു എന്നാണ് ഒരുത്തരം എടുത്തുപറയു
വാനുള്ളത്.

ഫ്രൈഡേ സിനിമീസ് സമർപ്പണം ചെയ്തു

1969-ൽ ഇന്ത്യൻ പോലീസ് സർവ്വീസിൽ ജോലി ലഭിച്ച 1981-ൽ ജോലിയിൽ പ്രവേശിച്ച ഒരാൾ ഇന്നാട്ടിലെ നിലയിൽ മനോഹരമായ ഒരു സിനിമ മറ്റ് സുഹൃത്തുക്കളുടെ സഹായത്തിനും പിന്നിൽ പ്രവർത്തിച്ച നിരവധി മഹിളാപ്രതിഭകളെ സ്മരിച്ചുകൊണ്ടുണ്ട്. ഇന്ന് ഉടലെടുത്തിരുന്ന ഒരു സ്ത്രീ എന്ന രീതിയും പ്രവർത്തിക്കുകയും ചെയ്തു. ഒരുപാട് ചെല്ലിനാശങ്ങൾ സഹിച്ചു. ഒരു ഭർത്താവിന്റെ ചുമതലയും പിടിച്ചു. ഭാര്യ: നവ്യ: നായർ ജോലിക്ക് പോകുന്നു, മകളെ വീട്ടിലാക്കി പി.ടി.എ പ്രസിഡന്റായി സേവനം ചെയ്ത ഒരു സ്ത്രീയുടെ നാട്ടുകാരിലൊരാൾ, സ്ത്രീകൾ അടക്കം മറ്റൊരാൾ സിനിമയിൽ അഭിനയിച്ചിരുന്നു. ഇതിൽ ഒരാളായിരുന്ന ഇതിൽ നായർ-സമുദായത്തിൽപ്പെട്ട രണ്ടാൾ, എൻ.വി. രാജൻ വൈദ്യർ മാസ്റ്റർ, എം.കെ. രാഘവൻ മാസ്റ്റർ, ഇ.എസ് ഉദ്യോഗസ്ഥനായിരുന്ന മുഹമ്മദ് ഇടമനയും പി.എ.ജോസ് സജീവ സാന്നിധ്യമായിരുന്ന മുഖ്യനായ ഇടമനയും ജോസഫ് ചെണ്ടുപുറം പോലീസുകാരെയും, ജോർജ്ജുകുട്ടി. ഒരേ സ്വന്തമായിൽ, ജോസ് മല്ലൂരേയും, ടിൻസും പി.ടി.എ പ്രസിഡന്റായിരുന്ന അന്തോണീസ് ജോസഫ് മറയ്ക്കൽ, പി.പി. പിതാംബരൻ നമ്പീശന്റെയും സഹോദരനായും സ്ത്രീകൾക്കും നിലനിൽക്കുന്നതാണ്

Mukundpuram Taluk

In 1792, Maharaja kingdom of cochin formed mukundapuram taluk by adding mapranam nadu and parts of Nandilathu nadu to mukundapuram nadu. In the last decade of the 18th century, the last Naduvazhi Nambiar of mukundapuram nadu died and Sakthan Thampuran confiscated all the powers and properties of mukundapuram Nambiar and mapranam Nambiar. Sakthan Thampuran divided old mukundapuram Taluk into six Properties 1) Thazhekkad 2) Areepalam 3) mukundapuram 4) mapranam 5) Nandikkara 6) Padukkad for administrative and revenue purposes. Five more properties were added to mukundapuram Taaluk afterwards: Kodassery (Chalakudy) Thiruvilwamala (Kuzhur), Koratty, Edavilangu and Malayattur. when new chalakudy taluk was formed in 2013 by bifurcating mukundapuram Taluk, it lost thon 50% of its territory.

IRINJALAKUDA MUNCIPALITY

Irinjalakuda is a muncipal town in Thrissur district, Kerala, India. It is the headquarters of Irinjalakuda Revenue Division and makundapuram Taluk. The place is well-known for koodalmanikyam Temple and the Thachudaya kaimals who had Princely status until 1971.



POPULATION

As of 2011 India census, Irinjalakuda had a population of 28,741. males constitute 48% of the population and females 52%. Irinjalakuda has an average literacy rate of 96% which is much higher than the national average of 74.65%. while male literacy stands at 97.12%, female literacy is 94.56%. 10% of the population is under 6 years of age.

TRANSPORTATION

Irinjalakuda is located on state Highway 22, which links to major national highways NH 47 and NH 66 in the state. The nearest is the Irinjalakuda Railway station which is about 8 km east of the town at Kallatumkara. It is managed by southern Railway of Indian Railways. The nearest airport is Cochin international Airport.

EDUCATIONAL ORGANIZATION

Between the 14th and 16th century, it was a centre of learning. Kerala school of astronomy and mathematics which was believed to be founded here, made major contributions in Algebra, Arithmetic, Astronomy, Calculus, Geometry, Infinite series and Linguistics.

Colleges

- Christ College
- St. Joseph's college
- Christ college of Engineering
- Universal college of Engineering, Vallivattom

State

- S.N.H.SS, Irinjalakuda
- L.F.C.H.S.S, Irinjalakuda
- Don Bosco Higher secondary school
- National Higher secondary school

CBSE

- Bhavan's Vidya mandir, Irinjalakuda

ICSE

- Don Bosco Central school

INDUSTRY

KPL oil mills, KLF oil mills, AKP metals KSE, CKK metals, Pappai Icecream, Delicious cashew etc... are in irinjalakuda.

KPL Oil Mill

Established in 1941, KPL oil mills Private limited has made a name for itself in the list of top suppliers of in India The supplier company is located in Thrissur, Kerala and is one of the leading sellers of listed Products It is listed in Trade India's list of verified sellers offering supreme quality of etc Buy in bulk from us for the best quality Products and Service.



KLF Industry

KLF Industries is a name synonymous with coconuts and coconut oil for over 75 years. It is among the top selling brands of coconut oil in the country. Adhering to the highest quality parameters from copra procurement through processing to packaging, KLF is synonymous with what's pure, wholesome and healthy in coconut oils. with a state-of-the-art extraction and packaging plant located at Irinjalakuda in Thrissur district of Kerala, it produces high grade coconut oil and sesame oil. It is founded by visionary businessman, the late Mr. K.L Francis in 1943.



KSE Limited

KSE Limited established in 1972, KSE Limited has made a name for itself in the list of top supplies of ice cream cattle feed in India. The supplier company is located in Irinjalakuda, Kerala and is one of the leading sellers of listed products. It is listed in Trade India's list of verified sellers offering supreme quality of sundae ice cream, kulfi ice cream etc. Buy ice cream, cattle feed in bulk from us for the best quality products and service.



AKP Vessel Industry

AKP Vessels in Injalakuda The business strives to make for a positive experience through its offerings. Indias leading B2B market place, Id mart ensures engaging in business activities is a seamless process for small and medium enterprises as well as large business.



Pappai Ice Cream

Fruto offers a whole lot of pleasure packed tastes and the wholesomeness of superior milk butter and quality ingredients. And the finest ingredients add to its quality and taste. Rime Rich Food Pvt. Ltd. brings to you the Fruto ice creams under the brand Pappai. Powered by the most advanced European Technology, Pappai's highly advanced manufacturing unit can deliver 1 lakhs plus litres of ice cream every day. The fully automatic machinery highly hygenic plant and 100% tamper proof packing ensure both good health and good taste.

PAPPAI
ice cream

Introduction

In Economics, Marginal Concepts are associated with a Specific change in the quantity used of a good or Service, as opposed to Some notion of the over-all Significance of that class of good or Service or of Some total quantity there of. A value that holds true given particular constraints is a Marginal value.

The marginal use of a good or Service is the Specific use to which an agent would put a given increase, or the Specific use of the good or Service that would be abandoned in response to a given decrease.

UTILITY

utility is the want satisfying power of a Commodity. The unit of measurement of utility is called util, which is an imaginary unit.

A utility function is a formula showing the quantities of goods and Services that an individual Consumers.

$$U = f(Q_1, Q_2)$$

where U is total utility and Q_1 and Q_2 are the quantities of the two Commodities Q_1 and Q_2 which he Consumes.

Marginal utility

The marginal utility was introduced by william stanley jevons. Marginal utility of a good is the additional (extra) utility gained by consuming one more unit of the good. In other words, marginal utility is the rate of change in total utility.

Marginal utility can be calculated by dividing the change in total utility by the change in the number of units consumed.

$$\text{Marginal utility} = \frac{\text{change in total utility}}{\text{change in units consumed}}$$

Mathematically marginal utility is defined as the first derivative of the total utility function.

$$MU(Q) = \frac{\partial TU(Q)}{\partial Q}$$

Example - 1

If a consumer 3 units of a commodity total utility derived is equal to the sum of the utilities derived from the three units. As quantity increases total utility increases. But total utility increases at a diminishing rate. The following table shows Marginal utility and total utility when a consumer 5 units of a commodity

Number of units	Marginal utility (utils)	Total utility (utils)
1	55	55
2	50	105
3	45	150
4	40	190
5	35	225

Marginal Propensity to Consume

In Economics, the marginal propensity to Consume (MPC) is a metric that quantifies induced Consumption, the Concept that the increase in personal Consumer spending (Consumption) occurs with an increase in disposable income (income after taxes and transfers). The proportion of disposable income which individuals spend on Consumption is known as propensity to Consume. MPC is the proportion of additional income that an individual Consumer. For example, if a household earns one extra dollar of disposable income, and the marginal propensity to consume is 0.65, then of that dollar, the household will spend 65 cents and save 35 cents. Obviously, the household cannot spend more than

the extra dollar (without borrowing).

According to John Maynard keynes, Marginal propensity to Consume is less than one. $MPc = \frac{\Delta c}{\Delta Y}$

Marginal propensity to Save

The marginal propensity to Save (Mps) is the fraction of an increase in income. That is not Spent and instead used for Saving it is the Slope of the line plotting Saving against income. For example, if a household earns one extra dollar, and the marginal propensity to Save is 0.35, Then of that dollar, the household will Spend 65 cent and Save 35 Cents. It is the fractional decrease in Saving That results from a decrease in income.

