GENES

INHERENT CHARECTERS

- TRAIT
- F1 GENERATION
- F2 GENERATION
- PHENOTYPE
- GENOTYPE
- ALLELE
- DOMINANT

- RECESSIVE

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Genetic Crosses

Acquired Traits

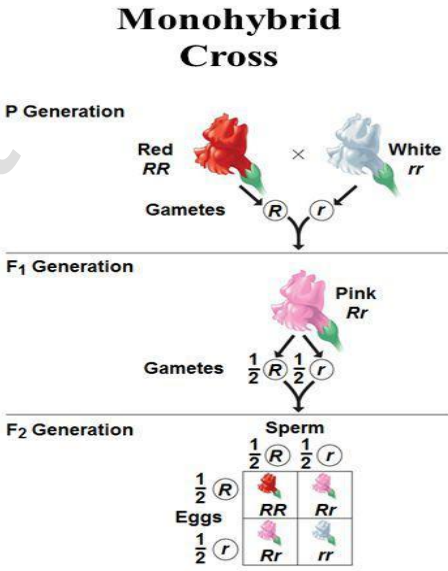
An acquired trait is a trait that that an animal, plant or person develops through interactions in their environment.

Pierced ears

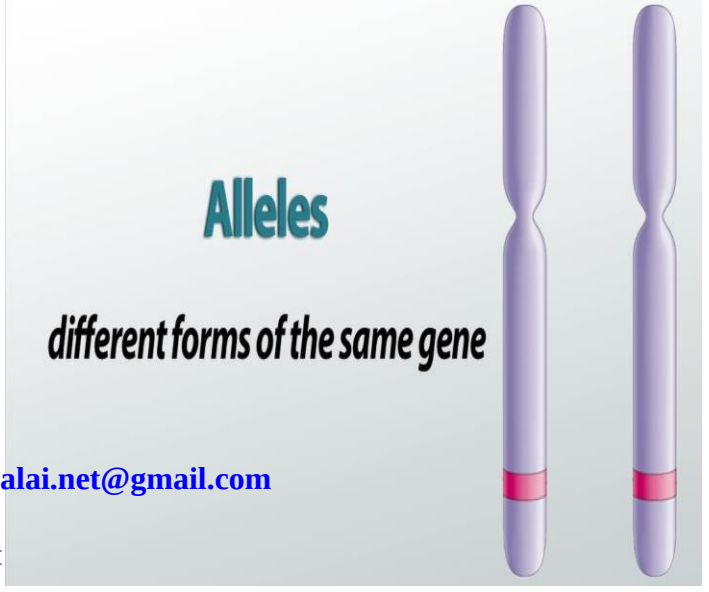
Leaves turned brown

Scars on a manatee

- **P generation:** two different pure-breeding parental plants
- **F1 hybrids:** the first generation plants obtained from crossing two selected pure breeding plants.
  - F1 hybrids do not produce seed that is the same as the parent plants
- **F2 hybrids:** second generation plants (result of self or cross fertilization of F1 hybrids



Phenotype – the **physical characteristics** of an organism blue eye color)



The Father of Genetics

Gregor Mendel

Austrian Monk
Born 1822
University of Vienna
Math/Science
Monastery Gardener
True Breeding Peas

Self Pollination Vs. Crossbreeding

10000 PEA PLANTSOF 34 VARIETIES

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Reason for selecting pea plant

- Can be self or cross pollinated (the deposition of pollen grain on the stigma is pollination)
- Can be grown quickly (easily cultivated)
- They are annuals - complete their life cycle within one year; all the stages of growth observed within a year
- Note:

Self pollination – pollen grain of a flower is deposited on its own stigma.

Cross pollination – pollen grain of one flower is deposited on the stigma of another flower.

MONOHYBRID CROSS

- Trait: Seed Shape
- Alleles: R – Round r – Wrinkled
- Cross: Round seeds x Wrinkled seeds:

P_1 = RR x rr

	r	r
R	Rr	Rr
R	Rr	Rr

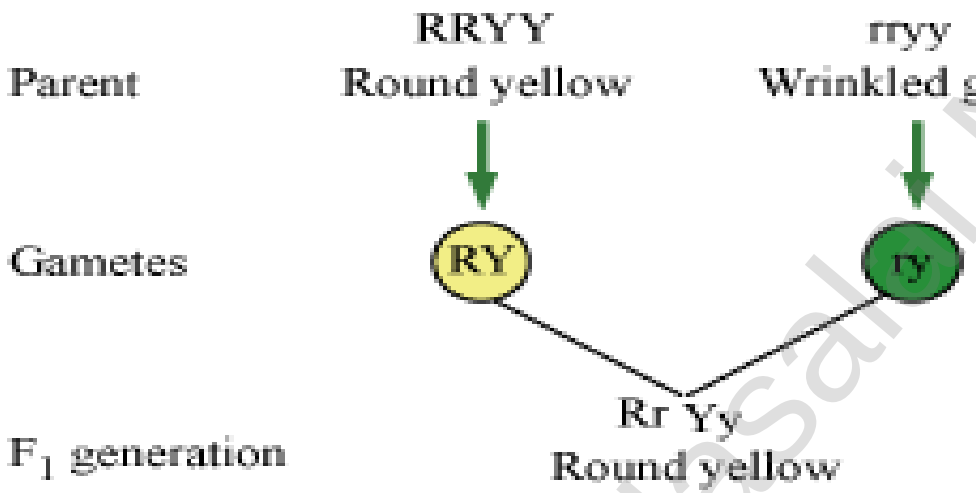
Genotype: Rr

Phenotype: Round

Genotypic Ratio: All alike

Phenotypic Ratio: All alike

DIHYBRID CROSS



	RY	rY	Ry	ry
RY	RRYY Round yellow	RrYY Round yellow	RRYy Round yellow	RrYy Round yellow
rY	RrYY Round yellow	rrYY Wrinkled yellow	RrYy Round yellow	rrYy Wrinkled yellow
Ry	RRYy Round yellow	RrYy Round yellow	RRyy Round green	Rryy Round green
ry	RrYy Round yellow	rrYy Wrinkled yellow	Rryy Round green	rryy Wrinkled green

MENDEL'S LAW

- **Law of Segregation** - states that the two alleles separate when gametes (sperm/egg) form. Thus, a gamete receives only one allele from each parent. (test cross)
- **Law of Independent Assortment** - states that different alleles (traits) separate independently. Thus, color, height, pod shape, etc. are not connected together. (dihybrid cross)

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CHROMOSOME

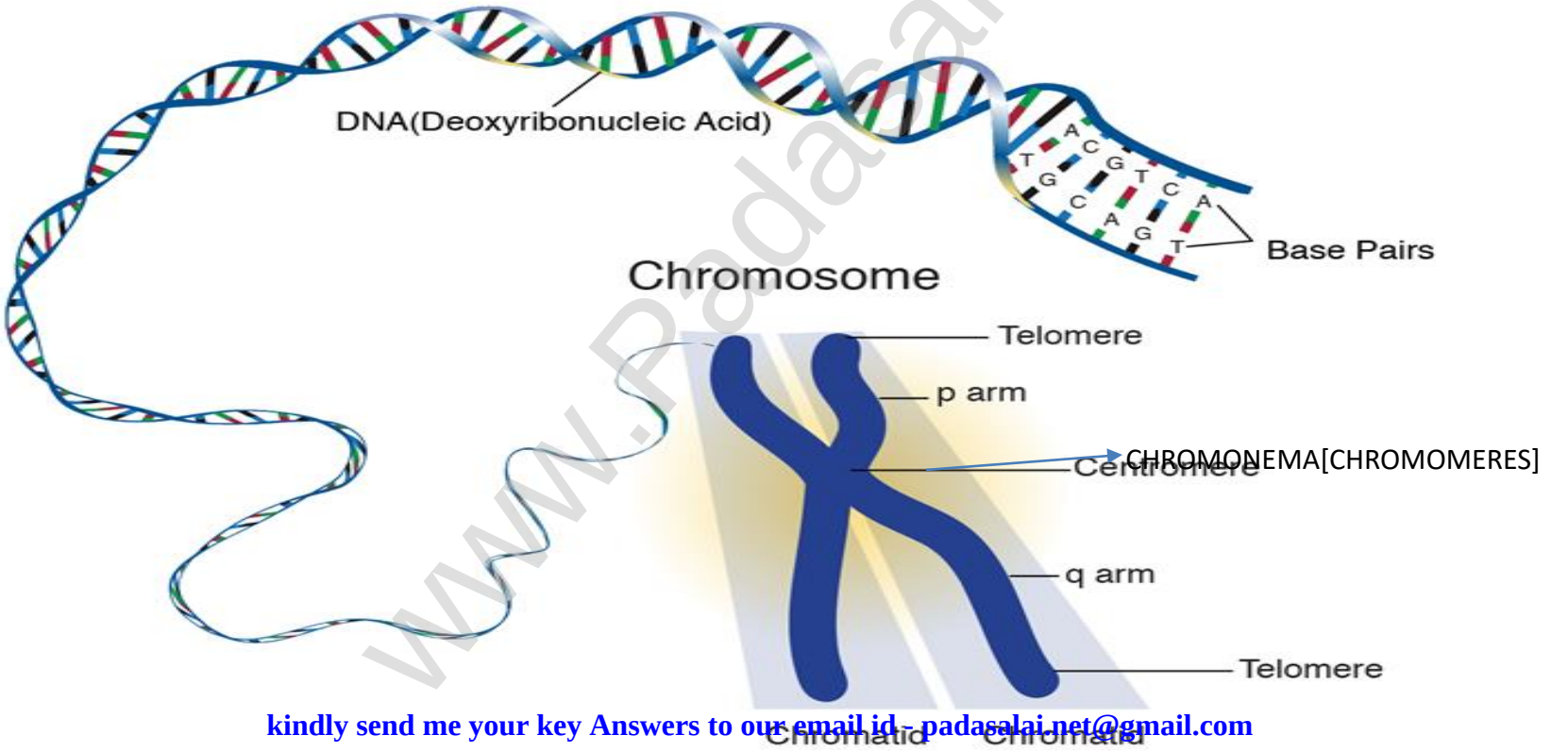
Chromosomes-highly condensed chromatin fibres packed with DNA

Genes -segments of DNA

Locus -specific position of gene on a chromosome

Chromonema –spirally coiled structures of chromotid which has beads like structures called chromomeres

Telomere - end of the chromosome



In humans, each cell normally contains 23 pairs of chromosomes, for a total of 46. Monkeys, chimpanzees, and Apes have 24 pairs (twenty-four pairs), for a total of 48.

