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Lysosomes

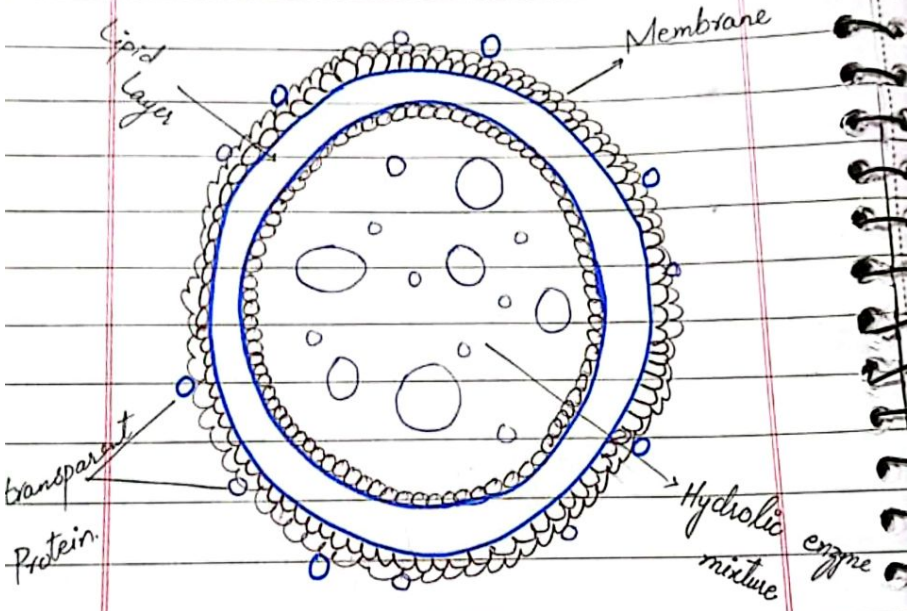
Defination:

- Lysosomes were isolated by De Duve in 1949.
- The word lysosomes is formed of two words Lyso means **dissolution** and soma mean **body.**
- Lysosomes are sphere-shaped sacs filled with hydrolytic enzymes that have the capability to break down many types of biomolecules.
- These are found only in eukaryotic cell

1- Structure of lysosomes:

- Lysosomes are membrane-bound organdles and the area with the membrane is called the lumen, which contains the hydrolytic enzymes and other cellular debris.
- The PH level of the lumen lies between 4.5 and 5.0, which makes it quite acidic

- The sizes of lysosomes vary, with the largest ones measuring in more than 1·2 μm. But the typically range from 0·1 μm to 0·6 μm.



2- Formation of lysosomes.

a) Primary lysosomes:

- The enzymes of the lysosomes are synthesized by ribosomes, present on the rough endoplasmic reticulum (RER).

3- Functions of Lysosomes:

- In lysosomes then fuse with membrane vesicles that derive from one of three pathways: endocytosis, autocytosis and phagocytosis.
- In endocytosis, extracellular macromolecules are taken up into the cell to form membrane-bound vesicles called endosomes that fuse with lysosomes.
- Autophagocytosis is the process by which old organelles and malfunctioning cellular parts are removed from a cell, they are enveloped by internal membranes that then fuse with lysosomes.
- Phagocytosis is carried out by specialized cell that engulf large extracellular particles, such as dead cells or foreign invaders and target them for lysosomal degradation.
- Many of the products of lysosomes digestion, such as amino acid and nucleotides, are recycled back to the cell

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for use in the synthesis of new cellular components.

4- Storage Diseases:

- Lysosomal storage diseases are a group of approximately 50 rare genetic mutation affects the activity of one or more of the acid hydrolases.

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Endoplasmic Reticulum (ER)

Defination:

- First time Porter reported endoplasmic reticulum in 1945.
- Endplasmic Reticulum is a complex network of tubular membranes exclusively present in the cytoplasm of the eukaryotic cell.
- In animal cells, the ER usually constitutes more than half of the membranous content of the cell.

* Structure of ER:

1- Types of ER:

- These are two types of ER.

1- Rough Endoplasmic Reticulum.

2- Smooth Endplasmic Reticulum.

