The Central Dogma of Molecular Biology

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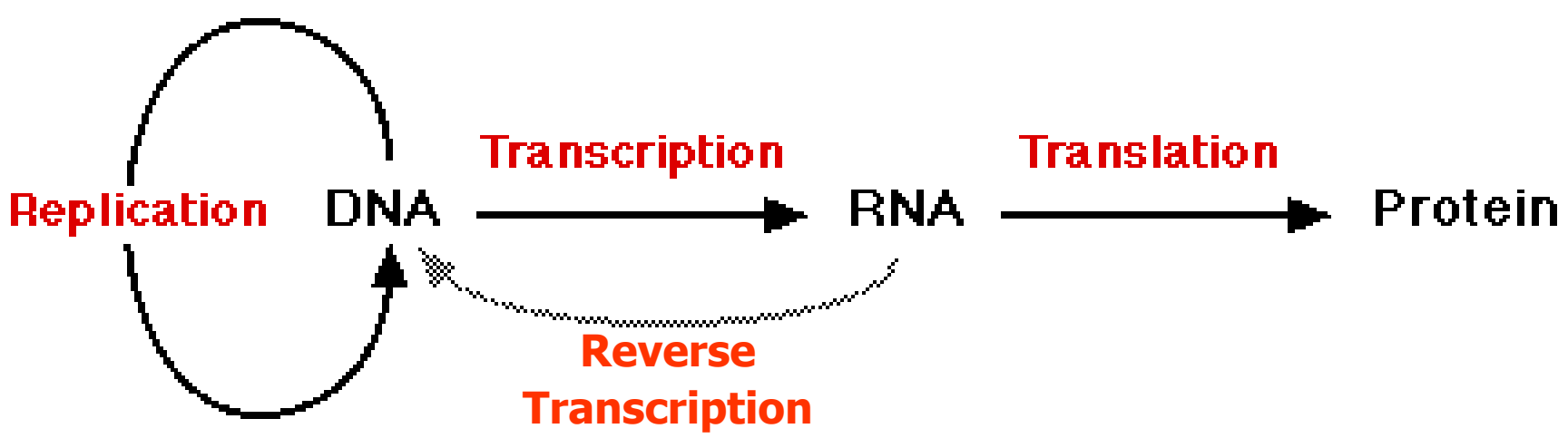
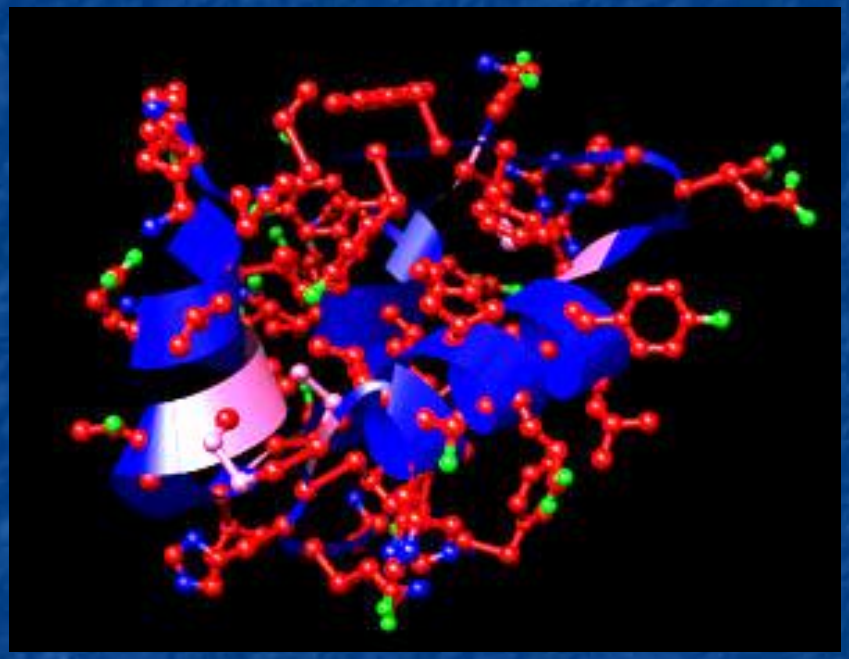