The Mps plays a Central role in keynesian economics as it quantifies the Saving-income relation, which is the flip side of the Consumption-income relation, and according to keynes it reflects the fundamental psychological law. The marginal propensity to Save is also a key variable in determining the value of the multiplier.

$$MPs = \frac{\Delta s}{\Delta Y}$$

where,

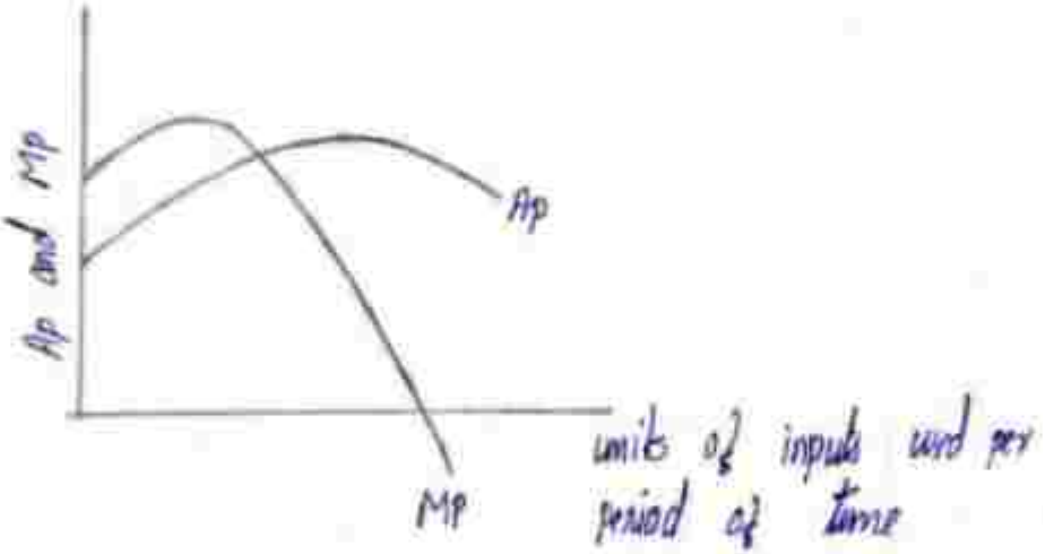
MPs = Marginal propensity to Save

ΔS = Change in Savings

ΔY = Chang in income

Marginal product

In particular neoclassical economics, the marginal product or marginal physical productivity of an input (factor of production) is the change in output resulting from employing one more unit of a particular input (for instance, the change in output when a firm's labour is increased from five to six units), assuming that the quantities of other inputs are kept constant.



marginal product of a given input can be expressed as:

$$MP = \frac{\Delta y}{\Delta x}$$

where Δx is the change in the firm's use of the input and Δy is the change in quantity of output produced.

If the output and the inputs are infinitely divisible, so the marginal "units" are infinitesimal the marginal product is the mathematical derivative of the production function with respect to that input. Suppose a firm's output Y is given

by the production function : $y = f(K, L)$.

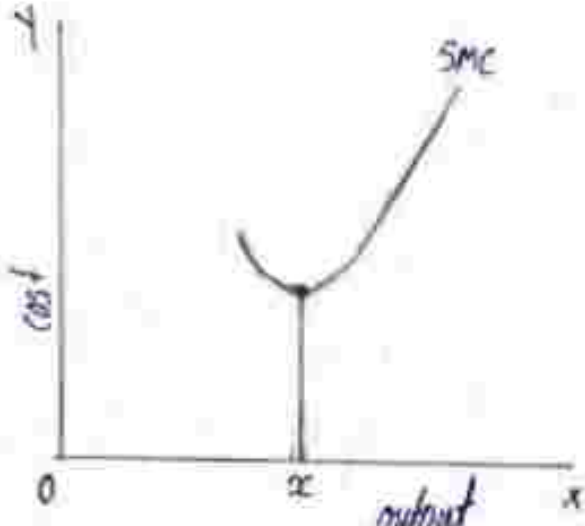
where K and L are inputs to production. Then the marginal product of Capital (MPK) and marginal product of labour (MPL) are given by :

$$MPK = \frac{\partial F}{\partial K} \qquad MPL = \frac{\partial F}{\partial L}$$

Marginal cost

Marginal cost is defined as the change in total costs resulting from producing one extra unit of output.

$$Mc = \frac{\Delta Tc}{\Delta Q}$$



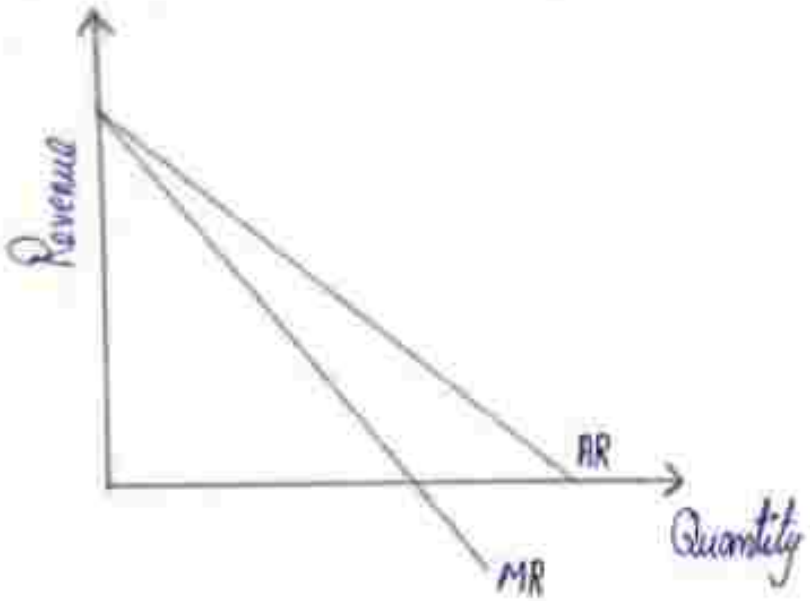
Graphically the Mc is the slope of the Tc curve. The Mc curve is a U-shaped curve. Initially the Mc declines, reaches a minimum when the size of the plant is optimum and rises beyond the optimum point. Marginal cost depends in no way on fixed costs.

Marginal Revenue

Marginal Revenue is defined as the addition to total revenue resulting from the sale of one more unit of output.

$$MR = \frac{\Delta TR}{\Delta Q}$$

MR shows the rate of change in total Revenue with respect to output, it is the slope of the total Revenue curve.



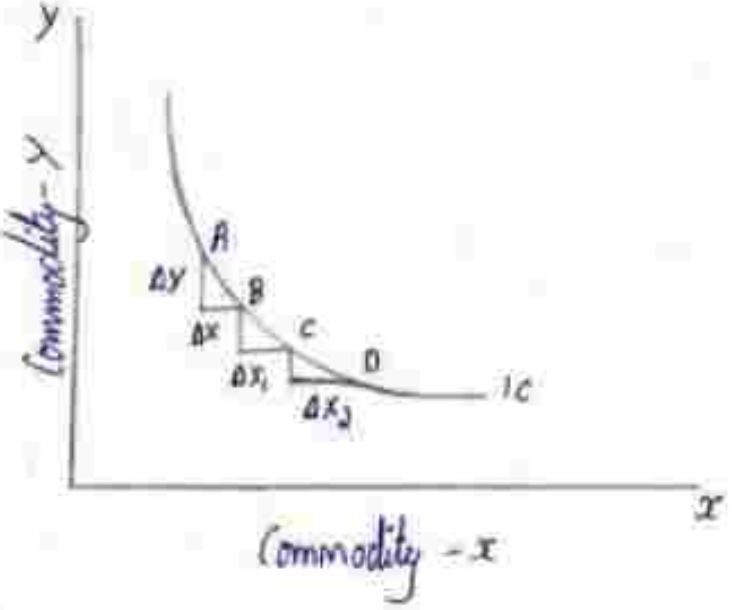
Marginal Rate of Substitution

The marginal Rate of Substitution (MRS) between any two goods is defined as the amount of the first good the Consumer is willing to give up to get one additional unit of the Second good and maintain the Same level of Satisfaction. The marginal rate of Substitution of x for y (MRS_{xy}) refers to the amount of y that a Consumer is willing to give up in order to obtain one additional unit of x and still remain on the Same indifference curve. Mathematically it Can be defined as,

$$MRS_{xy} = \frac{\text{Loss of } Y}{\text{Receipt of } x} = -\frac{\Delta Y}{\Delta x}$$

with respect to an indifference curve $-\frac{\Delta Y}{\Delta x}$ is its slope.

Thus the Slope of an indifference curve is called the marginal rate of Substitution.



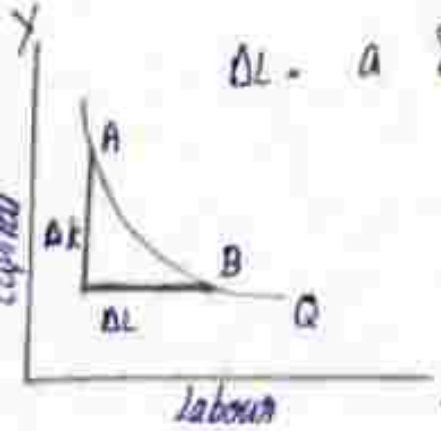
Marginal Rate of Technical Substitution

Marginal Rate of Technical Substitution (MRTS) is the rate at which one input can be Substituted for another without changing the level of output. The marginal Rate of technical Substitution between Labour and Capital ($MRTS_{LK}$) is defined as the amount by which Capital can be reduced by a given without changing output when there is a Small increases in the amount of labour.

$$MRTS_{LK} = \frac{\Delta k}{\Delta L}$$

where ΔK - a Small change in Capital

ΔL - a Small change in Labour



The Slope of the isoquant Shows the rate at which one input can be Substituted for another without any change in the level of output. The absolute slope of the isoquant is the marginal rate of technical Substitution between

two inputs.