SAT chromosome

- A **satellite chromosome** or **SAT chromosome** has a chromosome segment that is separated from the main body of the chromosome by such a secondary constriction
- the chromosomes number **13, 14, 15, 21 and 22** are examples of SAT chromosomes

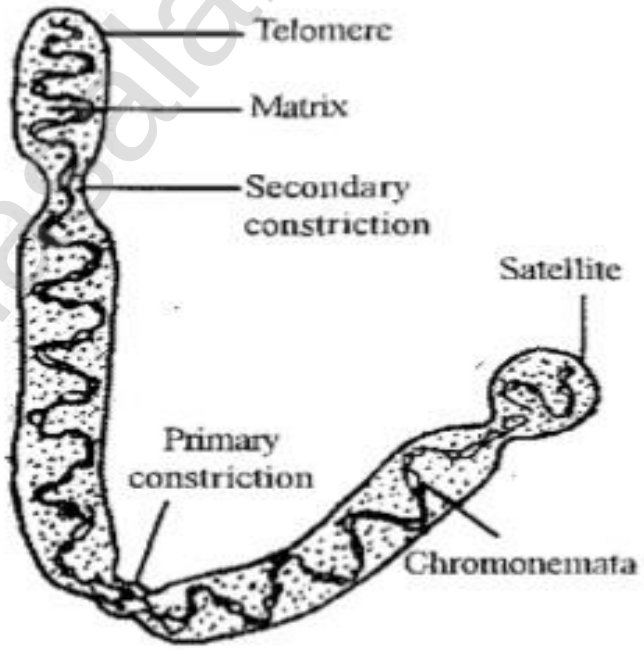
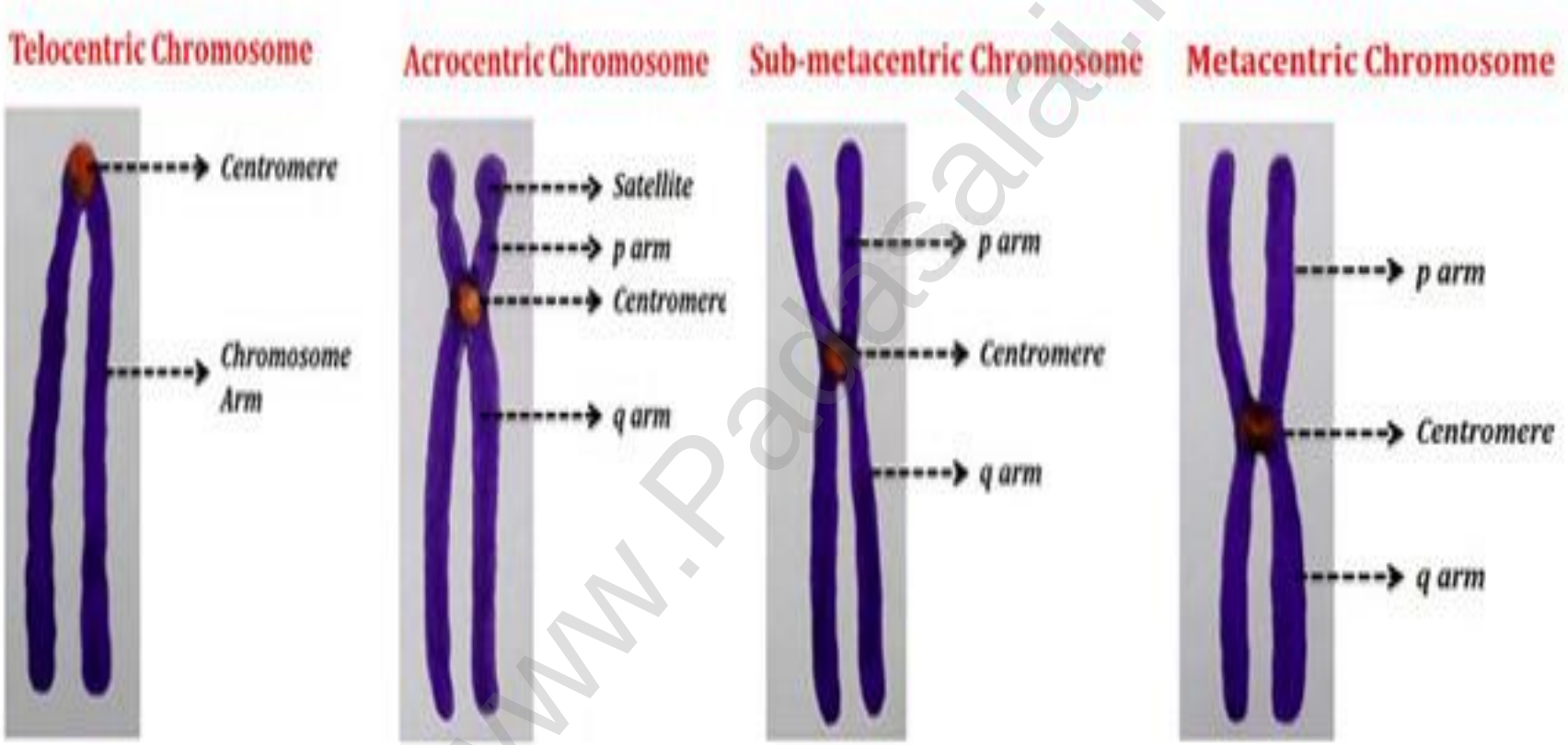