Importance of Proteins

- There are three main kinds:
  - structural - make up most body parts
  - hormone - chemical that controls the body
  - enzyme - catalyst - speeds up chemical reactions



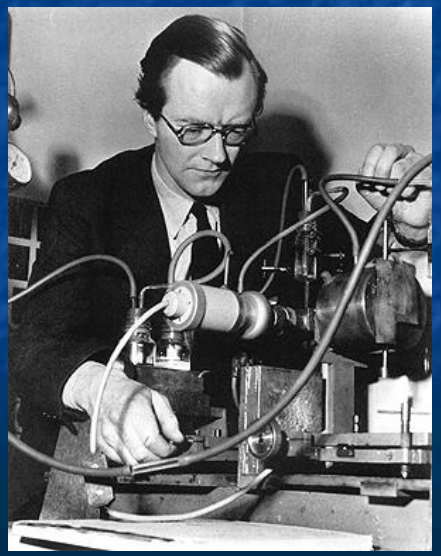
Insulin,
a protein

Importance of Proteins

- Without proteins there would be no life
- All cells make proteins
- Proteins in your body make up your:
  - Hair
  - Nails
  - Muscles
  - Skin
  - Cartilage

Discovery of DNA (deoxyribonucleic acid)

- 1953 Watson, Crick and Wilkins determined the structure of DNA to be a double helix
- They won a Nobel Prize for their work



DNA and RNA Compared

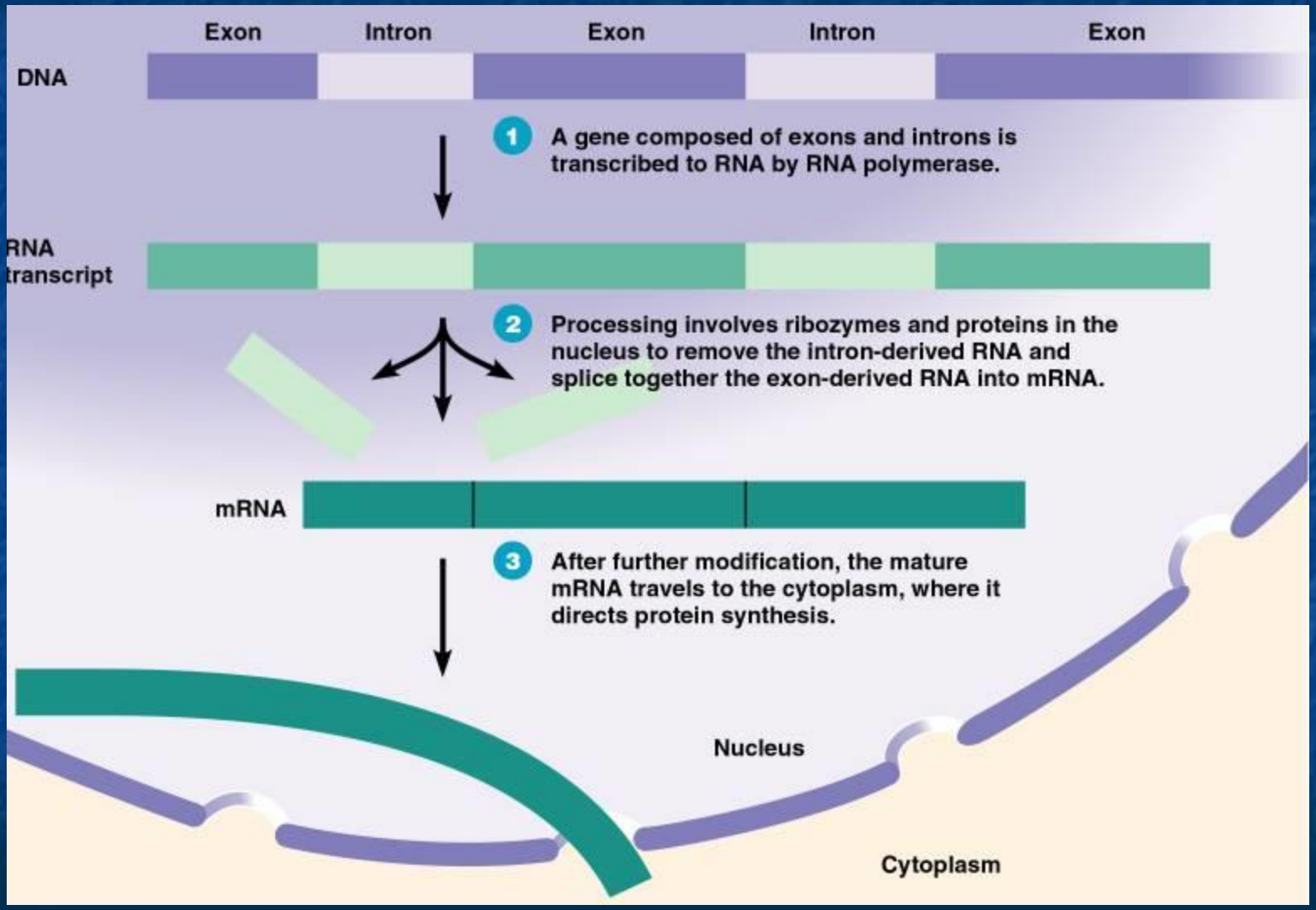
- DNA
  - Found only in nucleus*
  - Double helix
  - Bases = ATGC
  - Sugar = Deoxyribose
- RNA
  - Found in ribosomes, nucleolus
  - Single helix
  - Bases = AUGC (URACIL)
  - Sugar = Ribose