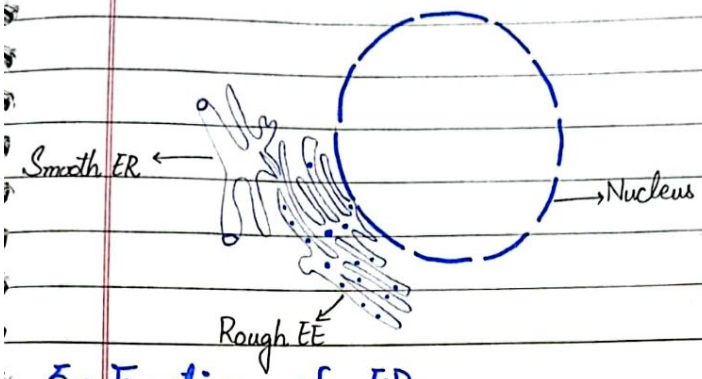
2- Rough ER

- The Rough Endoplasmic Reticulum is named so because of its appearance.

- The RER is generally a series of connected flattened sacs. It plays a central role in the synthesis and export of proteins and glycoproteins.
- It synthesizes and secretes proteins in the liver, hormones and other substances in the glands.
- RER is prominent in cells where protein synthesis happens.

4. Smooth ER:

- The Smooth Endoplasmic Reticulum, on the other hand, does not have ribosomes.
- The smooth endoplasmic reticulum has a tubular form.
- It participates in the production of phospholipids, the chief lipids in cell membranes and are essential in the process of metabolism.
- Smooth ER transports the production of the RER to ther cellular organelles, especially the Golgi apparatus.



5- Function of ER:

(a) The ER severe important functions particusly in the synthesis, folding, modification and transport of proteins.

(a) Ribosomes on RER, which gives RER its appearance, specialize in the synthesis of proteins that possess a signal sequence that directs them specifically to the ER for processing.

- Protein synthesis by the RER have specific final destination, such as the cell membrane, cell exterior, or the ER itself.

(b) SER is involved in the synthesis of lipid including chloestrol and phospholipids,

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Golgi Apparatus

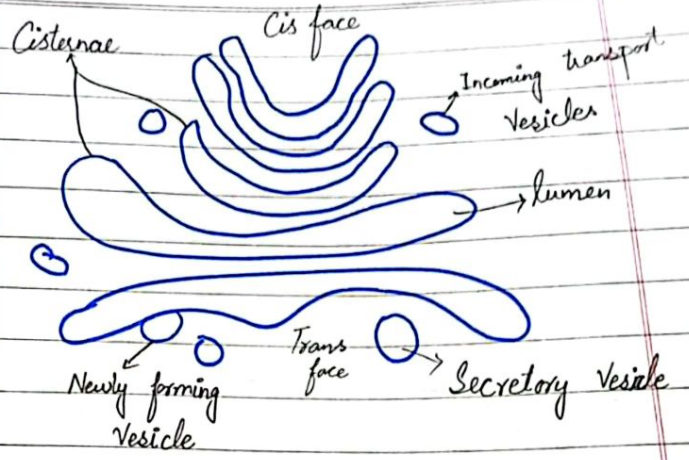
- Golgi Apparatus was discovered by Golgi in 1898. Golgi Apparatus are present only in eukaryotic cells.

1- Structure of Golgi Apparatus:

- The Golgi Apparatus has multiple names such as Golgi complex, Golgi body.
- Golgi Apparatus membrane-bound organelle of eukaryotic cells that is made up of flattened, stack pouches called cisternae
- The cisternae with associated vesicles are called Golgi Apparatus.
- The Golgi complex system of interconnected tubules is present around the central stacks.

2- Function of Golgi Apparatus.

Golgi complex performs following functions:



2- Function of Golgi Apparatus:

Golgi complex performs following functions:

a: Cell secreations:

- Golgi complex are concerned with cell secreations. For Example, in mammals, the pancreas secretes granules. These granules contain enzymes that help in digestion
- Following step are involved in the process of cell secreations:
- The ribosome's synthesize protein part of the cell secretions.

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- The ER transfers it to golgi Apparatus.
- Golgi Apparatus converts the secretions to finished products. These secretions are packed inside the membrane to form granules.
- Finally granules are exported outside by cell membrane.