Fig. 3.1 Structure of chromosome

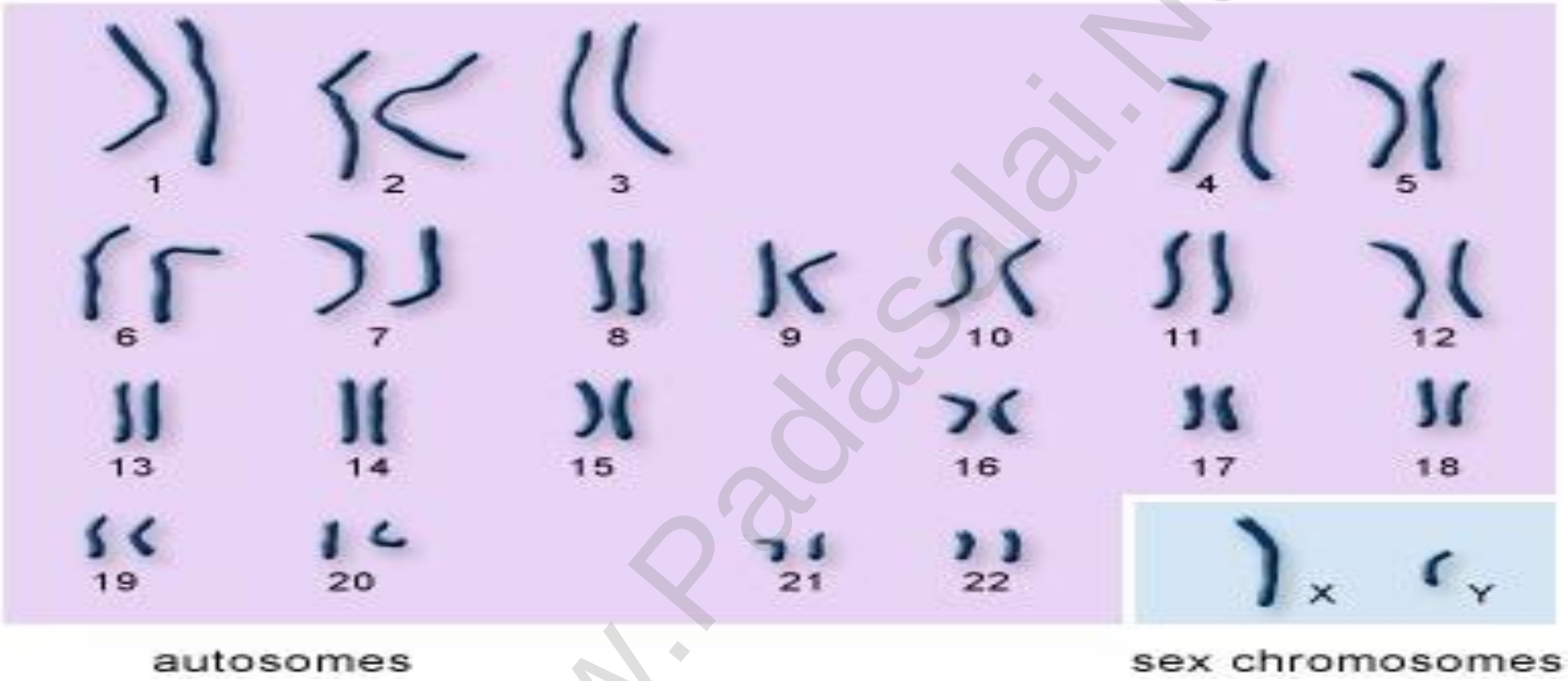
CLASSIFICATION OF CHROMOSOMES

BASED ON THE POSITION OF CENTROMERE



CHROMOSOME ----BASED ON FUNCTION

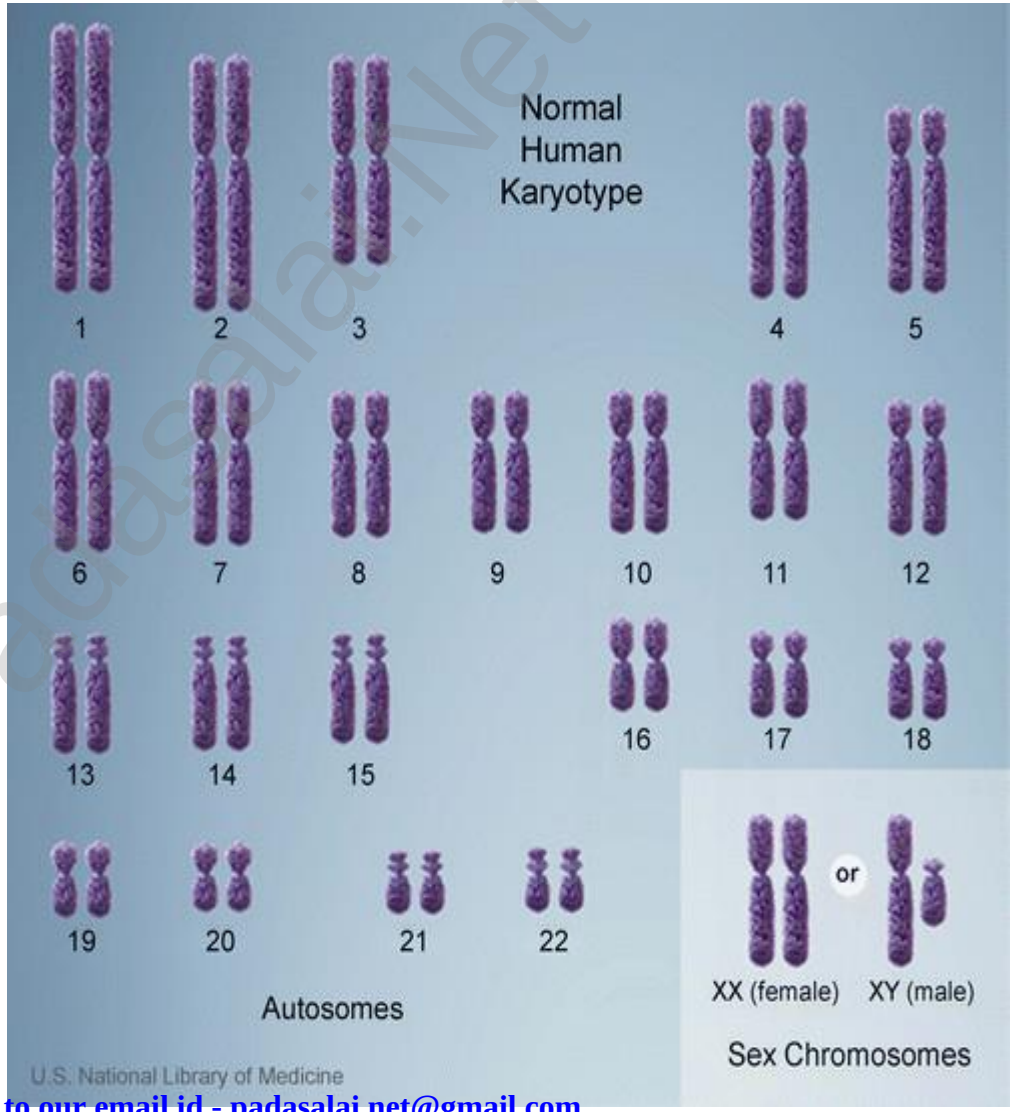
An **autosome** is a chromosome –determines somatic charecters.
An allosome is a chromosome –determines the sexual charecters .



Females have two copies of the X chromosome, while males have one X and one Y chromosome. The 22 autosomes are numbered by size. The other two chromosomes, X and Y, are the sex chromosomes. This picture of the human chromosomes lined up in pairs is called a karyotype.

KARYOTYPE , IDIOGRAM

- Number , size, shape in the cell nucleus Of an organism



- Diagramatic representation of Karyotype of a species.