Relationship between Average Revenue and Marginal Revenue

Marginal Revenue is the change in total revenue when one more unit of a commodity is sold.

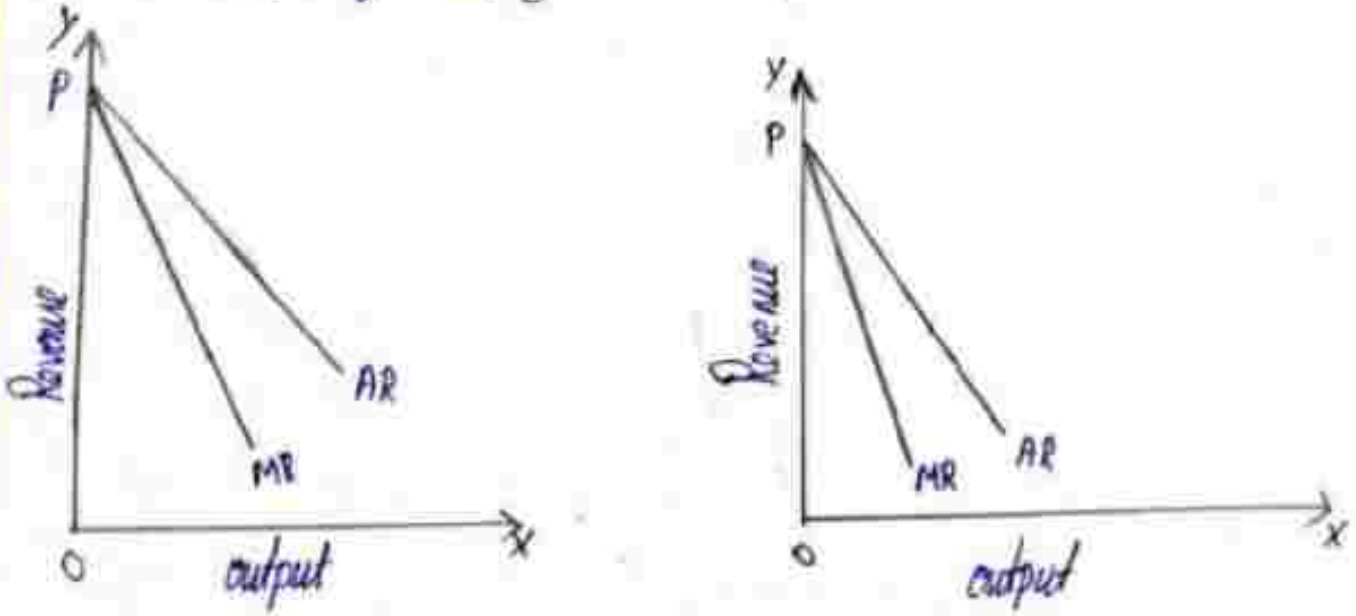
$$MR = \frac{\Delta TR}{\Delta Q}$$

Average revenue refers to revenue per unit of output.

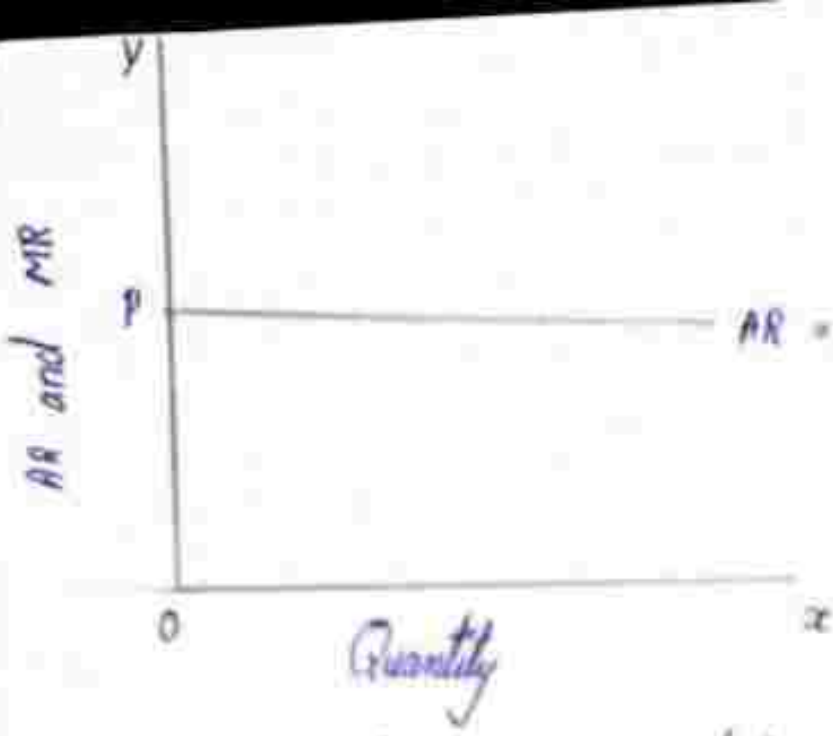
$$AR = \frac{TR}{Q}$$

Relationship between AR and MR :

a) when AR is decreasing, MR should be decreasing faster than AR. Thus, downward sloping MR curve is below the downward sloping AR curve. (a situation of monopoly and monopolistic competition)



b) If AR is constant, MR is equal to AR. Both are indicated by the same horizontal straight line.
(a situation of perfect competition).

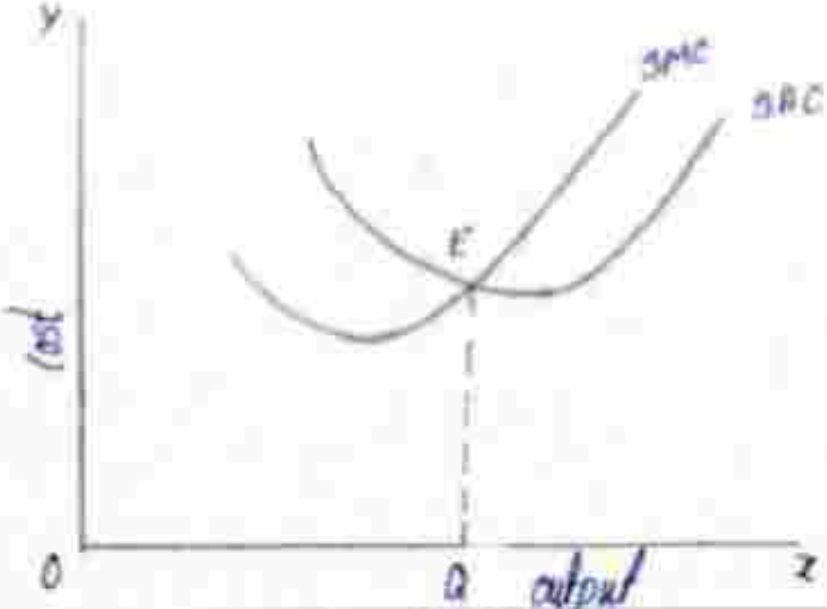


c) MR can be negative, but not AR.

Relationship between Average cost and Marginal Cost

There is a unique relationship between the Ac curve and Mc curve.

1) When Ac is decreasing as output increases Mc is less than Ac
2) When Ac is increasing as output increases, Mc is greater than Ac
3) Mc is equal to Ac when Ac is at its minimum. The Ac curve is flat over a small range of output and it is neither falling nor rising.



Elasticity : Price elasticity, Income elasticity, Cross elasticity — Elasticity

Elasticity is a measure of a variable's sensitivity to a change in another variable, most commonly this sensitivity is the change in quantity demanded relative to changes in other factors, such as price.

Price Elasticity

Price elasticity of demand is defined is the ratio of the percentage change in quantity demanded to the percentage change in price. price elasticity is a measure of the degree of responsiveness in the quantity of a commodity demanded to changes in its price.

$$Ed = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

Income Elasticity

Income elasticity of demand is defined as the percentage change in quantity demanded divided by the percentage change in income.

$$Ey = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

Cross elasticity

The responsiveness of demand for one commodity to changes in the price of a related commodity is called cross elasticity of demand.

$$Ed = \frac{\text{Percentage change in quantity demanded of one commodity}}{\text{Percentage change in the price of a related commodity.}}$$

Conclusion

The purpose of this chapter has been to develop some tools that we can use to study how make production and pricing decisions. You should now understand what economists mean by the term costs how costs vary with the quantity of output a firm produces.

x ——— x

Department of English

The Character of Lady Macbeth

There are two extreme views among Critics about the character of Lady Macbeth. Some Consider her a heartless, unwomanly Creature who edges her husband on to commit the most bloody deed, while others look upon her as a delicate, fragile woman who, out of her love for her husband, "unsexes herself", but whose womanly nature soon emerges and she collapses under the stress of events.

There is a touch of womanhood in the ruling passion of Lady Macbeth's mind. She is ambitious less for herself than for her husband. In her famous Soliloquy, after reading her husband's letter, she does not refer to herself even once. She wishes to see her husband on the throne and the Sceptre within his grasp. The strength of her

love for him adds Strength to her ambition. Even when She reproaches him, there is no indication of female Scorn, no want of wifely respect or love. She does not urge Macbeth on to new Crimes.

Lady Macbeth expresses no feeling of personal malignity towards any human being in the whole play. She becomes partner in the murder of Duncan from the Sole motive of ambitions. By this entire absence of personal virulence Shakespeare has given her a Statue like Simplicity. She has no personal grudge against Duncan, and the object of murder, in her view is the attainment of crown which in those days was a Symbol of divinity.

According to Bradley, Lady Macbeth is the most Commanding and perhaps the most awe-inspiring figure that Shakespeare drew She has an inflexible will which can keep imaginative visions, feeling and conscience in check. Aware of her husband's weakness She tries to Counteract it by assuming the direction

of the affairs which she calls "this night's great business' She rouses him with the word "Coward!, not with any argument. Her reasoning are mere. Sophism, they can persuade no man, but her courage sweeps. him off his feet.

