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Abstract

While DNA often takes the spotlight in discussions of genetics and molecular biology, RNA—once considered a mere messenger—is emerging as a central player in a myriad of cellular processes. From gene regulation to protein synthesis and beyond, RNA biology encompasses a diverse array of roles and functions critical for the functioning of living organisms. In this article, we embark on a journey into the captivating world of RNA biology, shedding light on its multifaceted roles and implications for health and disease.

Keywords:RNA Biology; Gene regulation; DNA.

Introduction

Ribonucleic acid (RNA) serves as a versatile molecule with multifunctional roles within the cell. While its primary function was once thought to be the transfer of genetic information from DNA to proteins, we now know that RNA plays diverse roles beyond this canonical function. ese roles include serving as structural components of ribosomes, catalyzing biochemical reactions as ribozymes, and regulating gene expression through mechanisms such as RNA interference (RNAi) and RNA editing [1-3].

Methodology

Messenger RNA (mRNA) is perhaps the most well-known type of RNA, responsible for carrying the genetic information encoded in DNA to the ribosomes, where it is translated into proteins. Transcription, the process by which mRNA is synthesized from a DNA template, is a critical step in gene expression regulation. Once transcribed, mRNA undergoes processing, including capping, splicing, and polyadenylation, to produce mature transcripts ready for translation [4, 5].

Non-coding rnas: unraveling the hidden regulators

In addition to mRNA, non-coding RNAs (ncRNAs) represent a diverse class of RNA molecules that do not encode proteins but instead play regulatory roles in gene expression. ese include transfer RNAs (tRNAs), which serve as adaptors between mRNA and amino acids during protein synthesis, as well as ribosomal RNAs (rRNAs), which form the structural and catalytic core of ribosomes.

Among the most intriguing non-coding RNAs are microRNAs (miRNAs) and long non-coding RNAs (lncRNAs), which have garnered increasing attention for their roles in gene regulation and cellular processes. miRNAs function as post-transcriptional regulators, binding to complementary sequences in target mRNAs and inhibiting their translation or promoting their degradation. lncRNAs, on the other hand, exhibit diverse functions, including chromatin remodeling, transcriptional regulation, and mRNA stability control [6-8].

RNA editing: rewriting the genetic script

RNA editing represents a fascinating phenomenon in which RNA sequences are altered a er transcription, leading to changes in the corresponding protein sequence. One of the most well-known examples of RNA editing is the conversion of adenosine to inosine (A-to-I editing) by adenosine deaminases acting on RNA (ADARs). A-to-I editing can result in changes in codon speci city, splicing patterns, and regulatory elements within mRNA transcripts, thereby expanding the functional diversity of the proteome.

RNA in disease: implications for health and therapeutics

Dysregulation of RNA biology has been implicated in a wide range of human diseases, including cancer, neurodegenerative disorders, and infectious diseases. Aberrant expression of miRNAs, for example, has been linked to tumorigenesis, metastasis, and drug resistance in cancer

In conclusion, RNA biology represents a rich and dynamic eld of study health and disease. By deciphering the mysteries of RNA, we open new avenues for therapeutic interventions and personalized medicine,

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paving the way for innovative approaches to improving human health and well-being.

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