

(A) MESSENGER RNA (mRNA)

(3)

1. The term messenger RNA (mRNA) was proposed by Jacob and Monod in 1961.
2. The RNAs carrying genetic information for protein synthesis from DNA (genes) to the site of protein synthesis (ribosomes) are known as messenger RNA (mRNA).
3. It forms only 3-5% of total cellular RNA.

Size 4. The molecular weight is about 500,000 for an average sized mRNA.

5. Its sedimentation coefficient is 8S.
6. They vary in length and molecular weight.
7. The minimum normal one is of at least 300 to 400 nucleotides.

Structure:

8. Always single stranded
9. Mostly contains usual bases.
10. May be few unusual substitute bases.
11. No base pairing.
12. May be random coiling in extracted mRNA.
13. Base sequence is complementary to the DNA template.
14. Types of mRNA are as there are types of genes. Since each gene can transcribe its own mRNA. But
15. mRNA differs only in the base sequence and length.
16. The structural features are
(i) cap, (ii) Noncoding region I (NCI), (iii) Initiation codon, (iv) coding region, (v) Termination codon, (vi) Non coding region II (NCII), (vii) Poly(A) sequence.

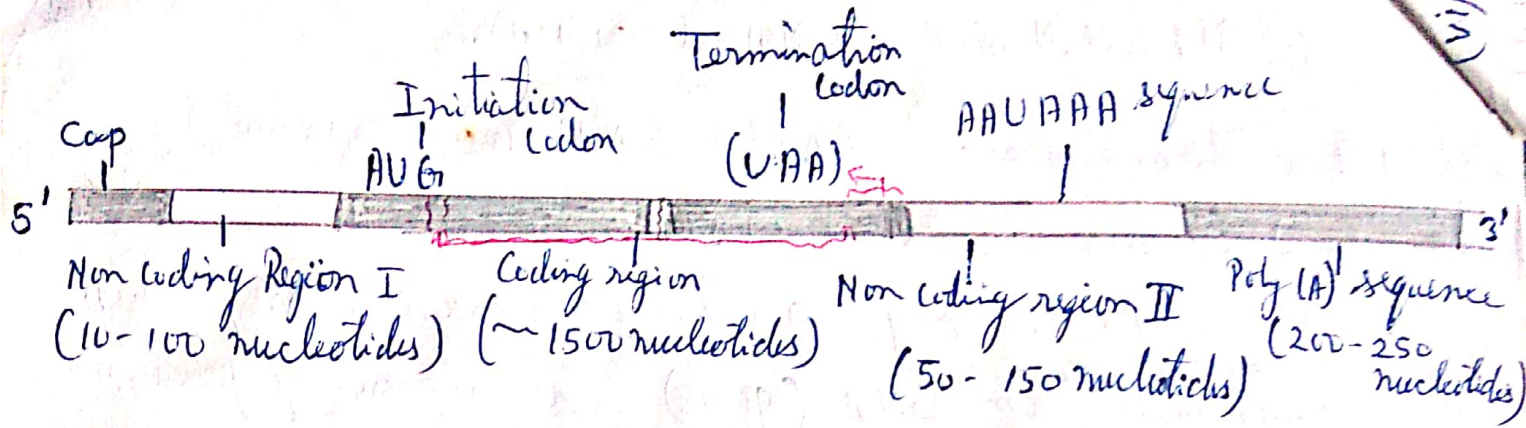


Fig: General structure with features of an Eukaryotic mRNA

- (i) Cap → 17. There is a cap at 5' end. It is found in most of Eukaryotes and animal viruses.
- 18. It is a blocked methylated structure,

$$m^7 Gpp Nmp Np \text{ or } m^7 Gpp Nmp Nmp Np.$$

[N = any of four nucleotides, Nmp = 2' methyl ribose.]
- 19. This cap helps in binding the mRNA to ribosomes.
- 20. mRNA without cap bind very poorly to ribosomes.
- 21. This cap is helpful effects the rate of protein synthesis.
- (ii) Non coding region I (NCI) → It is a 10-100 nucleotide region after the cap. It is rich in A and U residues, they do not translate protein.
- (iii) The initiation codon is AUG. in both pro- and Eukaryotes.
- (iv) The coding region: It consists of about 1,500 nucleotides on average. It translates protein.
- (v) Termination codon: It is helpful in termination of translation. The code may be UAA, UAG, or UGA.

(vi) Non-coding region 21 (NC 21) It consists of 50-150 nucleotides. It does not translate protein. It contains AAUAAA sequence in all the sequenced examples. (5)

(vii) Poly (A) Sequence :- It is at 3' end. Initially it consists of 200-250 nucleotides, but become shorter ~~at~~ with age and may become to 20. This sequence poly (A) is added in the nucleus before the mRNA reaches the cytoplasm.

mRNA forms polysomes by combining ribosomes. There are several ribosomes, ^(usually first 5) in a polysome forming a complex with mRNA.

mRNA is of two types.

(A) Monocistronic → Only one gene codes for a single mRNA. It is found in Eukaryotes.

(B) Polycistronic → Several adjacent genes (cistron) may transcribe an mRNA. It is also known as polygenic.

Stability :- (i) m-RNAs are constantly undergoing breakdown into its constituent ribonucleotides by the enzyme ribonucleases.

(ii) In bacteria they are very short lived. Its one end may be breaking down where as ~~one~~ on the other part are translating the protein. e.g. half life of mRNA is about two (2) minutes in case of E. coli

② Where as in Eukaryotes there are metabolically stable mRNAs - e.g. Immature RBC (reticulocyte) of mammals have lost their nuclei but possess ribosomes. The cell can synthesize haemoglobin not for hours but for many days by the mRNAs transcribed during presence of nucleus.