Department of biology

2025-2026

((Microbial Physiology))

Stage (-3-)

LEC- ((10))

The vital pathways that intersect within the cellular carbon structure to link all new compounds

By

Asst Lec dhuha salah al-khafagi

Nucleic Acid Synthesis

As in proteins, the synthesis of nucleic acids is primarily based on their fundamental building units, namely nucleotides. A nucleotide is a compound composed of one or more phosphate groups, a nitrogenous base (adenine, guanine, cytosine, thymine, or uracil), and a pentose sugar. These components are linked together by specific chemical bonds, as illustrated in Figure .((64

If the pentose sugar is ribose, the nucleic acid is referred to as ribonucleic acid (RNA). If the pentose sugar is deoxyribose (ribose lacking an oxygen atom), meaning that an oxygen atom is removed from the hydroxyl (OH) group at the α-carbon position, the nucleic acid is called deoxyribonucleic acid .((DNA

All of the nitrogenous bases mentioned above, except thymine, are found in RNA molecules. In DNA, however, thymine .replaces uracil

Central Metabolic Pathways Involved in Carbon Flow Within the Cell

Protein Synthesis .1

Proteins are polymers of amino acids, and amino acids are the basic building blocks of proteins. There are twenty amino acids that participate in the construction of various proteins. The sequence and order of these amino acids within a protein .determine its specific properties and functions

This ordered sequence is controlled by a genetic code (gene) located on the cellular DNA. The genetic code determines the correct amino acid sequence required for the synthesis of a specific protein. Each amino acid is encoded by a codon consisting of three consecutive nucleotide bases. More than one codon may encode a single amino acid, with the exception of tryptophan and methionine, each of which is specified by only .one codon

In bacterial cells, numerous different proteins are present, and each protein has its own specific number and sequence of amino acids. Amino acids are linked together by peptide bonds to form a polypeptide chain, and multiple polypeptide chains may then associate through linear or branched interactions to produce the .final three-dimensional structure of the protein

Site of Protein Synthesis

Protein synthesis occurs in the cytoplasm of bacterial cells, specifically at the ribosomes, which are the cellular structures responsible for protein production. The ribosome can be likened to a device capable of synthesizing any protein depending on the .(signal it receives from messenger RNA (mRNA

Messenger RNA is so named because it carries the genetic information from DNA to the ribosomes, where it is translated into proteins. The lifespan of mRNA in bacterial cells is very -.short and does not exceed two minutes

Ribosome Structure

The bacterial ribosome is composed of a specific type of ribonucleic acid known as ribosomal RNA (rRNA) and consists :of two subunits

(a small subunit (30S

(a large subunit (50S

These two subunits exist freely in the cell and associate to form .a functional 70S ribosome only when bound to mRNA

(Transfer RNA (tRNA

The third type of ribonucleic acid is transfer RNA (tRNA), whose function is to transport amino acids to the mRNA. Each tRNA molecule contains a sequence of three nitrogenous bases known as the anticodon, which is complementary to the codon present on the mRNA. Thus, tRNA plays a crucial role in recognizing the correct codon and ensuring the accurate .incorporation of amino acids during protein synthesis

Stages of Protein Synthesis

Protein synthesis begins with the activation of amino acids by enzymes known as aminoacyl-tRNA synthetases. This .activation process requires energy in the form of ATP

Once activated, the amino acid binds to its corresponding tRNA to form an amino acid–tRNA complex, which is then ready to interact with mRNA at the ribosome to continue protein synthesis, as shown in Figure (63). The process proceeds :through the following steps

Step 1: The 30S ribosomal subunit binds to one end of the .1 .mRNA molecule at a specific site

Step 2: The amino acid–tRNA complex binds to the codon at .2 .position X on the mRNA through the 50S ribosomal subunit

3. Step 3: A second tRNA carrying another amin