* DNA is also found in a select number of other organelles

Introns and Exons

- Introns – sequences in the DNA that are NOT used to make mRNA or to make a protein
- Exons – sequences in the DNA that are expressed or used to make mRNA and ultimately are used to make a protein

Introns and Exons

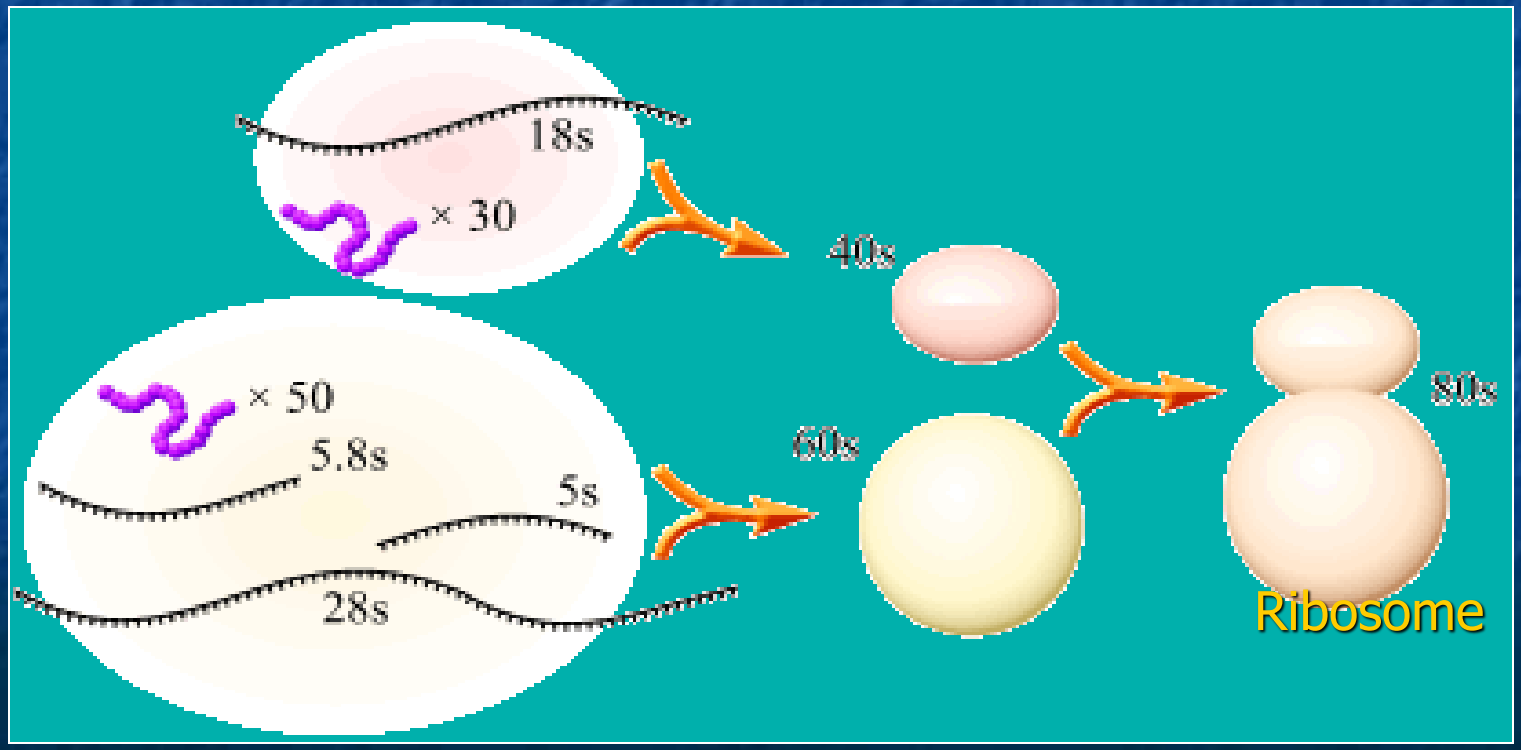