In the presence of overwhelming horror and danger, Lady Macbeth's self control is perfect as we see in the murder Scene and the banquet Scene. Not a word of complaint, no single word of her own suffering ever escapes from her in the presence of others. She relies on nothing but herself, for she never seeks her husband's help, but gives him her help She never betrays her husbands or herself even by a look. Save in Sleep.

The traces of feminine weakness and human feeling are seen in her from the begining of the play. If she had been a ready made fiend, there would have been no need to invoke the spirits to unsex her. Her words 'Had he not resembled my father as he slept, I had don't are spoken with regret, but they throw light into her nature. She could never have done the murder even if her husband had failed for she had to embolden herself with wine even to play the mirror role she did.

Coming to the drawbacks of Lady Macbeth, we.

have to admit that she appears almost inhuman in the earlier Sceneces of the play we find no trace of pity for the kind old king. no sense of value of the lives of the grooms on whom the guilt is laid, no awarness of the treachery and meanness of the morder. But if she is really a "fiend-like queen" as malcolm call her the Sleep-walking Scene would have been impossible. Lady Macbeth is not naturally humane. on being informed of Ducan's murder, her immediate reaction is "What, in our house?" Banquo's curt reply, 'Too cruel any whove is reproof of her insensibility.

Lady Macbeth vanished from our sight after displaying her essential frailty. we are left with the impression of woman in whom will conquered the softer parts with which reasserted itself when the will was broken Coleridge calls her a woman of high rank feeding her self with day dreams of ambition

TORVALD HELMER

Torvald embraces the belief that a man's role in marriage is to protect and guide his wife. He clearly enjoys the idea that Nora needs his guidance, and he interacts with her as a father would. He interjects her with trite, moralistic sayings, such as: "A home that depends on loans and debt is not beautiful because it is not free". He is also eager to teach Nora the dance she performs at the Costume party. Torvald likes to envision himself as Nora's savior, asking her after the party, "Do you know that I've often wished you were facing some terrible dangers so that I could risk life and limb, risk everything, for your sake?"

Although Torvald seizes the power in his relationship with Nora and refers to her as a "girl", it seems that Torvald is actually the weaker and more childlike character. Dr. Rank's explanation for not wanting Torvald to enter

his sickroom – "Torvald is so fastidious, he cannot face up to anything ugly" – suggests that Dr. Rank feels Torvald must be sheltered like a child from the realities of the world. Furthermore, Torvald reveals himself to be childishly petty at times. His real objection to working with Krogstad stems not from deficiencies in Krogstad's moral character but, rather, Krogstad's overly friendly and familiar behavior. Torvald's decision to fire Krogstad stems untimely from the fact that he feels threatened and offended by Krogstad's failure to pay him the proper respect.

Torvald is very conscious of other people's perceptions of him and of his standing in the community. His explanation for rejecting Nora's request that Krogstad be kept on at the office that retaining Krogstad would make him "a laughing stock before the entire staff" – shows that he prioritizes his reputation over his wife's desires. Torvald further demonstrates his deep need for society's respect in his reaction to Nora's deception. Although he says that Nora

has ruined his happiness and will not be allowed to spoil the children, he insists that she remain in the house because his chief concern is saving the "appearance" of their household.

MACBETH

→ WILLIAM SHAKESPEARE

TOPIC : Character Macbeth

How is Macbeth a Tragic Hero?

MACBETH

WILLIAM SHAKESPEARE

Macbeth, recognized for his military skill and integrity, is given a prophecy by three witches. They tell him that he will receive two titles other than the one he has one of those is "king". He does get the other title and dreams of becoming king of Scotland. He tells his wife, and everything else is history. Together, the two plot to make the prophecy come true. They kill King Duncan, frame his sons, and rise to the throne. Macbeth also kills his best friend and attempts to kill his son, Fleance, as a result of the prophecy. To ensure his throne, he has others murdered. Lady Macbeth can't take it and kills herself. Macbeth vows to fight the good fight until the end, and he is beheaded. Duncan's son, Malcolm comes to the throne and Scotland is again a peaceful realm.

Critical Analysis of Coolie

Mulk Raj Anand has been one of the important pillars of Indian writing in English. He has written many novels and one of his prominent works is 'Coolie'. Anand has always voiced the untouchables and less privileged and this novel yet again highlights this theme. It is a picaresque and episodic novel

It focuses on the story of Munoo, a boy who moving from place to place, city to city and town to city. North to South and then back to North. Apart from Munoo, there is no casual relationship between events and serious incidents. Everything is a result of chance and accident. Munoo, just drifts along with the situation passively.

The entire life of Munoo can be divided into four phases - Dowlatpur, Sham

Nagar, Shimla and Bombay. In all the phases, he meets many people and most of them, his contact is very minimal. The plot is very compact and appear as disconnected episodes. Munoo takes part in all of them. Some of the major themes of the novel are the suffering and exploitation of the poor, the underdog and millions of others in the sub-continent.

The British reigns had dehumanized and deteriorated the exploited and they lost all sense of self-respect and dignity and flatter and casing for their right to life. All the phases of Munoo's life have been linked thematically and there is a deeper meaning which keeps on digging is the principal theme. Anand has brought in this panoramic material has been formalized and organized through a wonderful pattern of contrasts and parallelism.

All over the novel, we find an abundant amount of suffering and poverty. The poor and rich lives are in utter contrast to each other. The rural life has been carefully and intricately contrasted with the modern one. Munoo's exploitation through village landlord's hands is contrasted by Munoo's own at all four phases.

Munoo is the consciousness centre of the novel and we get to see all actions through his perspective. Every thing around him is depicted the way it would appear to a child and it has the zeal for life, curiosity and spiritedness of a kid. We see that the point of view is of a true child, who brings all the material in focus and formalizes it. A child surveys the whole Indian sub-continent in the novel. No characters are capitalized and none of the incidents

are happening with the flow. It is the true and factual experience of a child. Anand has a Dickens like capacity to enter into a child's mind and look at the world through his eyes. He suffers loss of identity as transferred from one place to another during his journey.

Anand brings out the harmful effects of colonialism on the mentality of people. He talks about the inferiority complex which has been fed in the minds of Indians and talks about Munoo's submissive soul. This novel is unique in the sense that it voices the exploited and underprivileged people. It portrays the ugly truth that happiness only belongs to upper everywhere whether it is Bombay, Simla or Kangra Hills.

"English language is the greatest gift
Of Goddess saraswati to India."

C. Rajgopalachari

INTRODUCTION

English is called as "The window to the world". English is a west germanic language that was first spoken in early medieval England and is now the most widely used language in the world. It is the third most common native language in the world, after Mandarin and spanish. It is widely learned as a second language in india. The language has contributed significantly bringing people and their culture closer. It is a language of education. English language had come in to india along with colonization

Historical Background of Indian English

Early 1600's	East India company started trading and English missionaries first began their efforts.
1765	English was established firmly as the medium of instruction and administration by the british Raj
Early 1800s	A large number of christian schools imparting an English education
1835	The Process of Producing english-knowing bilinguals in india which officially endorsed T.B Macaulay.

The historical development can be divided into two Periods:

Pre-independence Period

Post-independence Period

Pre independence Period:

Charter act - The Act was renewed in 1813. The clause 43 of the charter contains: "a sum of not less than one Lakh of Rees in each year shall be set apart and applied to the revival and improvement of literature and the encouragement of the learned natives of India, and for the introduction and promotion of a knowledge of the sciences among the inhabitants of the British territories in India"

East-West Controversy - Also known as Oriental-accidental Controversy. The main issues were on: whether a limited number of people be given higher branches learning - whether English/Arabic/Persian be the instruction - whether the western sciences and literature or the studies be encouraged - whether the responsibility for education be entrusted the state or be left to Private enterprises.

Macaulay's Minute - Proposed by lord Bebington Macaulay in 1835. He says english education should be the aim of indian education and the promotion of literature should mean promotion of English literature.

The Downward filtration Theory - Put forward by Macauley - Education was to permeate to the masses from above, drop by drop from the himalayas of indian life and useful information was to trickle downwards, forming in time a broad and stately stream to irrigate the thirsty plains.

Post-independence Period

Associate official language - Parliament by an Act (1965) decided to accord English the status of Associate official language of India for an indefinite period.

Three language: Language Act Passed in 1965 - Hindi shall be the official language of India English shall be the associate official language the regional language shall be the languages of administration within the respective states.

Features of Indian English

Mother tongue influence - Certain sounds, Pronunciation and syllable stress patterns which are dominant in the vernacular languages continue to exist when indians speak in English. Eg harsh consonant sounds like Pa, ba and da, vowel sound generalization like e and a (message, communication, continue)

Regional influence - Certain Phrases, statements and Pattern of constructing sentences which are regionally accepted are converted and translated into English. For example. taxi wala, autowala, sirji. etc have become Part of the Indian English. Phraseology - Indian English has come up with it's own Phrases and Popular sentences that are widely accepted and understood in the Indian Context. for example, BA Failed used in Matrimonial ads to describe someone who was admitted to the course but did not pass the examination.

Phonetic and Phonological features - lack of aspiration in the word - initial Position. Words such as Pin and kanPur are Pronounced as Pin and kanPur; not as Phin and khanPur respectively. Retroflexion. Alveolar consonants: ṭ and ḍ are replaced by their corresponding retroflex consonants (T.D). Therefore, alveolar ṭ and ḍ in the name of the months such as OcṭoberS, SePtemberS and DeceṃberS are Pronounced as OCtober, SepTember and December: Lack of interdentals: words such as thanks that are Pronounced with corresponding unvoiced alveolar stops respectively.

Pronounciation - Indian english Pronunciation is a relatively dose approximation to the written form. Generalization in terms of schwa sound and clipping of the vowel sounds and non distinction between long and

short vowels sounds are prominent in Indian English. Non articulation of vowel sounds is another feature of Indian english.

Stress and intonation system of Indian English-

Different from British or American English. The rhythm of Indian English is based on long and short syllables rather than on stressed syllables. Indian english is a syllable-timed language with sing-song characteristics.

