OPEN ACCESS Freely available online

ISSN: 0974-8369
Biology and Medicine

Commentary

Ribosome Structure and its Function: From RNA to Protein

Christa Grant*

Division of Cell Biology, University of Queensland, Queensland, Australia

DESCRIPTION

Ribosomes play a crucial role in protein synthesis, a fundamental biological process that occurs in all living organisms. In eukaryotes, ribosomes are found in the cytoplasm and on the endoplasmic reticulum, while in prokaryotes, they are present in the cytoplasm. Ribosomes are responsible for the translation of genetic information encoded in messenger RNA (mRNA) into protein sequences. Ribosomes are composed of two subunits, the large and small subunits. Each subunit consists of a combination of RNA molecules, known as ribosomal RNA (rRNA), and protein molecules, known as ribosomal proteins. The small subunit is responsible for binding to mRNA, while the large subunit is responsible for catalyzing the formation of peptide bonds between amino acids to form a polypeptide chain.

Protein synthesis begins with the transcription of DNA into mRNA in the nucleus of eukaryotic cells or the cytoplasm of prokaryotic cells. The mRNA then travels to the ribosome, where it is translated into a protein sequence. The process of protein synthesis can be divided into three main stages: initiation, elongation, and termination. The first step in protein synthesis is the binding of the small ribosomal subunit to the mRNA molecule. The small subunit binds to the mRNA at a specific sequence known as the start codon, which is usually AUG (Adenine-Uracil-Guanine) in eukaryotes and prokaryotes. The start codon signals the beginning of the protein sequence. Once the small subunit is bound to the mRNA, the initiator tRNA (transfer RNA) molecule carrying the amino acid methionine binds to the start codon. The initiator tRNA has a specific anticodon sequence that is complementary to the start codon on the mRNA. This ensures that the correct amino acid is inserted at the beginning of the protein sequence. The elongation stage of protein synthesis involves the addition of amino acids to the growing polypeptide chain. This process is catalyzed by the large ribosomal subunit, which joins the small subunit to form a functional ribosome. The ribosome then moves along the mRNA in a process known as translocation. As the ribosome moves along the mRNA, it exposes the next codon in the sequence. A second tRNA molecule carrying the corresponding amino acid binds to the codon. The ribosome then catalyzes the formation of a peptide bond between the two amino acids, releasing the tRNA molecule and forming a longer polypeptide chain. This process is repeated for each codon in the mRNA sequence, adding amino acids one at a time to the growing protein chain. As the ribosome moves along the mRNA, the tRNA molecules are released, and the ribosome exposes the next codon in the sequence. The final stage of protein synthesis is termination, which occurs when the ribosome reaches a stop codon in the mRNA sequence. Stop codons include UAA, UAG, and UGA in eukaryotes and prokaryotes. When the ribosome encounters a stop codon, it does not bind to a tRNA molecule. Instead, it releases the polypeptide chain and disassembles into its two subunits. The polypeptide chain is then folded into its final three-dimensional structure, which determines its function in the cell. The protein may undergo additional modifications, such as phosphorylation, glycosylation, or lipidation, to become fully functional.

Roles of ribosomes in the immune system include synthesis of antibodies. Antibodies are proteins that are produced by B cells in response to an invading pathogen. Ribosomes are responsible for synthesizing these antibodies. They also produce cytokines, which are signaling molecules that are involved in the regulation of the immune response and in the formation of Major Histocompatibility Complex (MHC) molecules are proteins that are responsible for presenting antigens to T cells. Overall, ribosomes play a crucial role in the immune system by synthesizing the proteins that are required for immune response. Without ribosomes, the immune system would not be able to mount an effective response to invading pathogens.

Correspondence to: Christa Grant, Division of Cell Biology, University of Queensland, Queensland, Australia, E-mail: christa@health.qld.gov.au

Received: 22-Feb-2023, Manuscript No. BLM-23-20386; **Editor assigned:** 27-Feb-2023, Pre QC No. BLM-23-20386 (PQ); **Reviewed:** 14-Mar-2023, QC No. BLM-23-20386; **Revised:** 21-Mar-2023, Manuscript No. BLM-23-20386 (R); **Published:** 28-Mar-2023, DOI: 10.35248/0974-8369.23.15.548.

Citation: Grant C (2023) Ribosome Structure and its Function: From RNA to Protein. Bio Med. 15:548.