Ribonucleic Acid (RNA)

- Three types of RNA:
  - rRNA = ribosomal RNA - makes up the ribosome
  - mRNA = messenger RNA - is the message from DNA for the construction of the new protein molecule
  - tRNA = transfer RNA - carries amino acids to ribosomes

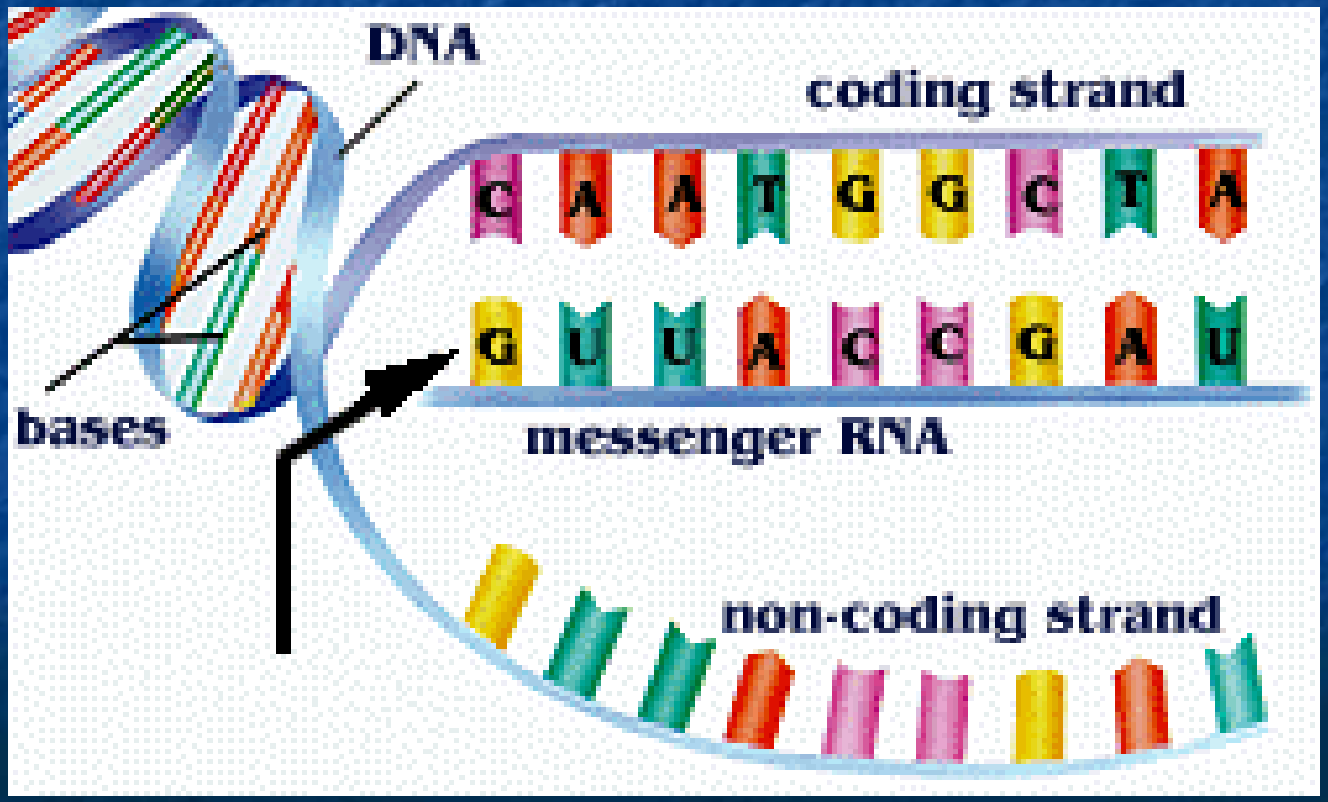
Ribonucleic Acid (RNA)