(b) Transportation:

- Golgi Apparatus transport the proteins or enzymes outside the cell.

(c) Formation of Glycolipids.

- It is the most important function of the golgi apparatus. They add carbohydrate to protein and lipids to form glycolipids.

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Nucleic Acid (DNA and RNA)

1- Short note on nucleic Acid? 2011(a)9

2- Difference b/w DNA and RNA protein? 2012(a)8

1- Introduction:

- The most important macromolecule for the continuity of life that is known as nucleic acid.
- Scientists observed this in nucleus of cell and so that's where we get the nucleic.

2- Types of nucleic Acid:

There are two types of nucleic acid (protein)

(i) Deoxyribonucleic (DNA) (ii) Ribonucleic Acid (RNA)

DNA: Responsible for transmission of hereditary effects from one generation to another.

RNA: Responsible for synthesis of proteins needed for the growth and maintainance of our body.

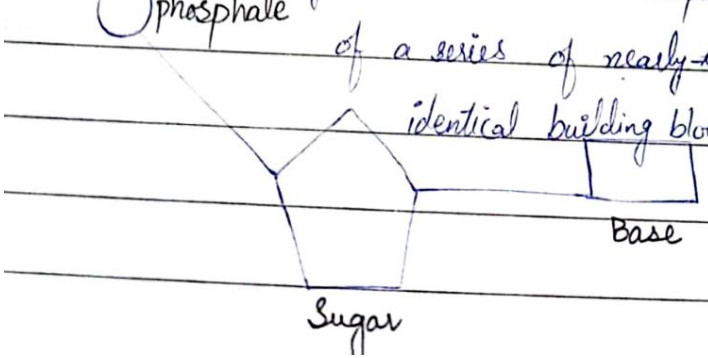
3- Deoxyribonucleic Acids.

Structure of Nucleic Acids.

- Biopolymers are made up of monomers known as nucleotides.
- Bio means synthesis biological system not synthetical synthesis.
- Polymers means repeated unit called as monomers which in these case are nucleiods.
- For Example: We have many types of biopolymers.
- Protein are made up of repeated unit called as Amino Acids.
- Nucleic Acids are also important biopolymers in our body are called as nucleotids.

Nucleiods:- (Basic structure of nucleic Acid):

Nucleic Acids are long chain like molecules composed of a series of nearly identical building blocks called nucleiods.



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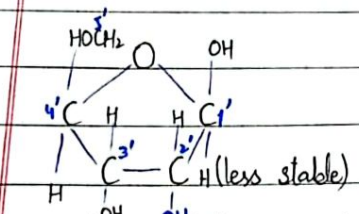
i) Sugars:

- Sugar present inside the nucleic acid as 5 carbon sugar (are called pentoses)

→ 6 carbon sugar Glucose (Hexoses)

Pentoses

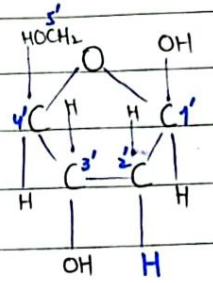
Ribose



presente in RNA

(less stable)

(means related oxygen) Deoxyribose

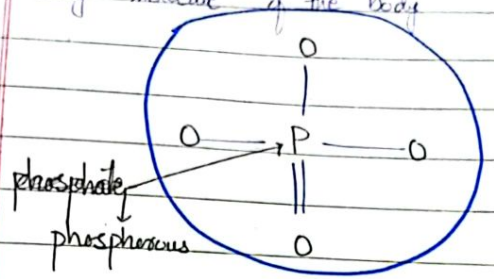


(More stable) present in DNA.

- The pentose sugar in DNA differes from the sugar in RNA by the absence of a hydroxyl group (—OH) on the 2' carbon of the sugar ring.

(ii) Phosphate:

- Phosphate group is same present in Adenosine Triphosphate (ATP) an energy carring molecule of the body



- ATP have 3 molecules of phosphate attach one another by energy phosphate.
- (—O) pdar due to presence of high ionized oxygen atoms which impart negative charge to the phosphate group.