Grammatical features of Indian English -

Reduplication - a small favor, Countability of Non-counts: words such as furniture and luggage become furnitures and luggages respectively. Addition of Prepositions / Particles - Observe the addition of the particle OFF in: 'Everyone is dismissing off my proposal.

INDIAN WORDS IN ENGLISH

→ Words of Hindu, religion and Philosophy - Adharma, Advaita, Ahimsa, Ananda Marg, Agrahaaram, Arjuna award.

→ Words representing things, animals, customs - Bandicoot, banyan, bhai, beebi, chakra, saras, challan, chilli, dal, d'bana

→ Words from Indian freedom movement - Bandh, Dhandi March, dharna, gherao, Jatha, Satyagraha

→ Proper Nouns and their Derivatives - Bharath, Gandhi, Gandhian, Ghudkha, Himalayan, Hindustani, Holi, IGNOU, Indiarubber

→ Mistellaneous words - Anganwadi, Ashram, autorikshaw, Ayurveda, beegum, bhaklo, bhatti, bhikshu, chup, Cooli, curryleaf. words related to culture and other religions - Arjan, Arya Samaj, Ashok chakra, baba, babu, Bakrid, Bradshaw, caste.

Indian English literature

Today, India not only remains a member of the English speaking world, but also contributes to a distinct genre of English literature called 'Indo Anglian literature. Raja Ram Mohan Roy and Keshab Chandra Sen were the first one who began to question the orthodox prejudices, dogmas and superstitions that had gripped them for centuries.

The beginning of the 19th century, the main aspect of the Indian Renaissance was the effort to recreate the cultural life that existed in the west. Indian writers in English are responsible for the use of several indian words in English. R.K Narayan, Raja Rao, Mulk Raj Anand, kamala Das, Nissim Ezekiel, Sarojini Naidu and V.S Naipul are some writers.

In the 20th century, English is like a window English is the language of information and technology. English is

the language of communication. It is the language of science and Technology. English is the language of advertisment and Marketing. English belame the part of everyday life. The English People have been always ready to accept words from other languages. The Opening of the colonies all over the world Provided them the opportunity to come across numberless languages in the various countries of the world.

So there are many requirements of English language not only for india, It is helpful and require for all country, English language for india is very important, because It has major role in india.

Department of History

Harappan Civilization

Culture in Harappan Civilization

Generally historians assumed that during Harappan civilization, many cultural activities were flourished.

→ Harappan Ceramics:

- The typical Harappan pottery is a fine, sturdy, wheel made ware with a buff or red slip decorated with painted black designs.
- They made and used metal patterns.
- Different shapes of pottery were used like dish, cylindrical, bowl shaped, goblet etc.
- More potteries were used in household purposes.

→ Terracottas:

- Harappan cities have provided a large quantity of terracottas:
  - Terracotta Bangles: They are hard, bright fired stone ware bangles and usually with 5-6 cm in diameter with tiny slits on them.
  - Material objects like toy carts with solid wheel, terracotta models.
  - Human figurines - male and female figures

Page No.
Date

Harappan Science and Technology

Historians termed Harappan Science as the 'exact science'.

- The many stones from Mohenjodaro resulted in the earliest version of Cartesian co-ordinates the basis of the numerical variation on the basis of measurement of mass.

Seals:

- Seal making was an important craft.
- Most of the seals are square or rectangular, but cylindrical and round seals are found.
- Seals are usually made with steatite stones, but those made with copper, gold and ivory were also formed.
- Motifs in the seal are of animals like elephant, rhinos, tiger, buffalo etc.
- Seals have 3D like projections to suggest which shows the skills of Harappans.
- Seals are assumed to be used for commercial purposes.

General Features of Mature Harappan Settlements:

* Harappan civilization was urban but it does not mean that all the settlements had an urban nature. A majority were in the village. The cities depended on villages for food, wood, labour etc.
* There were differences b/w the buildings in large cities and those in smaller towns and village. It was in the type and combination of raw materials used. In cities, buildings were made of mud bricks. In cities, buildings were made sundried and kilnbaked bricks.
* Some of the large settlements are Mohenjodaro, Harappa, Rakhigarhi, Dholavira etc in Civilization. Other large sites are Nageswar, Those were Daw in Sindh and Manikyala in Baluchistan.
* Recently, some very large Harappan sites have been reported in Punjab, Dholavira in Kutch district and Gumla Valley.

Culture in Harappan Civilisation

Comparing Harappan civilisation with Comparing with other chalcolithic cultures Harappan civilisation is advanced. Espesialy in pottery making, beads, religious belief. Most of the diciplince in Harappan civilisation is the inherited from pre-harapp times. Due to inability to des decipher the script Harappan culture we cant understant in it complete. Through ar archeological excavation we get pottery, Seriels, paintings, bonal evidence, building town planning in the society writing, seals, great bath, Granaries, Technology of Their trades etc with sights etc.

Harappan cites have been found in Afganistan, Punjab, Sindh, Baluchistan and

North west Frontier Province of Pakistan, Jammu, Punjab, Haryana, Rajasthan, Gujarat and western Uttar Pradesh in India.

Harappa Harappan civilisation is categorised into 3 complex according to its consentra- called Mohenjo-Daro Complex, Harappa Complex and Dholaviva Complex.

Terracottas and metal sculptures

Harappan 9 units of weights and measures are standardised. The smallest basic weight

The weight stone measurement is 1'2"8 16'32 cm

It was made by chert, chalcedony, black stone.

Commonly the weight shaped like pyramid with cut and rectangular in cubical form. The largest weight found at Mohenjodaro was in Beige shell stone

was found at Mohanjodaro and an ivory scale at Lothal and a shell object so far found in Saurashtra was used to measure angles.

Terracotas

From Harappan sites get figures of animals such as bull, buffaloes, monkeys, dogs etc. Materials like toy carts with solid wheel, terracota bangles, terracotta masks and Human figurines of both male and female.

Terracotta bangles are hard, high-fired ware, were usually with 5 to 6 cm in diameter with tiny holes on them.

There is the concept of Mother Goddess. Goddess Terracotta figurine of mother goddess is considered, there was a cult with diverse characteristics. It is not true to widespread presence of this deity indicates a prominent

mothergod is the simple of fertility.

'Priest King' - An impressive stone work assumed priest king. Sculpture is more prominent than other figurines. The figure is of a man with a close-cropped beard, half-closed eyes, and a fillet with an encrusted diadem around his head. A smaller ornament is tied around his right arm. A robe decorated bonfoil design is pass over his left arm and below his right arm it is found from Moranjodaro. And either it is a priest or king or both.

The female figurine from Dholavira is a fragment with punched mouth and [illegible] eyes, broad fan like headgear which is [illegible] Both ears and navel shown by hole. A [illegible] punched line on the waist. A [illegible]

Bronze, Copper statues.

Objects of pure copper, alloys with arsenic, tin, or nickel. Vessels, spears, knives, swords by making used by copper and bronze.

Bronze animals from d Piambad and a dancing girl from Mohanjodaro.

The dancing girl figure had 11cm in hight and made by lost-wax method. The red sculpture is naked, thin woman standing with her left hand resting on the hips holding some objects ornamented especially left hand.

Harappan ceramics

Pottery is in black on red ware, grey, black and red ware in colour. Typical Harappan pottery is fine, wheel-made red-ware, buff and pinkish with designs. Popular shapes are

storys are painted in the pottery. pottery

Distinct shapes of pottery like dish, vase, cylindrical, bowl shaped, globe goblet, Bowl on stand, perforated bowl etc. Bull, deer, fish, crow, etc are the animals painted in the pottery. Horizondal lines, geometrical patterns and pictoral motifs are some designs. Human figures are also used. Pottery for hosehold purpose is more. And they made and used metal pottery.

Seals and sealings

Seals and sealings.

They made seals. Most of them square or some rectangular. But few are cylindrical and round.

Seals are small, usually made with steatite, ivory, gold and they used the seal.

@ Animals like elephant, tiger, antelope, rhinoceros, buffalo, unicorn are the animal used in seal

Unicorn is another one found in seal it is a composite animal figure and belong to mythology In 1st millennium BC similar animals found in Greek.

Seals have 3d production to inside outside. It shows the workmanship of Harappans. Harappan script also found in the seals.

4000 short inscription found on seals. The average size of the seal is 2x2 inches

The proto-shiva deity is identified on seal like as a silted man associate with some animals.

Assume that seals are used to commercial purposes

The Historians Asko Parpola and Iravatham Mahadevan identified that script was written from right to left.

Three Kalibangan seals found [illegible] From citadel area. [illegible]

write right to left. There ~~is~~ rectangular seals & square seals and circular ~~seal~~ some of seals are ~~only~~ are contain only circular objects That are called buttonseals.

Harappan Science and Technology

According to historians Harappan science are exact science - mathematics, geometry, and astronomy.

From Mohenjodaro ring stones found, which is earlist version of Calendar to trace the seasonal variation on the basis of apparent movement of sun.

The Through astronomical observation they attend perfect N-S direction and E-W direction

Harappan Town planning system

The largest Harappan settlement areas are Mohenjodaro, Harappa, Dholavira and Ganweriwala

Earlier camider Harappan cities are oriented in N-S and E-W direction. Later identified it not in absolutely strait in direction.

The settlements are clearly planned.

Harappan cities are generaly in two section. upper city or citadal, and lower city. Citadel is raised from lower town and rectangular in shape. It generally located western side.

There is no correlation between the level of planning of small site and large sites with highest level planning are large and site Kalibangan.

House are different size most of them were rooms arranged around central courtyard.

Doorways and windows nearly open to the main street.

Elaborate arrangements of water for drainage and ~~water~~ bath. For waste management Terracotta drain pipes are used. Through it ~~waste~~ water

Rectangular soak-pits used for collecting solid waste.

River, wells, reservairs, cistern are the source of water. Mohanjodaro have large number of wells. Harappa and Dholavira have reservoir for rainwater type.

Great bath consist of a rectangular brick enclosure made water proof by a layer of gypsum

It had staircases from opposite sides and gallery around. It had adjoining rooms.

