RNA

(RNA) is a family of large biological molecules that perform multiple vital roles in the coding, decoding, regulation, and gene expression.

Together with DNA, RNA comprises the nucleic acids, which, along with proteins, constitute the three major macromolecules essential for all known forms of life. Like DNA, RNA is assembled as a chain of nucleotides.

Single-stranded RNA (ssRNA) but it may be double-stranded (dsRNA), but is usually single-stranded. Cellular organisms use messenger RNA (mRNA) to convey genetic information (often notated using the letters G, A, U, and C for the nucleotides guanine, adenine, uracil, and cytosine) that directs synthesis of specific proteins, while many viruses encode their genetic information using an RNA genome.

Some RNA molecules play an active role within cells by catalyzing biological reactions, controlling gene expression, or sensing and communicating responses to cellular signals. One of these active processes is protein synthesis, a universal function whereby mRNA molecules direct the assembly of proteins on ribosomes. This process uses transfer RNA (tRNA) molecules to deliver amino acids to the ribosome, where ribosomal RNA (rRNA) links amino acids together to form proteins.

Remarkably, 98% of the RNA within a cell is not translated into proteins. Of those, especially microRNAs (MicroRNAs) have been shown not only to have a major influence on physiologic processes but also to be deregulated and prognostic in malignancies.

Accumulating evidence has suggested that small nucleolar RNAs (snoRNAs) are gaining prominence and are more actively involved in tumorigenesis than previously thought. However, no report concerning the implication of snoRNAs in glioma has been published to date. In a study, SNORD76 was first found to be inversely associated with Hox Transcript Antisense Intergenic RNA (HOTAIR) knockdown, and surprisingly, forcibly expressed SNORD76 inhibited proliferation and growth of glioma cells. Moreover, downregulation of SNORD76 led to a more malignant phenotype. The pleiotropy of SNORD76 overexpression could be achieved at least partially through inducing cell cycle arrest at S phase by affecting the Rb-associated cell cycle regulation. Enforced SNORD76 expression in orthotopic tumors resulted in decreased tumor growth and the reduction of tumor volume. Additionally, in surgically resected glioma tissues, SNORD76, not its host gene, was associated with the WHO classification and was selectively downregulated in Glioblastoma (WHO grade IV). Collectively, the study adds to a growing body of evidence for the participation of snoRNAs in gliomagenesis and is the first to implicate a snoRNA in glioblastoma [1)].

Classification

Non-coding genes can be classified into different categories based on their functional characteristics. Here are a few examples:

Ribosomal RNA (rRNA): rRNA genes code for RNA molecules that are essential components of the

ribosomes, the cellular structures responsible for protein synthesis. Although rRNA does not encode proteins, it plays a critical role in translation by facilitating the assembly and functioning of ribosomes.

Transfer RNA (tRNA): tRNA genes encode RNA molecules that act as adapters between messenger RNA (mRNA) and amino acids during protein synthesis. tRNAs are responsible for carrying specific amino acids to the ribosomes, where they are incorporated into growing polypeptide chains.

MicroRNAs (MicroRNAs): MicroRNAs are short RNA molecules that regulate gene expression by binding to specific messenger RNAs (mRNAs) and inhibiting their translation or promoting their degradation. MicroRNAs play important roles in developmental processes, cell differentiation, and the regulation of various cellular pathways.

Long Non-Coding RNAs (lncRNAs): lncRNAs are RNA molecules that are longer than 200 nucleotides and do not encode proteins. They are involved in diverse regulatory processes, such as chromatin remodeling, transcriptional regulation, and post-transcriptional regulation. Some lncRNAs have been implicated in diseases, including cancer and neurological disorders.

Enhancer RNAs (eRNAs): eRNAs are short RNA transcripts that are synthesized from enhancer regions of the genome. They are thought to play a role in the activation of gene expression by facilitating the interaction between enhancer elements and target genes.

Piwi-interacting RNAs (piRNAs): piRNAs are small non-coding RNAs that are predominantly expressed in the germline cells. They are involved in silencing transposable elements, protecting genome integrity, and regulating gene expression during germ cell development.

These are just a few examples of non-coding genes, and the field of non-coding RNA research is continually evolving as more functions and regulatory mechanisms are discovered. Non-coding genes have demonstrated their importance in gene regulation, development, and disease, and studying them provides valuable insights into the complexity of genome function.

1)
Chen L, Han L, Wei J, Zhang K, Shi Z, Duan R, Li S, Zhou X, Pu P, Zhang J, Kang C. SNORD76, a box C/D snoRNA, acts as a tumor suppressor in glioblastoma. Sci Rep. 2015 Feb 26;5:8588. doi: 10.1038/srep08588. PubMed PMID: 25715874.