

What is Genes and Genetic code

A gene is a sequence of nucleotides in DNA or RNA that encodes the synthesis of a gene product, either RNA or protein. During gene expression, the DNA is first copied into RNA. The RNA can be directly functional or be the intermediate template for a protein that performs a function

Genes in action

Gene action refers to the way in which certain genes exert their effects on the body. They could be dominant, or recessive, or they could be sex linked or be involved in chromosomal aberrations. A combination of such gene actions results in the observable phenotype of an organism.

- ☐ Coded genetic instructions are located in the DNA of the nucleus of eukaryotic organisms.
- ☐ DNA and RNA are both nucleic acids, but differ in several ways.
- ☐ During transcription, the information in the template strand of the DNA of a gene is copied into a RNA molecule.
- ☐ The base sequence in a single strand of DNA acts as a template to guide information of pre-mRNA.
- ☐ The final mRNA molecule results when regions corresponding to introns are removed

A sequence of bases in DNA that codes for the synthesis of one polypeptide is called gene.

The genes must transmit their information from the nucleus to cytoplasm. Therefore, protein synthesis occurs in cytoplasm. The synthesis of RNA molecule from DNA is called transcription and the formation of a protein from RNA at the ribosome is called translation.

Three major kinds of RNA:

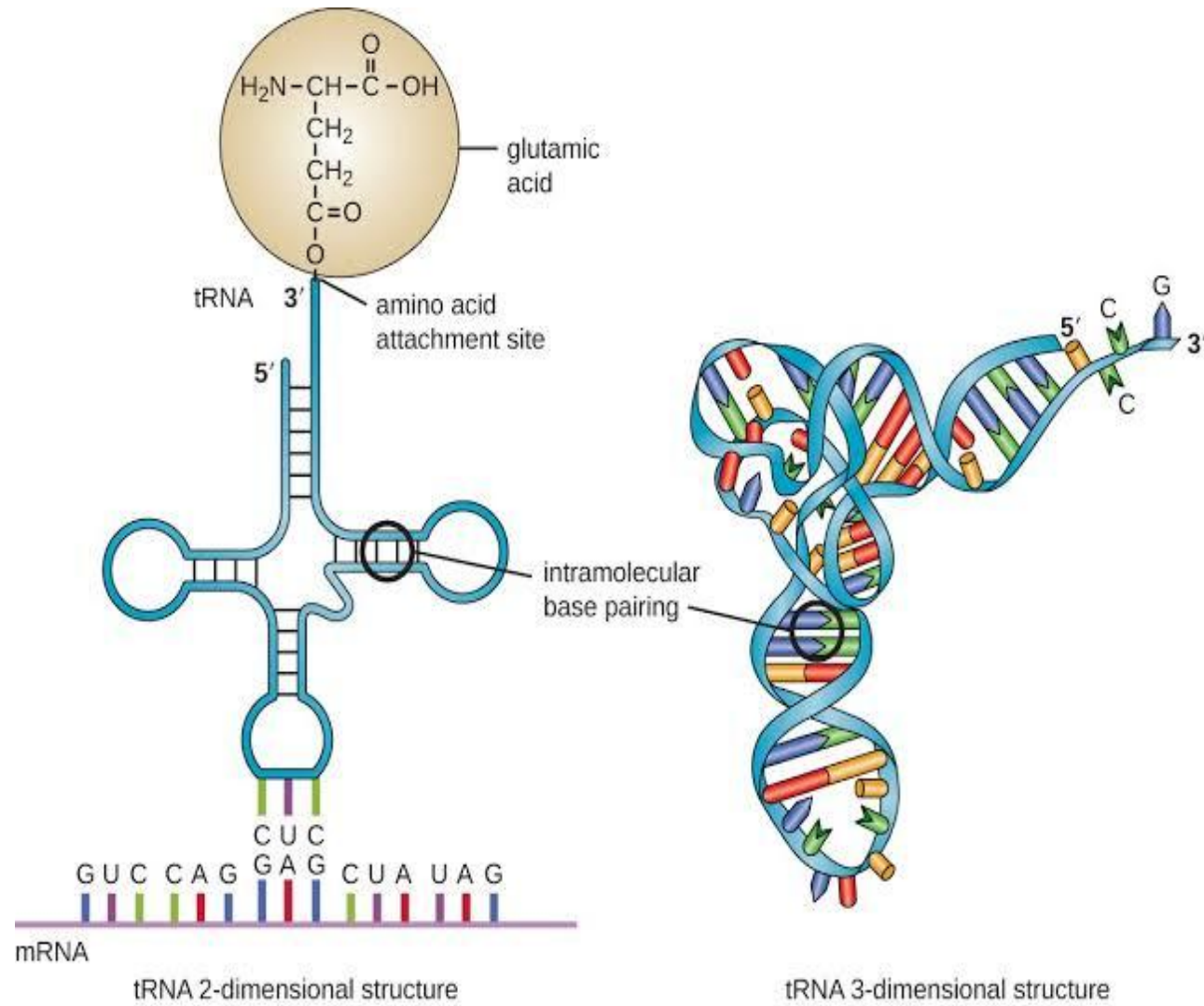
There are three major kinds of RNA. Each RNA has a specific role in protein synthesis. All the RNA are produced in the nucleus from DNA.

1. Messenger RNA (mRNA) is a linear strand. It carries a set of genetic instructions for synthesizing proteins to the cytoplasm.

