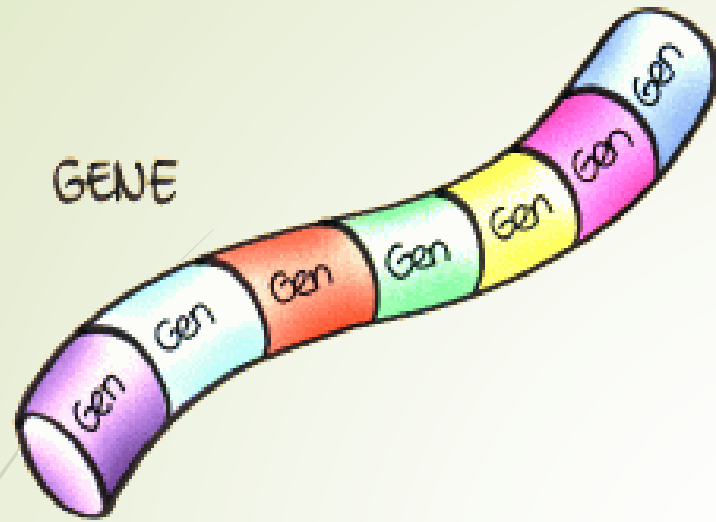


Genetic code.
Protein synthesis.
RNA structure, transcription and translation.



Genes

- Genetic information is encoded in the base sequence of the DNA
- **A gene** : DNA sequence that encodes amino acid sequence of a protein
- Beside the coding area, also other elements are needed → control elements and "empty areas"



The Genetic Code

- Describes how base sequences are converted to protein sequence
- DNA sequence is divided into series of units of three bases → a **codon**
- One codon is specific to one **amino acid** (structural component of protein)

1 st	2 nd position				3 rd
	T	C	A	G	
T	Phe	Ser	Tyr	Cys	T
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	STOP	STOP	A
	Leu	Ser	STOP	Trp	G
C	Leu	Pro	His	Arg	T
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	T
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	T
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G


The Genetic Code

Amino acids	
ala	- alanine
arg	- arginine
asn	- asparagine
asp	- aspartic acid
cys	- cysteine
gln	- glutamine
glu	- glutamic acid
gly	- glycine
his	- histidine
ile	- isoleucine
leu	- leucine
lys	- lysine
met	- methionine
phe	- phenylalanine
pro	- proline
ser	- serine
tthr	- threonine
trp	- tryptophan
tyr	- tyrosine
val	- valine

- The four bases can form 64 codons
- 20 amino acids are found from the nature
- Codons have also alternative functions needed to regulate protein synthesis




Protein synthesis

- Protein synthesis is the process of creating protein molecules. In biological systems, it involves amino acid synthesis, transcription, translation, and post-translational events. In amino acid synthesis, there is a set of biochemical processes that produce amino acids from carbon sources like glucose.
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Protein synthesis

- Protein synthesis is the creation of proteins. In biological systems, it is carried out inside the cell. In prokaryotes, it occurs in the cytoplasm. In eukaryotes, it initially occurs in the nucleus to create a transcript (mRNA) of the coding region of the DNA. The transcript leaves the nucleus and reaches the ribosomes for translation into a protein molecule with a specific sequence of amino acids.
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RNA :

- **RNA**, abbreviation of **ribonucleic acid**, complex compound of high molecular weight that functions in cellular protein synthesis and replaces DNA (deoxyribonucleic acid) as a carrier of genetic codes in some viruses. RNA consists of ribose nucleotides (nitrogenous bases appended to a ribose sugar) attached by phosphodiester bonds, forming strands of varying lengths. The nitrogenous bases in RNA are adenine, guanine, cytosine, and uracil, which replaces thymine in DNA.
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Sources of Variation:

Gene Mutation:

- Sudden change in the genetic make up of an individual is called gene mutation. This mutation produces a different phenotype characters. Thus mutation produces variation.