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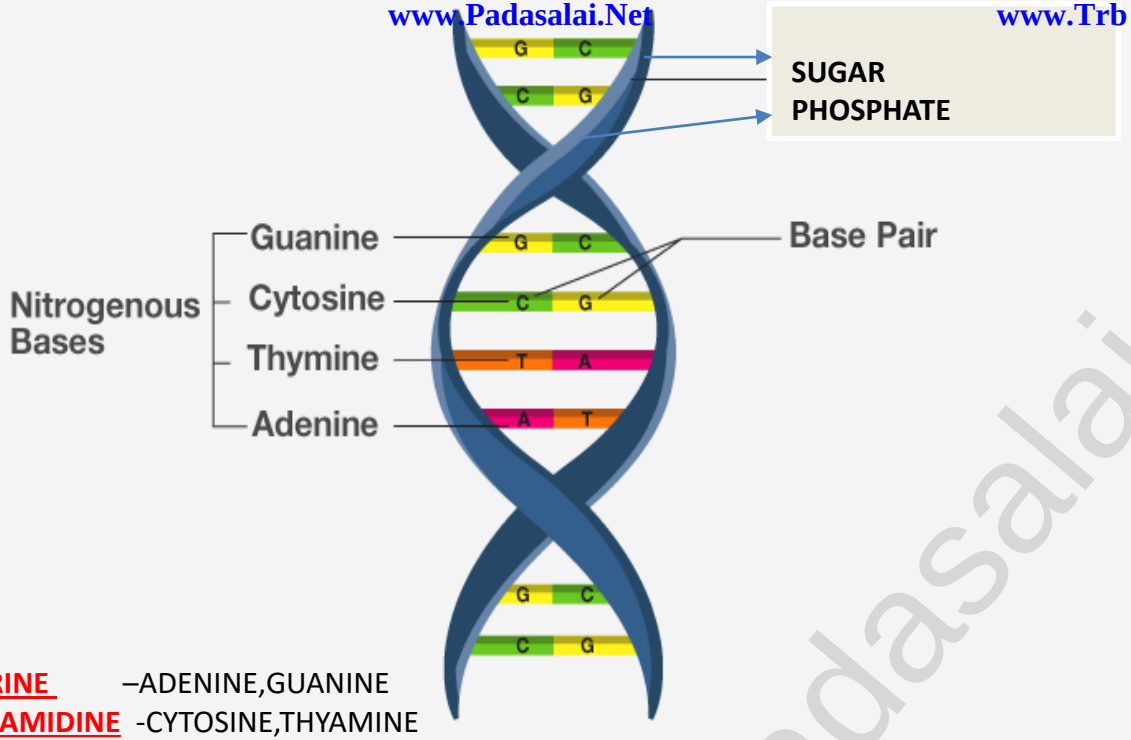
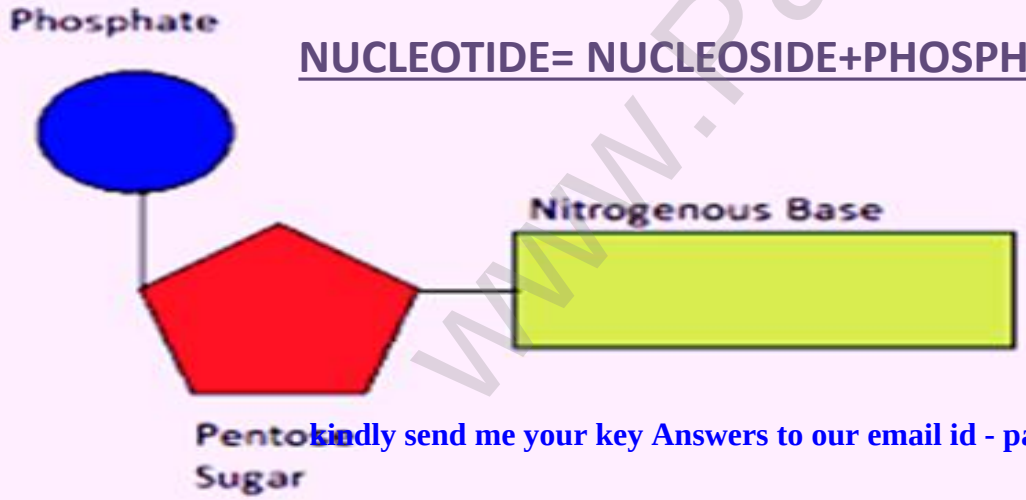
DNA STRUCTURE -JAMES WATSON & FRANCIS CRICK



PURINE –ADENINE,GUANINE

PYRAMIDINE -CYTOSINE,THYAMINE



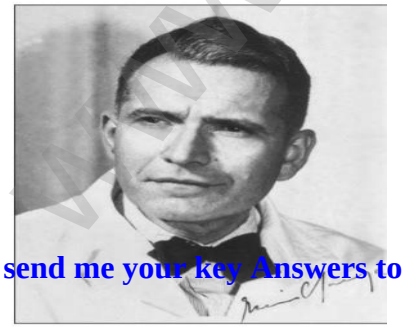
NUCLEOTIDE= NUCLEOSIDE+PHOSPHATE

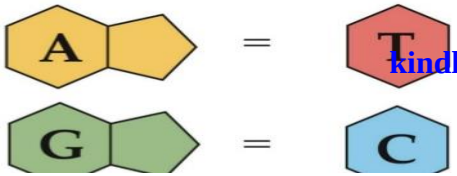