2. Transfer RNA (tRNA) picks up amino acids in the cytoplasm and carries them to the ribosomes. It joins these amino acids for the synthesis of polypeptide.

3. Ribosomal RNA (rRNA) with proteins makes up ribosomes.

tRNA



The genetic code:

The genetic code is a sequence of three bases- a triplet code. DNA must code for the 20 different amino acids. DNA has information carrying capabilities. These information are present in the sequence of nitrogenous bases of DNA. DNA transfers these sequences to mRNA. Each three-base combination is a **codon**. There 64 possible codons. But there are only 20 amino acids. Hence more than one codon can specify same amino acids. This characteristic of code is called **degeneracy**. All codons does not code for amino acids. There are some initiation and termination codes.

1. Termination codons: The base sequence UAA, UAG and UGA are stop codons. They indicate the termination point of the polypeptide synthesis.

2. Initiation codon: The codon AUG codes for the amino acids methionine. It is a start codon

Genetic codes:

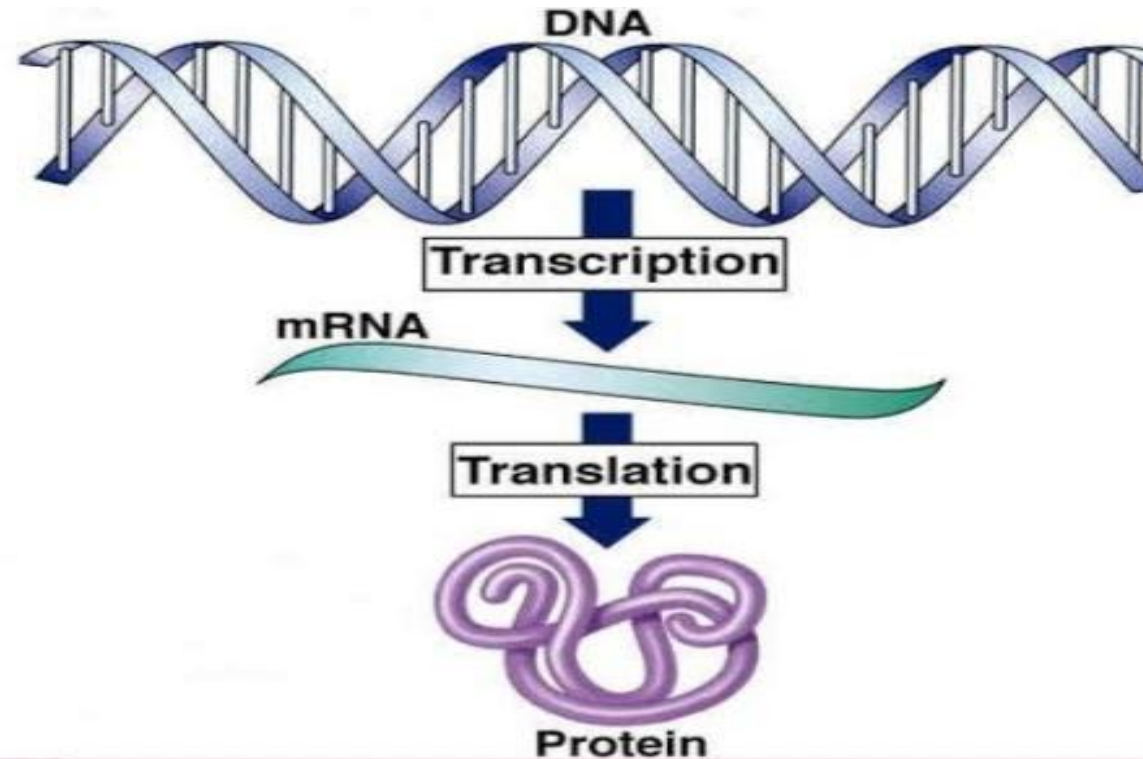
the Genetic Code

- Shown as mRNA
- 5' → 3'
- 64 codons
- Redundant
- One “start” codon: **AUG**
- Three “stop” codons: **UAG**, **UAA**, **UGA** (don't encode amino acids)

		Second mRNA base					
		U	C	A	G		
First mRNA base (5' end)	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U C A G	Third mRNA base (3' end)
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G	
	A	AUU } AUC } Ile AUA } AUG Met or start	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G	
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G	

Cells use RNA to make proteins

All the organisms use the same basic mechanism of reading and expressing genes which is often referred to as **central dogma**. The genetic information resides in DNA . The genetic information flows down into RNA , which is then converted into genes.



The first step of central dogma is the transfer of information from DNA to RNA,
Which occurs when an mRNA copy of gene is produced. This process is called
as **transcription**.

Transcription is initiated when the enzyme RNA polymerase binds to the particular binding site called a promoter located upstream of a gene. The enzyme then moves along the strand into the gene and mRNA is synthesized. At stop signal on other end of gene, the enzyme disengages itself from the DNA and releases the new assembled RNA chains. This chain is complementary transcript of the gene from which it is copied.

The second step of central dogma is the transfer of information from RNA to proteins, which occurs when the information contained in the mRNA is used to direct the synthesis of polypeptides by ribosomes. This process is called **translation**, because the nucleotide sequence of the mRNA is translated into an amino acid sequence in the polypeptides.

Gene expression