Harrappa had a good Granary. It located north of the platforms. There is many reasons Harappan civilisation was destroyed by Aryans and flood.

Harappan civilisation lasted 700 years.

Culture of Harappan civilization

'Karma' refers to any physical or mental work (having Sanskara value work) done either by the individual himself or others. Depending on the nature of karma, it is divided into three types.

Sanchita karma refers to the accumulated karma of previous births. Prarabdha karma refers to the fruits of the karma that we are experiencing in this birth. Agami karma refers to the karma that we are doing in this birth and will be experiencing in the future births. Sanchita karma is the karma that is stored in the form of seeds in the subconscious mind. Prarabdha karma is the karma that is ripened and ready to be experienced in this birth. Agami karma is the karma that is being done in this birth and will be experienced in the future births.

Nine planets are mentioned in Vedic astrology. They are Surya (Sun), Chandra (Moon), Kuja (Mars), Budha (Mercury), Guru (Jupiter), Shukra (Venus), Shani (Saturn), Rahu and Ketu. Rahu and Ketu are the ascending and descending nodes of the Moon's orbit around the Earth. They are not physical planets but have significant astrological influence.

നിലവിലെ ഇലക്ട്രോണിക് ഉപകരണങ്ങൾക്ക് കൂടുതൽ
ഉപയോഗപ്രദമായ ഒരു ഡിജിറ്റൽ ഡിവൈസ് ആയ പേഴ്സണൽ കമ്പ്യൂട്ടറിലെ
ഓപ്പറേറ്റിംഗ് സിസ്റ്റം, ഡിസ്പ്ലേ, ഇൻപുട്ട് ഡിവൈസുകൾ, ഡിജിറ്റൽ സ്റ്റോറേജ്
സിസ്റ്റം എന്നിവയുടെ പ്രവർത്തനങ്ങൾ വിവരിക്കുന്നു. കൂടാതെ ഓപ്പറേറ്റിംഗ്
സിസ്റ്റം ഇൻസ്റ്റാൾ ചെയ്ത ഒരു ഡിജിറ്റൽ കമ്പ്യൂട്ടർ ഉപയോഗിച്ച് ഒരു
പ്രോഗ്രാമിംഗ് ഭാഷ ഉപയോഗിച്ച് ഒരു പ്രോഗ്രാം എഴുതുന്നതിനുള്ള
പരിശീലനവും ഈ കോഴ്സിന്റെ ഭാഗമാണ്.

1. Past history and historiography

The Past is a vast quite unknown space of enormous magnitude leaving comparatively few traces in various forms of posterity. The ancient word history from which the term history was derived was used both as a noun an adjective to denote with herodotus the word historia began to Aristotle The root meaning of the term historia implying to or know from visual experience resulted in almost The earliest works and subsequent of historians followed him in taking History

2. What is Historiography?

Historiography is the study of how history itself is written or handed down throughout the age it takes into consideration the various means by which a historical sources is formed such as the credibility of the source used the motives of main history The word history come from the ancient greek historia which mean inquiry knowledge acquired by investigation The science of writing history is called historography. The Past is a

3. History versus the Past

The terms history and past when used as nouns history means the aggregate of past events whereas Past means the period of time that has already happened in contrast to the Present and future

History is also verb with the meaning to narrate or recount Past meaning to narrate or recount Past is also preposition with the meaning begun in place usually or time Past is also with the meaning in direction that Passed Past is also adverbive with the meaning having already happened. The Past is an ocean of events that once happened

4. Conceptualizing history

Though the field of conceptual history is heterogenous Conceptual historians share two common ideas The first is Recognition that in political discussion Concept are used as to weapons This is characteristics especially in the of value laden Concept such as democ terrorism freedom etc These Concept are used in various ways to meet ends of the political actors using the

Concept are part of the world the world is accordingly changed

The past History and Historiography.

History : കഴിഞ്ഞുപോയതിനെക്കുറിച്ച് എഴുതുന്ന രീതിയെ പറയുന്ന പേരാണ് History.
Example : documents, book.

History, Actual History രണ്ടും different ആണ്. രണ്ടാമത്തേത് പറയുന്നതിനെ മാത്രമേ ആദ്യത്തേത് പറയുന്നുള്ളൂ.

ഒരു Society യിലെ കഴിഞ്ഞുപോയ (past) പ്രവർത്തനങ്ങളുടെയും ഇതുപോലുള്ള സാഹചര്യങ്ങളുടെയും തെളിവുകൾ കൂട്ടിച്ചേർത്ത് പഠനമാണ് History.
ചരിത്രത്തിൽ എഴുതിയിരിക്കുന്ന കാര്യങ്ങൾ സത്യമാണോ എന്നതാണ് ഇന്നു നിരീക്ഷിക്കുന്നത്. അതിൽ നിന്ന് തെറ്റുകൾ കണ്ടുപിടിക്കുന്നതാണ് Historiography.

French Revolution

'Shi' എന്ന word ൽ നിന്നാണ് 'Science' എന്ന വാക്ക് ഉണ്ടായിരിക്കുന്നത്.

Indian Revolution

'Ithihaso' എന്ന word ആണ് ഇതായി മാറിയിരിക്കുന്നത്. Ex: രാമായണം, മഹാഭാരതം...

പ്രവർത്തിച്ചിരുന്ന എന്ന പുരാണത്തിൽ ഈ പദത്തിനുള്ള അർത്ഥം. ഈ അർത്ഥത്തിൽ 13 നൂറ്റാണ്ടിൽ ഇതിനുള്ള അർത്ഥത്തിൽ ഉപയോഗിച്ചിരുന്നു.

Arabian Revolution

'Ihawiq' : അതായത് particular date അനുസരിച്ച് സൂചി പിടിക്കുന്നത്.

History യുടെയും Historiography യുടെയും ഉത്ഭവം 18-20 നൂറ്റാണ്ടിലാണ്.

'History' എന്ന ഗ്രീക്ക് പദത്തിൽ നിന്നാണ് History ഉണ്ടായത് 'History' എന്ന വാക്കിന്റെ അർത്ഥം 'Judge' എന്നാണ്. എന്നുവച്ചാൽ 'തീർപ്പ് നിർണ്ണയിക്കൽ'. രണ്ടുപേർ തമ്മിൽ തർക്കം വരുമ്പോൾ അതിനെപ്പറ്റി അന്വേഷിച്ച് തീരുമാനം പറയുന്നതിനെയാണ് 'Historia' എന്നുകൊണ്ട് ഉദ്ദേശിക്കുന്നത്

history was received of in two major ways:
a) as educational, didactic or moral composition
a meaning that derived from old roman tradition
b) a critical writing.
തുടർച്ചയായ sources നോക്കി രേഖപ്പെടുത്തുന്നതാണ് ഈ പറഞ്ഞിരിക്കുന്നത്

E.H. Carr എന്ന Historian History ക്ക് Modern definition നൽകിയിട്ടുണ്ട്:-
History എന്നത് past ഉം present ഉം തമ്മിലുള്ള സംവാദം (dialogue) ആണെന്നാണ് അദ്ദേഹം

ചരിത്രരചനാശാസ്ത്രം

Historiography

History and the history of historical thought and writing.
ഭൂതകാല പ്രവൃത്തികളിൽനിന്നുള്ള Historical documentsന്റെ പഠനത്തെയാണ് Historiography എന്ന പറയുന്നത്.

History പ്രവൃത്തികളുടെയും അനുഭവങ്ങളുടെയും ആണെങ്കിലാണ് നമുക്ക് ലഭിക്കുന്ന ശൂന്യമായ രേഖകളിൽനിന്നും 'Live picture' എന്നും ലിഖിതങ്ങളിൽനിന്നും, പുരാതന പുസ്തകങ്ങളിൽനിന്നും ഒക്കെയും ചരിത്രമുണ്ടാക്കുന്നത്.
എന്നാൽ Historiography യുടെ ഉദ്ഭവം ഏകദേശം 18-20 നൂറ്റാണ്ടിൽ ആണ്. ഈ സമയത്താണ് ചരിത്രം theory ആയി പഠിക്കാൻ Historians തുടങ്ങിയത്.

American Historian Carl Becker :-

Carl Becker തന്റെ അഭിപ്രായത്തിൽ old History യും Modern History തമ്മിലുള്ള ഒരു comparative സമീപനമാണ് ഒരാൾക്ക് ചരിത്രത്തിൽ ഒരു value കൊണ്ടുവരുന്നത്. അവരുടെ ആശയത്തിലൂടെ ഒരാൾക്ക് ഒരുപാട് കാര്യങ്ങൾ പഠിക്കുന്നു.

Three different Meaning of History

* history in general
* critical study of historical works
* a particular field of historical scholarship such as Greek historiography.

ചരിത്രത്തിലെ ശരിയായതോ തെറ്റായതോ എന്നു നോക്കുകയല്ല ചരിത്രകാരൻ Historiographer ചെയ്യുന്നത്. ചരിത്രത്തിന്റെ (History) നിർമ്മിതിയിലെ പ്രശ്നങ്ങളെയും നിലപാടുകളെയും ചരിത്രപരമായ സമീപനത്തോടെ വിശകലനം ചെയ്യുന്നു.

What is historiography

The Historiographer acts like a history detective seeking to unravel the logic of the production of history. (Veeraraghavan)

ഒരു historiographer ന്റെ duty എന്നു പറയുന്നത് ഒരു ചരിത്രപ്രശ്നത്തിന്റെ ഒരു വശമെടുത്തുകൊണ്ട് മുന്നോട്ടു പോകുകയല്ല അതിനെ സമഗ്രമായി കാണുകയാണ് ചെയ്യുന്നത് എന്നതാണ് ഇതിനെ വ്യത്യസ്തമാക്കുന്നത്. ഇതിനു വേണ്ടിയാണ് നമ്മൾ നേരത്തെ പറഞ്ഞ Inclusion, Exclusion എന്നീ തിരിവുകൾ Historiographer ചെയ്യേണ്ടത്.