DNA MOLECULE

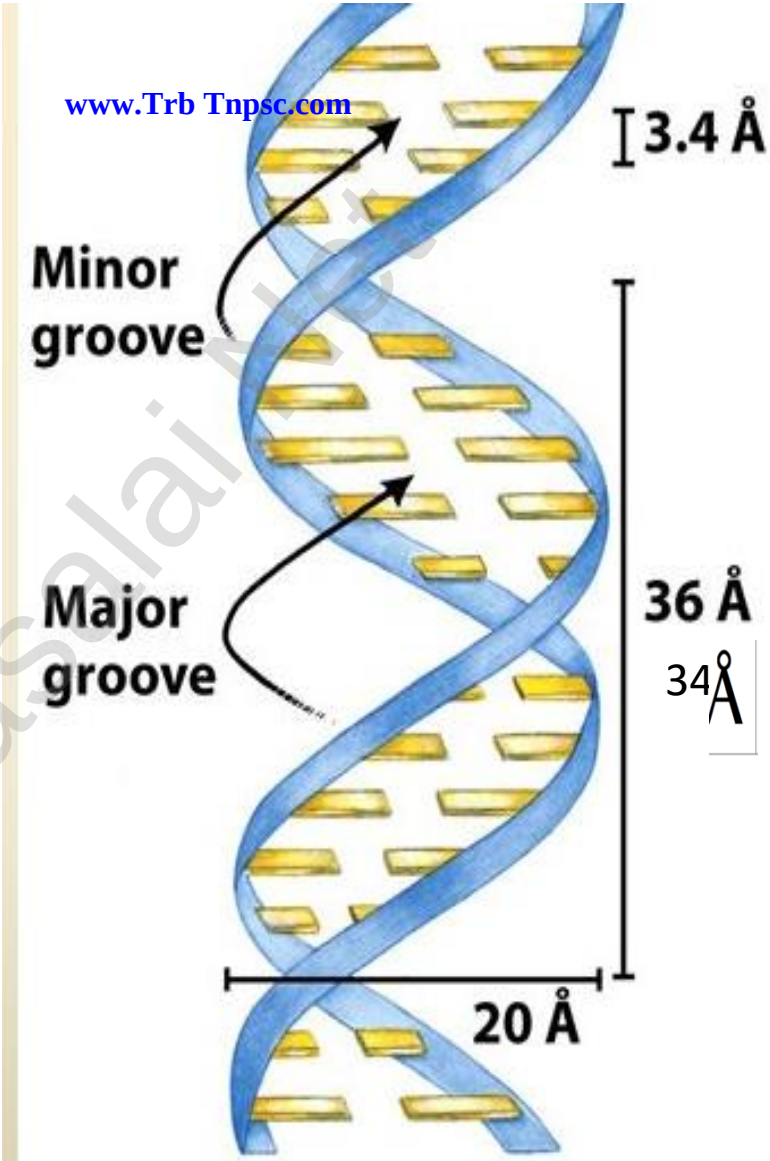
- Has two polynucleotide
- Forms a double helical structure
- Runs anti parallel to each other
- Nitrogenous base at the center
- Sugar –phosphate forms the backbone
- Nitrogenous base pairing is between purine and pyramidine. It is made by hydrogen bond which becomes stable [**COMPLEMENTARY BASE PAIRING**]