(iii) Nitrogeneous Base:

- Nitrogeneous Base are basically molecules that contain nitrogen in varing amount and they act as a base

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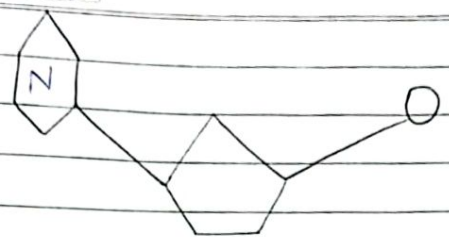
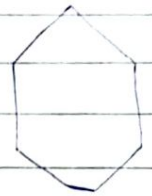


- Each nucleotide consists of a nitrogen-containing aromatic base attached to a pentose sugar, which is in turn attached to a phosphate group.
- Organic chemicals using amount present in human body.
- Nitrogen is combine (carbon, hydrogen, oxygen) these chemicals in ring like structure
- These molecules are bases since they can donate electrons to others molecules forms to new molecules in this process nitrogen combines of all these other atoms to form ring structure.
- Each nucleic acid contains four of five possible nitrogen containing bases: Adenin (A), Guanine (G) Cytosine (C), thymine (T) and Uracil (U).

(iv) Ring structure:

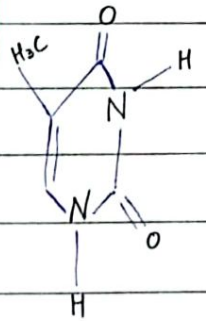
There are three types of ring structure

(a) Pyrimidine:-

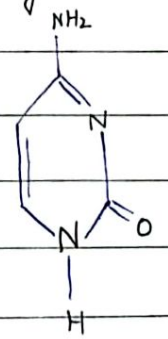


- C, T and U are collectively called pyrimidines.
- There are three types as:

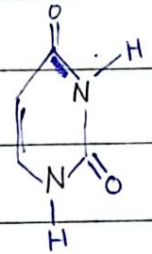
(i) Thymine



(ii) Cytosine



(iii) Uracil



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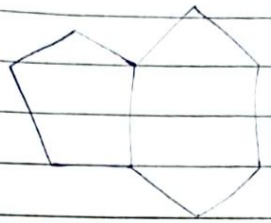
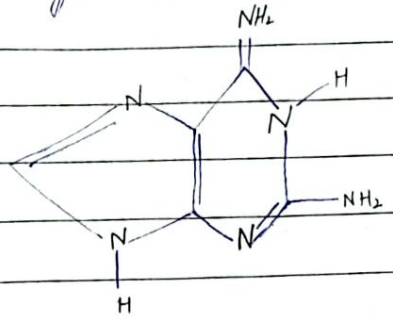
- These are smaller.

(b) Pusines.

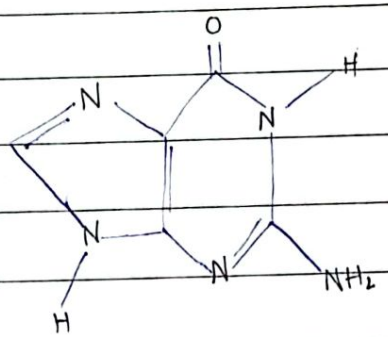


- A and G are categorized as pusines
- There are two types as:

(i) Adenine

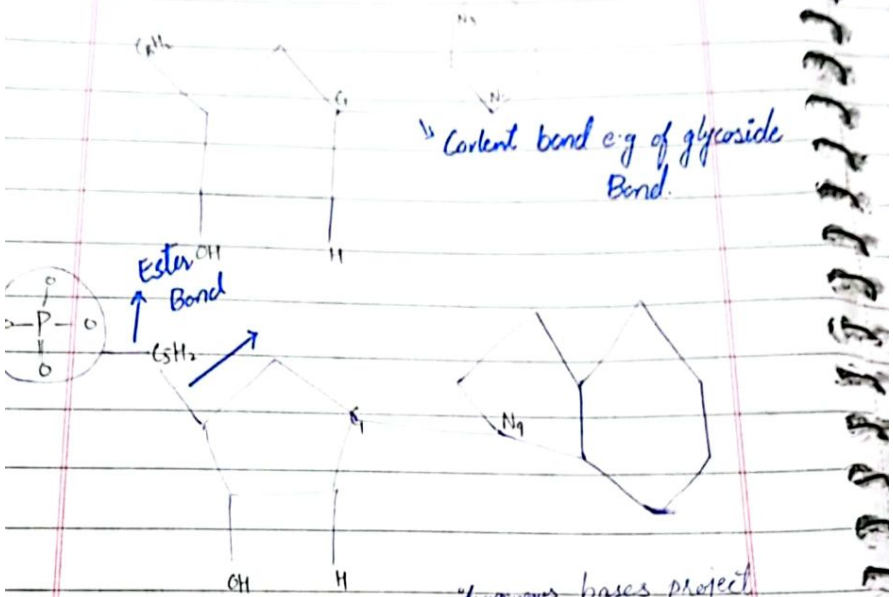


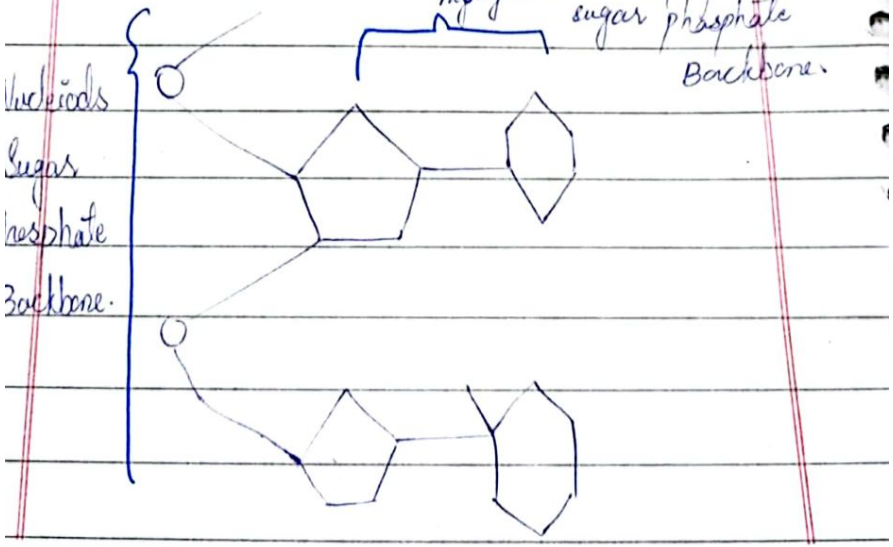
(ii) Guanine



These are larger.

(b) Individual Structure of Nucleotide.





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3- DNA:-

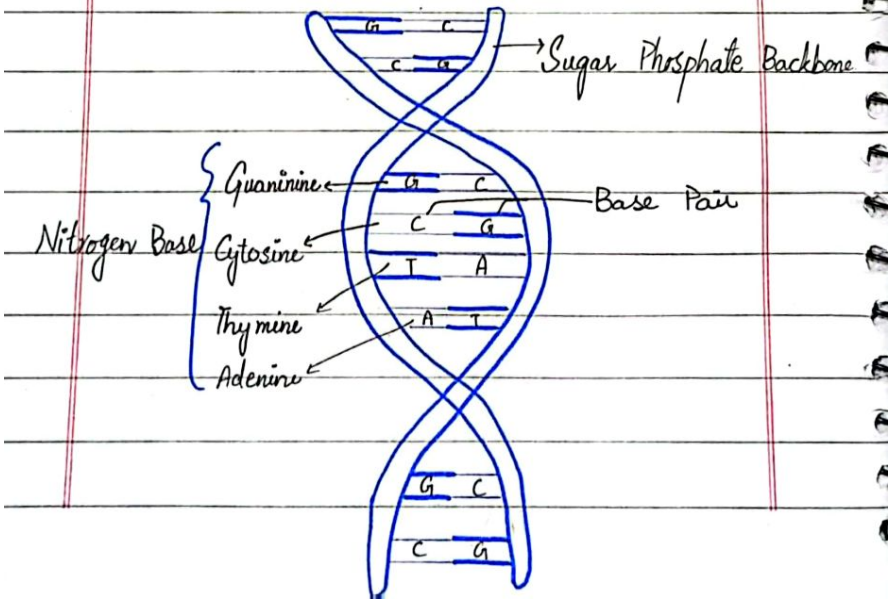
- It was first discovered in 1869 by Swiss Friedich Mieschler.
- On February 28, 1953, James Watson of the United states and Francis Crick of England found the double-helical structure of DNA. In 1962, they were awarded Nobel Prize for this work.