- Ribosomal RNA is used to make a ribosome
- The ribosome "reads" the mRNA plan for the new protein



Ribonucleic Acid (RNA)

- Messenger RNA

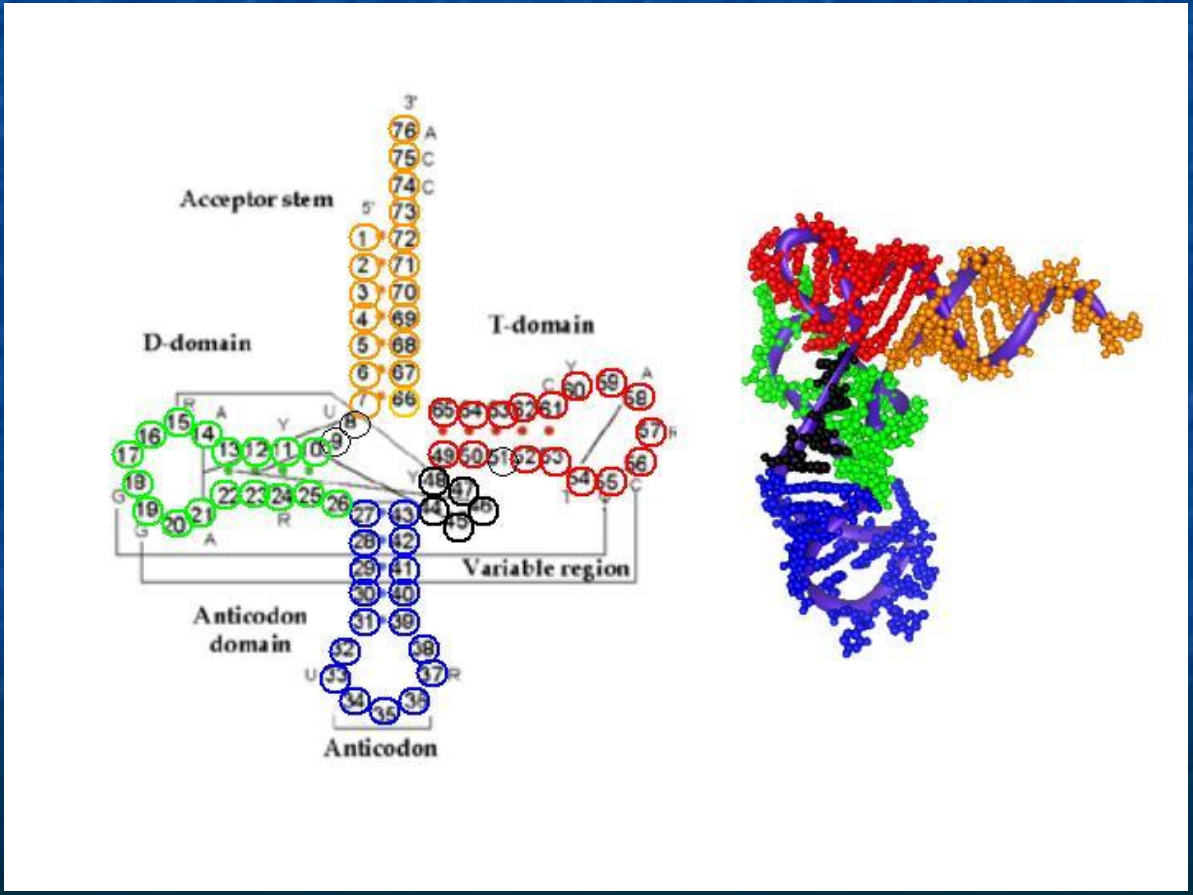


Ribonucleic Acid (RNA)