. **1949:** Erwin **Chargaff** discovers the rules of base pairing

A-T C-G

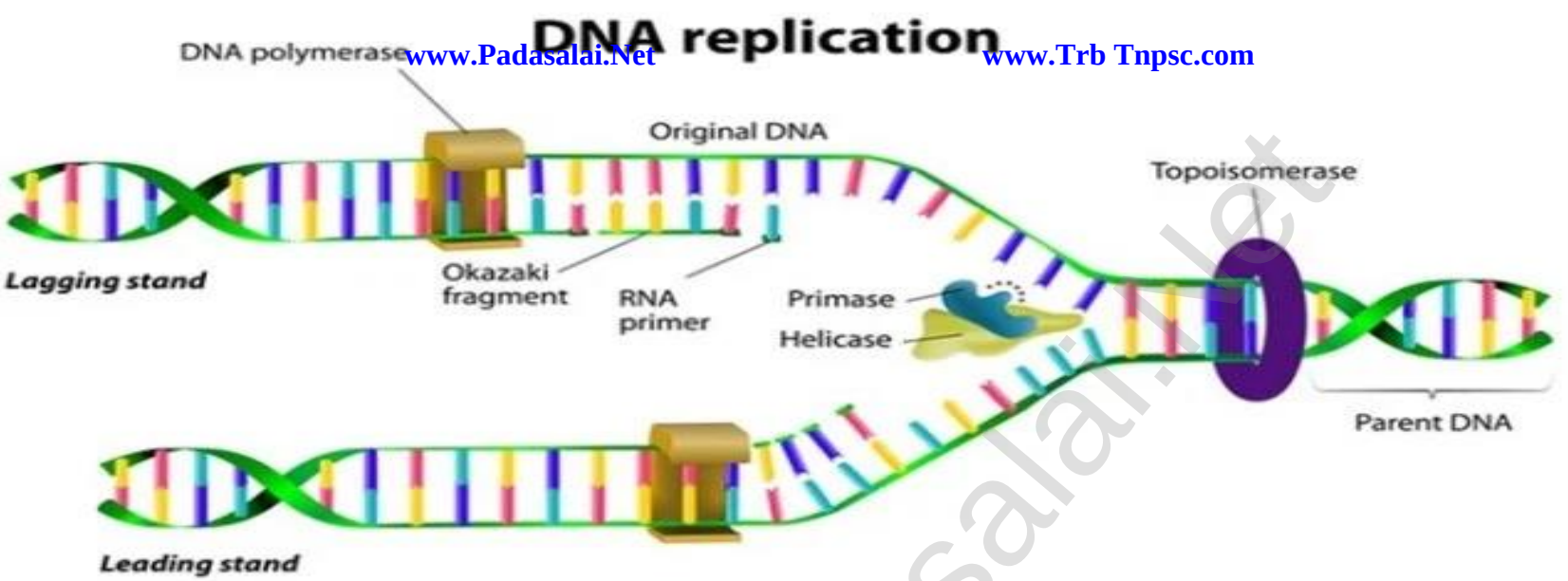






NULEOSIDE =NITROGEN BASE +SUGAR
NUCLEOTIDE= NUCLEOSIDE+PHOSPHATE

PURINE -ADENINE,GUANINE
PYRAMIDINE -CYTOSINE,THYAMINE



DNA producing exact copies of its own.

4 STEPS

1.FORMATION OF REPLICATION FOTK AT THE ORGIN OF REPLICATION -two strands open and separate at site of orgin of replicatioin forming replication fork.

2. UNWINDING OF DNA MOLECULE – Helicase seperates the DNA and Topoisomerase removes the twists above the replication fork . Each DNA strand functions as a template.