Types of RNA

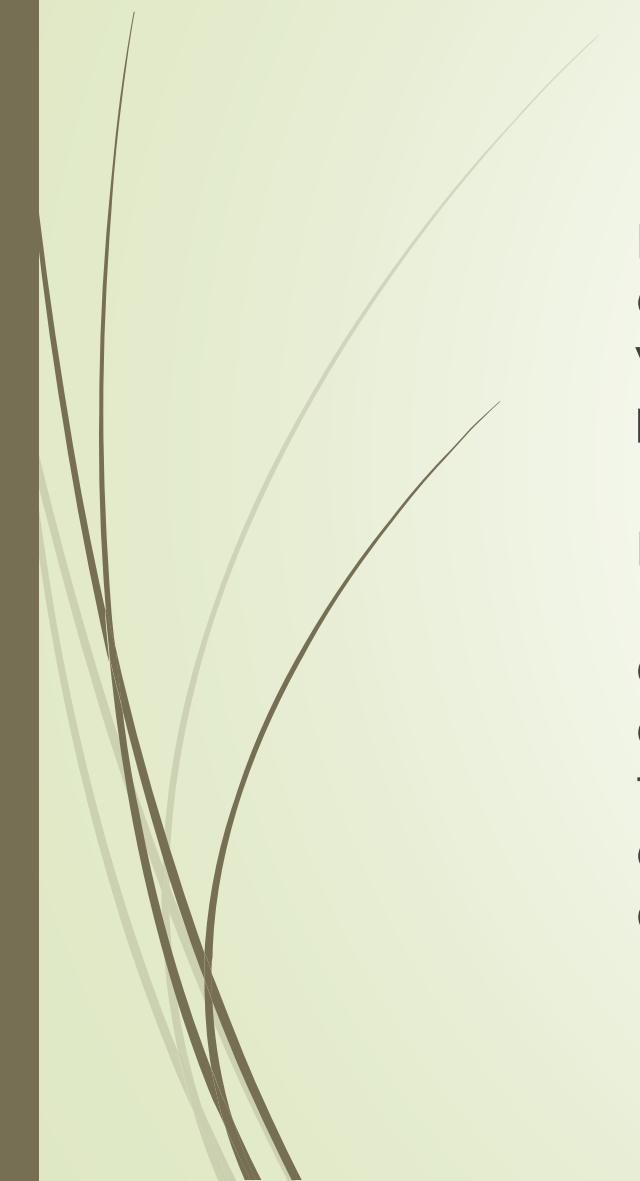
mRNA, **tRNA**, and **rRNA** are the three major types of RNA involved in protein synthesis. The mRNA (or messenger RNA) carries the code for making a protein.

rRNA forms ribosomes, which are essential in protein synthesis.





mRNA:



Messenger RNA or mRNA. So mRNA really is a form of nucleic acid, which helps the human genome which is coded in DNA to be read by the cellular machinery. So we have DNA in our nuclei. And then we have ribosomes and other cellular organelles which translate DNA. But between the DNA code itself, and the machinery that uses DNA to make proteins, there has to be a translator. And mRNA is actually the translated form of DNA that the machinery can recognize and use to assemble amino acids into proteins. So this is really a fundamental link between what we think of as being the code of life and the actual cell being able to construct a living organism.

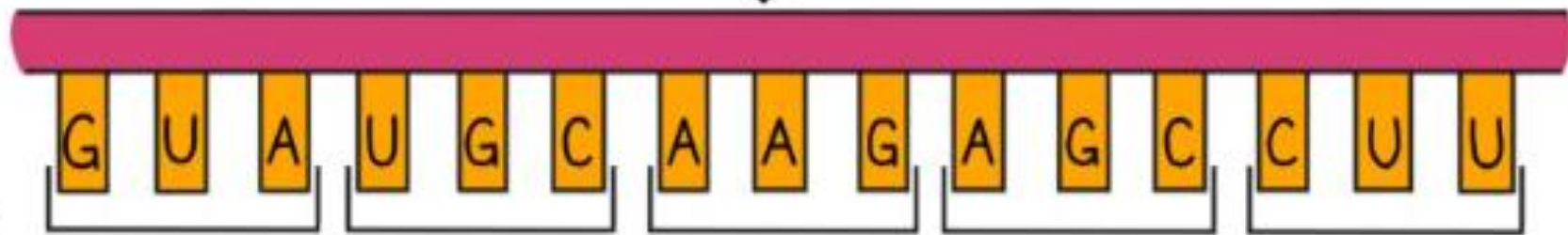
mRNA: The Starting Point of Translation

DNA is transcribed into mRNA.



