TYPES OF RIBONUCLEIC ACID

RNA are of three different type performing different functions during protein synthesis. These are : mRNA (messenger RNA), tRNA (transfer RNA),rRNA (ribosomal RNA).
MESSENGER RNA (mRNA):- Monod and Jacob (1961) coined the term messenger RNA to describe the template RNA that carried genetic information for protein synthesis from nuclear DNA to ribosome in the cytoplasm. Messenger RNA (mRNA) make up less than 5% of the total cellular RNA. The molecular weight of an average sized mRNA molecule is about 500,000 and its sedimentation coefficient is 8s mRNA varies greately in length and molecular weight.
Structure:- mRNA is always single stranded . It contains mostly the bases adenine , guanine cytosine and uracil. There are few unusual substitute bases also. Although there is a certain amount of random coiling in extracted mRNA , but there is no base pairing.Usually each gene transcribe its own mRNA. Therefore , there are approximately as many types of mRNA molecules as there are genes.The eukaryotic mRNA has the following structural features:-
1.*Cap:* -At the 5prime end of the mRNAmolecule in most eukaryotes and animal virus is found a cap. This is blocked methylated structure, *m7 Gpp Nmp Np or m7 Gpp Nmp Nmp Np*, where N= any of the four nucleotides and Nmp=2'Omethyl ribose. The rate of protein synthesis depends upon the presence of cap. Without the cap mRNA molecules bind very poorly to the ribosomes.

2. *Non coding region1 (NC1):-* The cap is followed by a region of 10 to 100 nucleotides. This region is rich in A and U residues , and does not translate protein.

3.*Initiation codon* is AUG in both prokaryotes and eukaryotes.

4.*The coding region* consists of about 1500 nucleotides on the average and translates protein.

5.*Termination codon*:- Termination of translation on mRNA is brought about by a termination codon. In eukaryotes the termination codon are UAA,UAG or UGA.

6.*Noncoding region (NC2*): Consists of 50-150 nucleotides and does not translate protein.This region contains an AAUAAA sequence in all cases .

7.Poly (A)sequence :-At the 3' end is a plyadenylate or poly(A) sequence, which initially consists of 200-250 nucleotides , but which becomes shorter with age. This poly (A) sequence is added in the messenger as a tail before the mRNA reaches the cytoplasm.

Massemger RNA combines with ribosome to form polyribosome or polysomes which serve as work benches for protein synthesis . Each polysome contains several ribosomes.

RIBOSOMAL RNA (rRNA)

Ribosomal RNA (rRNA) or insoluble RNA constitutes the large part (upto 80%) of the total cellular RNA. It contains the four major RNA bases with a slight degree of methylation and shows differences in the relative properties of the bases between species. It's molecules appear to be single polynucleotide strand which are branched and flexible. At low ionic strength , rRNA behaves as random coil, but with increasing ionic strength the molecule shows helical regions , produced by base pairing between adenine and uracil; guanine and cytosine.

TYPES:- The eukaryotic cell have four kinds of rRNA molecules:- i) 28s rRNA ii)18SrRNA iii)5SrRNA iv)5.8S rRNA. The 28S rRNA, 5.8S rRNA and 5s rRNA occur in 60s ribosomal subunit while 18srRNA occurs in 40S ribosomal subnit of 80S ribosomes of eukaryotes.

The prokaryotic cells contain three kinds of rRNA molecule :- i) 23SrRNA (occur in 50S ribosomal subunit) ii)16S rRNA (occur in 30S ribosomal subnit) iii)5s r RNA (occurs in 50S ribosomal subunit).

FUNCTIONS:- The rRNA performs several functions:i)Gives structural integrity of ribosomes ii)serves as the sites for mRNA iii)has a role in protein synthesis.

TRANSFER RNA (t RNA)

The RNA which possess the capacity to combine specially with only one amino acid specific enzyme called aminoacyl t RNA synthetase , transfer that amino acid from the amino acid pool to the site of protein synthesis and recognize the codon of the m RNA, is known as the transfer RNA (tRNA) or soluble RNA (s RNA).

STRUCTURE:- These are smallest molecule of RNA . Each tRNA has an anticodon of three nucleotides. Each tRNA has a molecular weight of about 30,000 and the sedimentation coefficient of mature eukaryote tRNA is 3.8S. It is made up of 73-93 nucleotides . The t RNA molecule consists of a single strand looped about itself.

The nucleotide sequence (primary structure) of tRNA was first workedout by Holley et al (1965) for yeast alanine tRNA. Since then the sequence of different tRNA s, ranging

from bacteria to mammals, has been established . Holley proposed a secondary structure of tRNA "the clover leaf model " which is the most widely accepted structure. The structural features of this two dimentional tRNA structures are as follows:-

The two most essential components responsible for recognizing aminoacid on the one hand and the mRNA on the other are i)Acceptor end ii)Anticodon loop.

i) *The acceptor end* : All tRNA molecules contain the same terminal sequence of 5' CCA 3' bases at 3' end of the polynucleotide chain. The last residue , adenylic acid (A) is the amino acid attached site.

ii)*The anticodon loop*: The anticodon loop is directly opposite to the acceptor end having three bases to recognize and form hydrogen bonds with the mRNA , thus reading the genetic message. It is complementary to the corresponding triplet codon of mRNA.

iii)*The D- loop (Di- hydro-uridine loop) or DHU arm* :- It is made up for the recognition by the specific amino-acetyl tRNA synthetase and is made up of 8-12 unpaired base.

iv)*The t-loop (Name for T CG) or ribosomal binding loop*: It is thought to interact with a complementary region of 5S ribosomal RNA during protein synthesis . It is involved in the binding of t RNA molecule to the ribosomes. It is made up of seven unpaired bases including pseudouridine ( ) so it is known as T C arm.

v)*The extra , optional or variable arm*: It occurs only in some tRNAs. It may be small containing only 2-3 nucleotides (class I tRNAs) or larger containing 13-21 nucleotides with upto five base pair in a stem (class II tRNA).

FUNCTIONS:- It plays a key role in protein synthesis , carrying amino acids to the site of protein synthesis and attaches itself to ribosome in accordance with base sequence specified by mRNA (codon) by their anticodon . The crucial factor in enzyme protein synthesis from hereditary messenger carried by the mRNA is the codon anticodon relationship in translation. The anticodon located in tRNA in the form of 3 bases , must be complementary with the triplet codon in the messenger RNA . AS such this sequence of complementarity between the two is the most important event in enzyme synthesis.