Advancements in Targeted Chemotherapy: Precision Medicine in Cancer Treatment.

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Introduction

In the realm of cancer treatment, the quest for more effective and less harmful therapies has been ongoing for decades. Traditional chemotherapy, while potent in targeting rapidly dividing cancer cells, often comes with significant side effects due to its indiscriminate nature, harming healthy cells along with cancerous ones. However, the landscape of cancer treatment has been rapidly evolving with the advent of targeted chemotherapy, a cornerstone of precision medicine. This approach tailors treatment to the specific molecular characteristics of an individual's cancer, offering the promise of more effective therapy with fewer adverse effects. [1].

Targeted chemotherapy is rooted in the understanding that cancer is not a monolithic disease but a complex array of conditions driven by various genetic mutations and molecular alterations. By identifying these specific genetic changes unique to a patient's tumor, clinicians can select drugs that precisely target the aberrant pathways driving cancer growth, sparing healthy cells and minimizing collateral damage [2].

The process of protein synthesis can be divided into two main stages: transcription and translation. Transcription occurs in the nucleus of eukaryotic cells (or in the cytoplasm of prokaryotic cells), where the DNA sequence encoding a particular gene is copied into a complementary RNA molecule called messenger RNA (mRNA). This process is catalyzed by an enzyme known as RNA polymerase, which binds to the DNA at a specific region called the promoter and starts synthesizing the mRNA strand by adding complementary RNA nucleotides to the DNA template [3].

During transcription, only one strand of the DNA, called the template or antisense strand, is used as a template for mRNA synthesis. The mRNA molecule is synthesized in the 5' to 3' direction, complementary to the DNA template. As RNA polymerase moves along the DNA template, the newly synthesized mRNA molecule is elongated until it reaches a termination sequence, at which point RNA polymerase dissociates from the DNA, and the mRNA molecule is released [4].

Once the mRNA molecule is synthesized, it undergoes several processing steps before it is ready to be translated into a protein. These processing steps include capping, polyadenylation, and splicing. The 5' end of the mRNA is modified by the addition of a modified guanine nucleotide, known as a 5' cap, which plays a crucial role in mRNA stability and translation initiation. Additionally, a polyadenine (poly-A) tail is added to the 3' end of the mRNA, which also contributes to mRNA stability and facilitates nuclear export. Finally, in eukaryotic cells, introns (non-coding regions) are removed from the pre-mRNA molecule, and the remaining exons (coding regions) are spliced together to form the mature mRNA molecule [5].

With the mature mRNA molecule synthesized and processed, it is now ready for translation, the second stage of protein synthesis. Translation takes place in the cytoplasm on ribosomes, large complexes composed of proteins and ribosomal RNA (rRNA). The process involves decoding the nucleotide sequence of the mRNA molecule to assemble a corresponding sequence of amino acids, the building blocks of proteins [6].

Translation begins with the binding of the small ribosomal subunit to the mRNA molecule at a specific sequence called the start codon (usually AUG), which signals the initiation of protein synthesis. Then, transfer RNA (tRNA) molecules, each carrying a specific amino acid, bind to the corresponding codons on the mRNA molecule through complementary base pairing. The tRNA molecules carry out this function with the help of their anticodon sequences, which are complementary to the codons on the mRNA [7].

As the ribosome moves along the mRNA molecule, tRNA molecules sequentially bind to the mRNA, bringing in their specific amino acids and forming peptide bonds between adjacent amino acids. This process continues until a stop codon (UAA, UAG, or UGA) is reached, signaling the termination of protein synthesis. At this point, the newly synthesized protein is released from the ribosome, folded into its functional conformation, and may undergo further modifications to become fully active [8].

The fidelity of protein synthesis is crucial for maintaining cellular function and homeostasis. Errors in protein synthesis can lead to the production of defective proteins, which may result in various diseases and disorders. To minimize errors, cells employ several mechanisms, including proofreading by ribosomes and tRNA molecules, as well as quality control processes that target and degrade faulty proteins [9].

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Conclusion

In summary, protein synthesis is a complex and highly regulated process that enables cells to produce the diverse array of proteins required for life. From the transcription of DNA into mRNA to the translation of mRNA into protein, each step is carefully orchestrated by the cellular machinery to ensure the accurate synthesis of functional proteins. Understanding the mechanisms underlying protein synthesis not only sheds light on the fundamental processes of life but also holds great promise for biomedical research and the development of novel therapeutics.

References

1. Davis HP, Squire LR. Protein synthesis and memory: a review. Psychological bulletin. 1984 ;96(3):518.
2. Haselkorn RO, Rothman-Denes LB. Protein synthesis. Annual Review of Biochemistry. 1973 ;42(1):397-438.
3. Moldave K. Eukaryotic protein synthesis. Annual review of biochemistry. 1985 ;54(1):1109-49.
4. Carter CG, Houlihan DF. Protein synthesis. Fish physiology. 2001 ;20:31-75.
5. Crick F. History of Biology: Biochemistry. History. 2015 ;27:5-2016.
6. Matthews CN, Moser RE. Prebiological protein synthesis. Proceedings of the National Academy of Sciences. 1966 ;56(4):1087-94.
7. Berg P. Specificity in protein synthesis. Annual review of biochemistry. 1961 ;30(1):293-322.
8. Koshland Jr DE. Application of a theory of enzyme specificity to protein synthesis. Proceedings of the National Academy of Sciences. 1958 ;44(2):98-104.
9. Novelli GD. Amino acid activation for protein synthesis. Annual Review of Biochemistry. 1967 ;36(1):449-84.
10. Laursen BS, Sørensen HP, Mortensen KK, Sperling-Petersen HU. Initiation of protein synthesis in bacteria. Microbiology and molecular biology reviews. 2005 ;69(1):101-23.

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