Synthesising a polypeptide:

1. **A ribosome becomes attached to the starting codon (AUG) at one end of the mRNA molecule.**
2. **The tRNA molecule with the complementary anticodon sequence moves to the ribosome and pairs up with the codon on the mRNA**. This tRNA carries a specific amino acid (methionine).
3. **A tRNA molecule with a complementary anticodon (UGC) pairs with the next codon on the mRNA (ACG).** This tRNA carries another amino acid (threonine).
4. **The ribosome moves along the mRNA, bringing together two tRNA molecules at any one time, each pairing up with the corresponding two codons on the mRNA.**
5. The two amino acids (methionine and threonine) on the tRNA **are joined by a peptide bond using an enzyme and ATP which is hydrolysed to provide the required energy.**
6. **The ribosome moves on to the third codon (GAU) in the sequence on the mRNA**, thereby linking the amino acids (threonine and aspartic acid) on the second and third tRNA molecules.
7. As this happens the **first tRNA is released from its amino acid (methionine) and is free to collect another amino acid (methionine) from the amino acid pool in the cell.**
8. The process continues, with up to 15 amino acids being added each second until a polypeptide chain is built up.
9. Up to 50 ribosomes can pass immediately behind the first so that **many identical polypeptides can be assembled simultaneously.**
10. **The synthesis of a polypeptide continues until a ribosome reaches a stop codon**. At this point, the ribosome, mRNA and

Polypeptide synthesis—translation

In summary, the DNA sequence of triplets that make up a gene determine the sequence of codons on mRNA. The sequence of codons on mRNA determine the order in which the tRNA molecules line up. They then in turn determine the sequence of amino acids in the polypeptide. In this way genes precisely determine which proteins a cell manufactures.

Assembling a protein:

Sometimes a single polypeptide chain is a functional protein. Often a number of polypeptides are linked together to give a functional protein (quaternary structure). What happens to the polypeptide next depends on the protein being made but usually involves:

- **the polypeptide is coiled or folded, producing its secondary structure.**
- **The secondary structure is folded, producing its tertiary structure.**
- **Different polypeptide chains, along with any non-protein groups, are linked to form the quaternary structure.**