4- Function of DNA:

- DNA is one of the most important molecules in living cells. It encodes the instruction manual for life.
- Genome is the complete set of DNA molecules within the organisms, so in humans this would be the DNA present in the 23 pairs of chromosomes in the nucleus plus the relatively small mitochendrial genome.
- Humans have a dipde genome, inheriting one set of chromosomes for each parent. A complete and functioning diploid genome is required for normal development and to maintain life.

Structure of DNA:

- DNA is a polymer of the four nucleotides A, C, G and T, which are joined through a backbone of alternating phosphate and deoxyribose sugar residues.
- DNA is a double helix with two right handed helical polydeoxyribonucleotide stands twisted around the same central axis.
- Hydrogen bond binds two helices and the bases are bundle within the helix. Due to the presence of phosphate groups, DNA is negatively charged.



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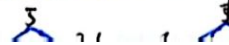
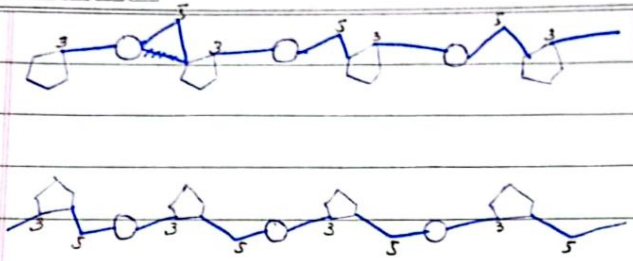
- The sizes and functional groups of the bases, base pairing is highly specific: A can only pair T, and G can only pair with C. This means that the two strands of a DNA double helix have a very predictable relationship to each other.
- The sequence of one strand is 5′–AATTGGCC–3′, the complementary strand must have the sequence 3′–TTAACCGG–5′. This allows each base to match up with its partner.

5′—A—A—T—T—G—G—C—C—3′
3′—T—T—A—A—C—C—G—G—5′

- When two DNA sequences match in this way, such that they can stick to each other in an antiparallel fashion and form a helix, they are said to be complementary.





4- RNA:

Introduction:

Structure of RNA:

- Like DNA, RNA consists of a chain of chemical compounds called nucleotides
- RNA is a single-stranded nucleic acid polymer of the four nucleotides A, C, G and U joined through a backbone of alternating phosphate phosphate and ribose sugar residues. In RNA the fourth base is different from that of DNA.
- The RNA generally consists of a single strand which sometimes folds back.

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Types of RNA:

There are several different types of RNA and each as specific functions.

- Each plays a different role in protein synthesis the process by which cell combine amino acids to produce proteins.

ii) Ribosomal RNA (rRNA):

- It is a major component of ribosomes. The rRNAs form extensive secondary structures and play an active role in recognizing conserved portions of mRNAs and tRNAs. They also assist with the catalysis of protein synthesis.
- From 50 to 5,000 sets of rRNAs genes and as many as 10 million ribosomes may be present in a single cell.
- The nucleolus is where the rRNA genes are transcribed and the early assembly of ribosomes takes place.

(ii) Messenger RNA (mRNA):-

- Messenger RNA (mRNA) delivers the information encoded in one or more genes from the DNA to the ribosome, a specialized structure, or organelle, where the informations is decoded into a protein.
- It is the RNA transcript that is produced during DNA transcription.
- mRNA bind to specific mRNA molecules (with partly and fully complementary sequences) and reduce their stability or interfere with their translation, providing a way for the cell to decrease or fine-tune levels of mRNAs.

(iii) Transfer RNAs (tRNA):-

- tRNAs are also involved in protein synthesis, but their job is carries individual amino acids into the ribosomes for assembly into growing polypeptide chain.
- The tRNA molecules contain 70 to 80 nucleotides and fold into a characteristic cloverleaf structure.
- The nucleiode sequence is coversed into a protein

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sequence by translating each three-base sequence with a specific protein.