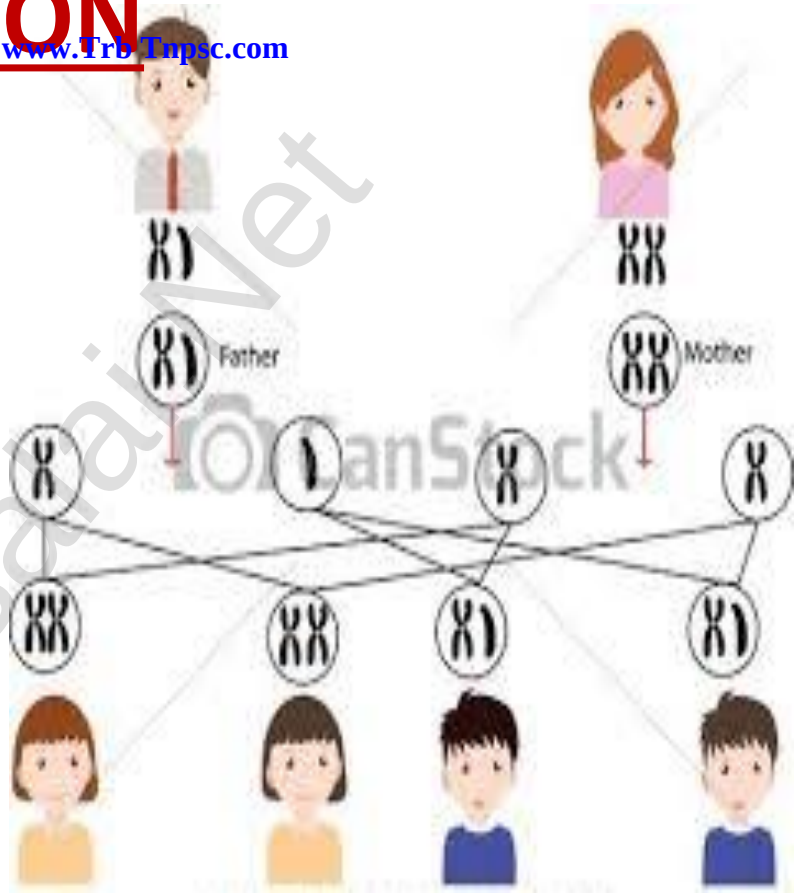
3. FORMATION OF RNA PRIMER – DNA template synthesis RNA primer close to the replication site.

4. **SYNTHESIS OF NEW COMPLEMENTARY STRAND** –RNA primer is added to strand by DNA polymerase .The synthesized continous DNA strand of the **daughter strand** is LEADING STRAND . The synthesized short segmented DNA **[OKAZAKI FRAGMENTS]** of daughter strand is LAGGING STRAND.

SEX DETERMINATION

Sex Determination in Humans

- Chromosomal sex is determined at fertilization
- Sexual differences begin in the 7th week
- Sex is influenced by genetic and environmental factors
- Females (generally XX) do not have a Y chromosome
- Males (generally XY) have a Y chromosome



- **Mother is not responsible for determining the sex.**
- **Egg[22+x] with a sperm[22+x]---------->female child[44+xx]**
- **Egg[22+x] with a sperm[22+y]---------->male child[44+yy]**

MUTATION

- ***Mutation is a phenomenon which results in alteration of DNA sequences and consequently results in changes in the genotype and phenotype of an organism***

- The term "mutation" was coined by **Hugo de Vries** (1901).

- De Vries also proposed mutation theory of evolution in his book **"The Mutation Theory" published in 1903.**

- *Hugo de Vries* worked on ***Oenothera lamarckiana* or Evening Primorse.**

TYPES OF MUTATION-

1. CHROMOSOMAL MUTATION
2. GENE MUTATION

1. CHROMOSOMAL MUTATION [2 TYPES]

A. SUDDEN CHANGE IN THE STRUCTURE

- DUE TO ERRORS IN CELL DIVISION
- CHANGES IN THE NUMBER OF GENES AS A RESULT OF DELETION DUPLICATION, INVERSION AND TRANSLOCATION

B. SUDDEN CHANGE IN THE NUMBER OF CHROMOSOME

- ADDITION AND DELETION IN THE NUMBER OF CHROMOSOME [PLOIDY]
- TWO TYPES – EUPLOIDY AND ANEUPLOIDY
- EUPLOIDY : BEARING MORE THAN THE USUAL NUMBER OF CXHROMOSOMES.
  [3N] : TRIPLOIDY IN PLANTS AND ANIMALS ARE STERILE
  [4N]: TETRAPLOIDY IN PLANTS RESULTS IN INCREASED FRUITS AND FLOWER SIZE.
- ANEUPLOIDY : LOSS OR GAIN OF ONE OR MORE CHROMOSOME.
- THREE TYPES – [2N-1]MONOSOMY
  [2N-2]NULLISOMY
  [2N+1]TRISOMY Eg. [DOWN'S SYNDROME] chromosome 21 is copid .Mental retardation, behavior problem,vision and hearing disabilities.

GENE MUTATION

- Changes in the nucleotide of a gene.
- Involves substitution , deletion ,insertion , or inversion of a single gene or
- More than a nitrogenous base.
- Results in abnormal protein formation
- Eg. Sickle cell anaemia

Normal Red Blood Cell

Sickle Cell