ഒരു വശത്തെ മാത്രം തെരഞ്ഞെടുത്ത് പരിശോധിക്കുക എന്നതാണ് Historiographer ന്റെ duty അല്ലാതെ പ്രശ്നങ്ങളെ കൂട്ടിച്ചേർത്ത് ഒരു truth activity ആണ് ഒരു നല്ല Historian Historiographer ൽ വേണ്ടത്.

Trends in Historiography

ഓരോ കാലഘട്ടത്തിലുള്ള trends കൾ വ്യത്യസ്തമാണ്.

Christ historiographer :- ചരിത്രത്തെ ദൈവശാസ്ത്രത്തിന്റെ ഭാഗമായി കാണുന്നു. തിന്മയുടെ മേലുള്ള നന്മയുടെ വിജയങ്ങൾ സമൂഹത്തിൽ കാണുന്നു. സമീപകാല ദൈവശാസ്ത്രം സംഭവിക്കുന്നു

കുറച്ചു കൂടിക്കഴിഞ്ഞ് എഴുതപ്പെട്ടിരിക്കുന്നു. Eg:
'The Cities of God' (Book)

History യിൽ - Historian ചരിത്രം എഴുതുന്നു
Historiography യിൽ - Historiographer അതിനുശേഷം ശരിയാണോ എന്ന് തെറ്റിച്ചു നോക്കുന്നു.
ഒരു കവിതയുടെ History അല്ല നമ്മൾ ചെയ്യുന്നത്.
ഒരു കവിത History എന്തുകൊണ്ട് ഉണ്ടായി എന്നുള്ളതാണ് Historiography.

Quasi History

Quasi History യിൽ ചരിത്രമെങ്കിലും അതിൽ Supernatural powers ഒക്കെ ചേർക്കുന്നു. അതുപോലെ തെറ്റിച്ച് കൂടിച്ചേർക്കുന്നു.
മലയാളത്തിലെ ഇതിഹാസങ്ങൾ എല്ലാം ഉദാഹരണങ്ങൾ ആണ്. Historical ആയി പറയാൻ പറ്റുന്ന കുറച്ച് Quasi History. ഇതിൽ mythology യെല്ലാം ഇടകലർത്തി കൂടിച്ചേർക്കുന്നു.
Example: രാമായണം, മഹാഭാരതം...
തെളിവായി കാണുന്നതാണ് Quasi History.
ഇങ്ങനെയുള്ള കഥകളിലും ചരിത്രത്തിലും കുറച്ച് മാറ്റം വരുത്തി അതിനെ നിലനിൽക്കുന്നതിനും സംഭവിക്കുന്നു.

* ഏറ്റവും മുമ്പത്തെ Quasi പുസ്തകങ്ങൾ എഴുതപ്പെട്ടിട്ടുള്ളത് ഗ്രീക്കിലാണ്, അതിനുശേഷം അതിന്റെ ചുവടുപിടിച്ചാണ് ഗ്രീക്കിൽ ഉള്ളത് അതിനെ അനുകരിച്ച് എഴുതിയിരിക്കുന്നു.
* Odyssey, Iliad തുടങ്ങിയവ Quasi രചനയ്ക്ക് ഉദാഹരണമാണ്.
* Homer പറഞ്ഞ കഥയിൽ നിന്നാണ് തുടങ്ങുന്നത്.
* Gilgamesh യിലും രണ്ടായിരത്തെ തുടർന്ന് അങ്ങനെ പറയുന്നു.

ഇവ മറ്റുള്ളതിൽ നിന്നും വ്യത്യസ്തമാക്കുന്നതിനു വേണ്ടിയാണ് നമ്മൾ ഓരോന്നും വായിക്കുന്നത്. അതിൽ നിന്ന് ഓരോന്നിനെക്കുറിച്ചും അറിയുന്നത് ഉപകാരപ്രദമാണ്, തീർച്ചയായും.

* Quasi History എന്നതിന്റെ അർത്ഥം ഏതാണ്ട് എന്നാണ്.
* Quasi History means' history and while dealing with the Sources quasi historical in Nature one should be very careful and interpret the events and Incidents
Example: Hattu Bhaaradham
* ചിലതൊക്കെ Historical ആണ് എന്നാൽ history proper.
* Mesopotamian Composed number of quasi-historical works
Example: Rig Veda Hesiod, Genesis, Enuma Elish, Epic Gilgamesh, myth of Adapa
* Egyptians also composed to work. Birth of Royal Child, The journey of Son, End of universe
* half history half Mythology.
* The creation myths like the poem Teogony

ഇതുകൂടാതെ past ൽ നിന്ന് different History യും ഉണ്ടാക്കാൻ കഴിയും

* ഒരു സമൂഹത്തിന്റെ past ചോദിക്കുമ്പോൾ ചിലപ്പോൾ ചരിത്രത്തിലുണ്ടായിരുന്നതോ ഇല്ലാത്തതോ ആയ ഒരുപാടുകാര്യങ്ങൾ past ആയി പറഞ്ഞേക്കാം.
* past എന്നുറപ്പിച്ച് അറിയണമെങ്കിൽ Evidence കിട്ടണം എന്നില്ലതാനും. ചരിത്രപരമായിട്ടുള്ള History എന്നതിന് ഇപ്പോൾ ലഭ്യമായിട്ടുള്ള documents, images, videos തുടങ്ങിയവ evidence ആയി കാണാം.

Condition of History

* Evidence ഉണ്ടായിരിക്കണം
* ആരെങ്കിലും കണ്ടിട്ടുള്ള തെളിവുകൾ ഉണ്ടായിരിക്കണം
* Evidence collect ചെയ്ത ആളുടെ ഒപ്പ് ഉണ്ടായിരിക്കണം
* Evidence പിന്നീട് ഒരു History ആയിരിക്കണം
* കിട്ടിയ തെളിവുകൾ ഒരു Evidence മായി തന്നെയും ചേർന്ന് കിടക്കണം
* ഒരിടത്തു നിന്നും മറ്റൊരിടത്തേക്ക് കൊണ്ടുപോകുന്നതും (Travel with people)

Conceptualising History

History എന്ന Subject അതായിരിക്കുന്ന 18th Century കാലത്ത് 'History' എന്നാൽ 'ഭൂതകാലം' എന്നാണ് ഉദ്ദേശിക്കുന്നത്.

Scientific ആയി History പഠിക്കുന്നു
മനുഷ്യന്റെ പഴയ കാലങ്ങളിൽ ചുറ്റുപാടിനെ കുറിച്ചും ലോകത്തിൽ നിലനിൽക്കുന്നത്. എങ്ങനെ മനുഷ്യൻ ഒരു ചുറ്റുപാടിന്റെ ഫലമായി തലമുറകളിലൂടെയും മാറ്റങ്ങൾ വരുത്തി എന്നും
History യെ ചരിത്രത്തെ മാത്രം നോക്കുകയല്ല Result എടുക്കുന്നതാണ് പഠനമുണ്ടാക്കുന്നത്.
രണ്ടാമതൊന്നായത് വലിയ തെറ്റുകളെ തുടർന്ന് പോകാൻ പാടില്ല എന്നുള്ളതിനാൽ പലതരത്തിലുള്ള Philosophic ഒന്നിലധികം History പഠിക്കുന്നു.

* Science ഉം History യും തമ്മിൽ ചേർക്കുന്നു (Compare ചെയ്യുന്നു) ചില ചരിത്രത്തിൽ നിന്നും ഒഴിവാക്കുന്നതാണ് History യിൽ ഉള്ളത്. Science ൽ ഉള്ളത് നിലവിലുള്ളതിനെ തെളിയിക്കുന്ന രീതിയാണ്.

* Metaphysical assumptions → നേരിൽ കാണാൻ കഴിയാത്ത ഒന്നിനെ മുൻനിർത്തിയുള്ള അന്വേഷണത്തിൽ ഏർപ്പെടുന്ന രീതി
* 19th century യിലാണ് History ഉടലെടുത്തത്
* Scientificity and professionalism
  American Historical Association
  Indian Historical Association
* ഒരുതരം ഉദാരമായ സമീപനം സ്വീകരിക്കുന്നതിനെയാണ് History (objectivity)
* Emmanuel Kant, Francis Bacon, Leopold Ranke, തുടങ്ങിയവരാണ് പ്രമുഖ Historians.

ASSIGNMENT 9

THE PAST OF HISTORY

The past is an 'ocean of events that once happened'. Explained the renowned polish philosopher Leszek Kolakowski. 'The writing of history is a process of highly selective reconstruction of features of the past confusion occurs sometimes when we use the word 'HISTORY' to mean not just historical writing but also as a synonym for the entirety of past happenings.

The important aspect of history is the present evidence of past. The past is over and done with it, it cannot be retrieved. It can only be reconstructed or understood again. If any traces any clues are left over the past is often looked up on from the view point of contemporary Society. Thus History becomes an ideological instrument in the hands of the Society which hold power. This powerful sections use history to justify their cause. It should be shown with people, for example, in a book, a documentary, website, a museum etc. the present meaning of history, crystallished only the 18th c. The ancient word 'histor' from which the term 'Historia' was derived denoting Historian, another word derived from 'Histor' was used as a verb to mean the activity of finding out the correct information about persons, things and events.

The past history and historiography

Note (1)

History is the study of the past historiography is study of history and it historical writing. Orginal history

- past
- representation of past
- historiography

history historiography

- histor

(2)

a person who

capable of judging correctly from among conflicting versions

capacity of such judgement as a

quality of software.

② Historians

History derived history. — [illegible]

historia

historia a form of a writing or a literary genre involving a presentation of the findings of an enquiry.

religion book different types history —

also.

finding of enquiry about understand. need

arrived at inform.

3 types of writing and subscribed

* writing history
* Critical history
* particular history.
* [illegible] angle of [illegible]

combinations writing history

* [illegible] [illegible]

Critical history.