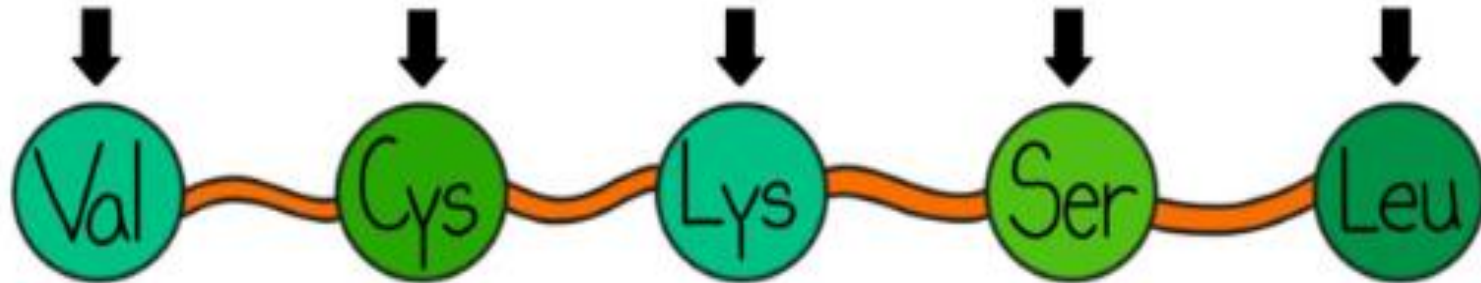
mRNA is translated into amino acids.

Each codon corresponds to one amino acid.




Amino acids form polypeptide chains.

Polypeptide chains fold into proteins.






Transfer RNA :

- Transfer RNA (abbreviated tRNA) is a small RNA molecule that plays a key role in protein synthesis. Transfer RNA serves as a link (or adaptor) between the messenger RNA (mRNA) molecule and the growing chain of amino acids that make up a protein. Each time an amino acid is added to the chain, a specific tRNA pairs with its complementary sequence on the mRNA molecule, ensuring that the appropriate amino acid is inserted into the protein being synthesized.
- 




rRNA

- ribosomal RNA (rRNA), molecule in cells that forms part of the protein-synthesizing organelle known as a ribosome and that is exported to the cytoplasm to help translate the information in messenger RNA (mRNA) into protein. The three major types of RNA that occur in cells are rRNA, mRNA, and transfer RNA (tRNA).
- 




Transcription

- ▶ Transcription and translation are processes a cell uses to make all proteins the body needs to function from information stored in the sequence of bases in DNA. The four bases (C, A, T/U, and G in the figure) are the building blocks of DNA and RNA. During transcription, a piece of DNA that codes for a specific gene is copied into messenger RNA (mRNA) in the nucleus of the cell. The mRNA then carries the genetic information from the DNA to the cytoplasm, where translation occurs.
- 



Translation

- During translation, proteins are made using the information stored in the mRNA sequence. The mRNA attaches to a structure called a ribosome that can read the genetic information. As the mRNA passes through the ribosome, another type of RNA called transfer RNA (tRNA) carries a protein building block called an amino acid to the ribosome. The tRNA carrying the amino acid binds to a matching sequence in the mRNA. As each tRNA binds to the mRNA strand, the amino acid it carried joins with the other amino acids to form a chain of amino acids. Once all of the amino acids coded for in the piece of mRNA have been linked, the completed protein is released from the ribosome.
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Thank you for your
attention!