RNA editing

RNA editing is the name given to several reactions whereby the nucleotide sequence on an mRNA molecule may be changed by mechanisms other than RNA splicing. RNA editing was first identified in 1986 in the mitochondrial gene of trypanosome, in which the transcripts were found to be extensively modified by the insertion of uracil residues.

Individual nucleotides within the mRNA may be changed to other nucleotides, deleted entirely or additional nucleotides inserted. The effect of RNA editing is to change the coding capacity of the mRNA so that it encodes a different polypeptide than that originally encoded by the gene.

Broadly RNA editing can be divided into two parts –

(a) Base insertion/deletion type

- U-insertion/deletion editing in the kinetoplastid.
- C-insertion/dinucleotide (GC, GU, CU, AA, AU) editing in mitochondria of slime moulds is achieved by slippery transcription.
- G or A-insertion editing found in negative strand RNA viruses and Ebola virus respectively.

(b) Base substitution/modification type

- A to I (inosine) editing in glutamate receptor, hepatitis delta virus, etc. occurs through deamination of adenosine with the help of adenosine deaminases acting on RNA (ADARs) by specifically targeting single nucleotides within partially double stranded pre-mRNAs.
- A to G or U to A or U to G editing found in vertebrate mRNAs.
- C to U editing in plant mitochondria and chloroplasts, mammalian apo B, etc. involves transition due to deamination of cytosine by cytidine deaminase.

An example of RNA editing (base substitution) in humans is apolipoprotein B mRNA. In liver, the mRNA does not undergo editing and the protein produced after translation is called apolipoprotein B100 –

![Diagram of RNA editing in apolipoprotein B mRNA](image-url)
In cells of the small intestine, RNA editing causes the conversion of a single C residue in the mRNA to U and, in so doing, changes a codon for glutamine (CAA) to a termination codon (UAA). Subsequent translation of the edited mRNA yields the much shorter **apolipoprotein B48** (48% of the size of apolipoprotein B100) –

Apolipoprotein B48 lacks a protein domain needed for receptor binding which apolipoprotein B100 possesses and hence the functional activities of the two proteins are different.

**Significance of RNA editing** -

- It is essential in regulating gene expression of organisms.
- RNA editing mutant was reported with strong defects in organelle development.
- Deficiency causes diseases.
- It is a mechanism to increase the number of different proteins available without the need to increase the number of genes in the genome.
- May help protect the genome against some viruses.