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(3) modern Indian history } Particular historiography
national movements

Greek historiography greek history

Eli, Carr modern definition

defined history as a dialogue between the Past and present

historiography

historiography generally understood as either the practice of writing history or as analytical account of the way in which history has been written over centuries. (history and the history of historical thought and writing)

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Rich calling used – twentieth century ~~of~~ England

Carr Becker ~~Hegel~~ Collingwood no objective value ~~of~~ relativity ~~of~~ historical judgment

historiography others ~~in~~ two types.

* The Chief object of ~~such~~ enterprise in historiography is to asses in terms of values Standards

The value of historical works for us.

~~Objective~~ objects ~~of~~ ~~Collingwood~~ Croce

Dewey Egypt)

* ~~Person~~ responsible original ~~judgment~~

~~of~~ relative value ~~judgment~~.

three type of historiography

(a) history in general

(b) ~~Critic~~ critical study of historical works.

(c) a particular field of historical scholarship such as ~~Greek~~ historiography.

Greek ~~historians~~ Greek historiography.

(5)

(a) history general [illegible]

(b) [illegible]

(c) [illegible]

Eg: Annals history Annals historiography.

* [illegible]

* practice of writing history.

* [illegible]

* [illegible]

Unit-I

* Historiography tries to place these various sources in to a specific context. This means that the historiographer does not merely accept the content of a source at face value but traces the [illegible] looking for various motifs in

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it is formation

(6) suggest reasons for and against, discussion between groups their opinions.

* one of the questions the historiographers must ask is how some facts remain included or excluded from a history.

* historiographers also should understand inclusion, conclusion arguments.

* [illegible] and [illegible] must [illegible] [illegible] [illegible]

* Theory of historiography

(3)

Significance of historiography

Quasi history

judgement).

(3) [illegible] Quasi history [illegible]

* [illegible] control [illegible]

Quasi historical works and proper history

Some elements [illegible] is there. And some element [illegible] is history is there. But is not complete. Historical account is not a history paper. [illegible] account of [illegible] stories and that. Therefore [illegible] history [illegible] Quasi historical works cannot [illegible].

* is not complete history paper. means [illegible] objective [illegible] evidence that [illegible] history papers [illegible] account [illegible].

* Quasi history also [illegible] history [illegible]

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(9) The term Quasi history is used to explain the classical or free compositions. Classical compositions but quasi history are those free compositions. Quasi history compositions but more or less historical compositions.

Ex: Saint Augustine's 'The city of God' The book of Christian philosophy contains historical facts, some moral elements are also mixed.

Quasi history appears elements, the quasi means half and it is concerned that we are concern with as numerous classes which carry half of history.

Quasi history are those which are not exactly historical but they are also not purely imaginative. Quasi history are those which are not exactly historical but they are also not purely imaginative.

Ex: Mahabharata, Ramayana, Odyssey etc.

Quasi history are those which are not exactly historical but they are also not purely imaginative. Quasi history are those which are not exactly historical but they are also not purely imaginative. Quasi history are those which are not exactly historical but they are also not purely imaginative. Quasi history are those which are not exactly historical but they are also not purely imaginative. Quasi history are those which are not exactly historical but they are also not purely imaginative.

(10)

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(10)

Ch: [illegible]

[illegible] Quasi-historical Literature [illegible] [illegible] [illegible]

Greek civilization (ancient Greek) ancient
civilization ഗ്രീക്കിലെ ancient literature
ന്റെ ഭാഗമാണ്.

* Greek literature ൽ ഉൾപ്പെടുത്തിയിരിക്കുന്നു
ഇവ ഉണ്ടാക്കിയ ഗ്രീക്ക് ജനതയെ
ഉൾപ്പെടുത്തുന്നു.

Eg: Works of Homer and elements

Homer ന്റെ രണ്ടു കൃതികളും ഇതുപോലെ
ഉള്ളതാണ് ഇതിഹാസങ്ങൾ. ഇതിൽ ഒരുപാട്
കഥകൾ ഉൾപ്പെടുന്നു. ഗ്രീക്കുകാരുടെ വിശ്വാസം
അനുസരിച്ചുള്ള ദൈവങ്ങൾ ഇവർ
ഉണ്ടാക്കിയിരിക്കുന്നു. ഗ്രീക്ക് ജനതയുടെ
ചരിത്രവും ഇതിൽ ഉണ്ട്. Greek civilization was another
having number of Quasi historical works
other creations mix like the poem Theogony
~~Mythology~~ by Hesiod ~~Theogony~~ of God and Story
twelve Olympians ഇതിൽ പറയുന്നു ഈ ദൈവങ്ങൾ
മനുഷ്യരുടെ ജീവിതത്തിൽ ഇടപെടുന്നു, ദൈവങ്ങൾ
തമ്മിലുള്ള ബന്ധങ്ങൾ ഇതിൽ വിവരിക്കുന്നു
mainly ~~poetry~~ history contents ഉള്ള
Quasi historical works ആണ് ഇതിഹാസങ്ങൾ.
ദൈവങ്ങളുടെ ഇടപെടലുകൾ നമുക്ക് ഇതിൽ
നിന്നും മനസ്സിലാക്കാൻ സാധിക്കുന്നു.

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past and history differentiation

12

* Ocean of events that once happened explained the renowned polish Philosopher Leszek Kolakowski. ഒരിക്കൽ സംഭവിച്ച ഒരുപാട് കാര്യങ്ങൾ ചരിത്രത്തിൽ ഉൾപ്പെടുത്തുന്നതിനെ പറ്റി പറഞ്ഞിരിക്കുന്നു. ഇതിൽ ചരിത്രത്തിൽ ഉൾപ്പെടുത്തുന്ന events നെ ആണ് past of history എന്ന് പറയുന്നത്.
* history യിൽ important ആയിട്ടുള്ള കാര്യങ്ങൾ മാത്രം ഉൾപ്പെടുത്തുന്നതിനെ history and neglections.
* ഒരു ഭൂതകാല history യും past ഉം തമ്മിൽ വ്യത്യാസം ഉണ്ട്. past ഇൽ ഉള്ള എല്ലാ കാര്യങ്ങളും history ആയിരിക്കണമെന്നില്ല. past ഇൽ ഉള്ള ചില കാര്യങ്ങൾ history ആയിരിക്കും.
* ഒരു വ്യക്തിയുടെ ജീവിതത്തിലെ നടന്ന സംഭവങ്ങൾ ഓർമ്മയിൽ നിൽക്കുന്നത് Contemporary എന്നാണ് പറയുന്നത്.
  Eg: 5 വയസ്സിൽ നടന്ന കാര്യങ്ങൾ ഓർമ്മ ഉണ്ടായിരിക്കുകയില്ല (ഓർമ്മയിൽ നിൽക്കുന്നില്ല) അത് past ആണ്. history ഉം അല്ല. പക്ഷേ 25 വയസ്സിൽ കല്യാണം കഴിച്ചു family ആയി കഴിയുമ്പോൾ ഉള്ള കാര്യങ്ങൾ ഓർമ്മയിൽ ഉണ്ടാകും അത് history ആയിരിക്കും.
* ഒരു past ഉം മുഴുവൻ ഓർമ്മയിൽ ഉണ്ടാകുന്നില്ല history ആയിരിക്കണമെന്നില്ല.
  Eg: ഓണത്തിന് ഓണക്കോടി വാങ്ങിച്ചു ഉടുത്തു ഓണം ആഘോഷിച്ചു എന്നുള്ളത് ഓർമ്മയിൽ നിൽക്കുന്നുണ്ടാകും പക്ഷേ അത് ചരിത്രമാകുന്നില്ല. ചരിത്രമാകുന്നതിന് ചില നിബന്ധനകൾ ഉണ്ട്.

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* Past and [illegible]
* Both archaeologists, historians and geologists are interested in past.
* [illegible] past [illegible]
* evidence of past [illegible] called history main sources [illegible]
  Ex: [illegible] Pictures, books, Pictures
* past is Evidence [illegible] past
* past and present [illegible] history and [illegible]

The verus The past

* [illegible] Past is [illegible] move [illegible] present [illegible]
* [illegible] present [illegible] [illegible] [illegible] history
* evidence [illegible] history [illegible]
* [illegible] evidence [illegible] history [illegible]

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(14)

* collect material regarding the topic.
* Analyse and organise.
* Some of the human activities are [illegible]
* As interpretation requires objectivity, modern evidence must be compare scientifically.
* Past event is important to understand present and future activities.

Conceptualising history

* History is one concept it is so relevant to our society.
* History from which term historia.
* History means to enquire, investigate and [illegible] (Bolge)
* History means to inquire recent developments activity is [illegible].
* E.H. Carr defined history as [illegible] scientific approach history [illegible] analysis.
* [illegible] past regarding history. [illegible] evidence [illegible]

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revisit ചെയ്യുക എന്നാണ് fact.

* Conceptualising ചെയ്യുന്നതിന് പറയുന്നു, concept ന്റെ relationship പറയുന്നതിനെയാണ് ഇതിൽ പറയുന്നത്. ഇതിനെ ചിലപ്പോൾ analytical skill എന്നും പറയാറുണ്ട്. എന്നാൽ ഇതിനെ ഇങ്ങനെ പറയാൻ പറ്റില്ല.

* historical thinking skill എന്നാൽ The Activity of finding out the correct information about person, things or events.

* Science history ഉണ്ടാക്കുമ്പോൾ നമ്മൾ ഇതാണ് Conceptualize ചെയ്യുന്നത്. ഇതിൽ ചിലത് തെറ്റുകളാണ് history ചെയ്യുന്നത്.

* ചരിത്രത്തിലെ ഒരുകാര്യം പറയുമ്പോൾ അതിന്റെ ചരിത്രപരമായ വിശദീകരണമാണ്.

* fact നെ argument ചെയ്യുകയാണ്.

* Scientific, proto ചിന്തയുടെ അടിസ്ഥാനത്തിലാണ് പറയുന്നത്.

* objective ആയിട്ട് പറയണം.

* ചിത്രങ്ങൾ ഉപയോഗിക്കണം.

* ചരിത്രത്തിലെ ഒരു കാര്യം മറ്റൊരു രീതിയിൽ പറയാൻ

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