- Transfer RNA
  - Each tRNA holds one amino acid
  - Every tRNA has a special region called the anti-codon (3 bases)
  - A tRNA anti-codon "mates" with codon on the mRNA molecule
  - There are 61 different tRNA molecules, yet only about 20 amino acids

Ribonucleic Acid (RNA)

- Transfer RNA



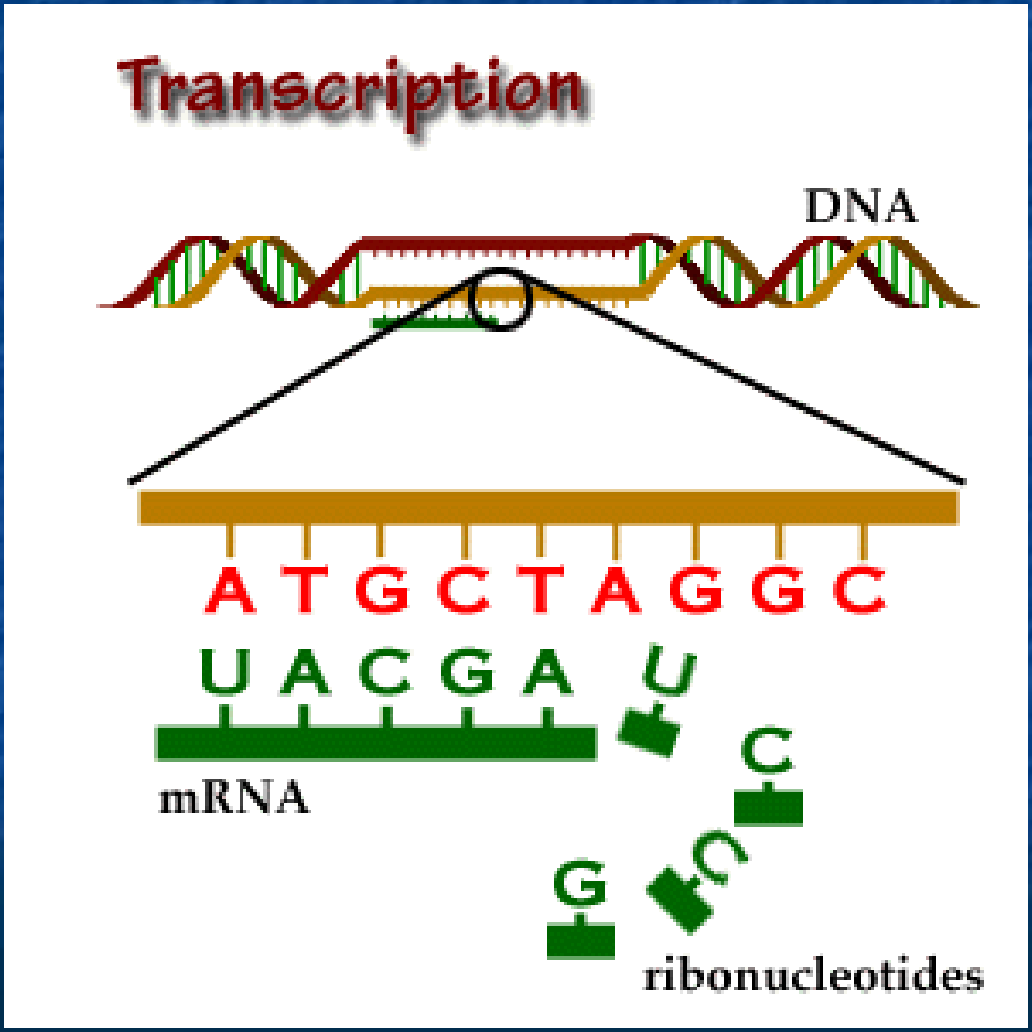
Transcription

- Transcription is the special copying of one side of the DNA molecule (the sense strand) that results in a single strand of RNA
- The original DNA is not changed
- This process can be repeated
- The amount of DNA that is transcribed is usually one gene

Transcription

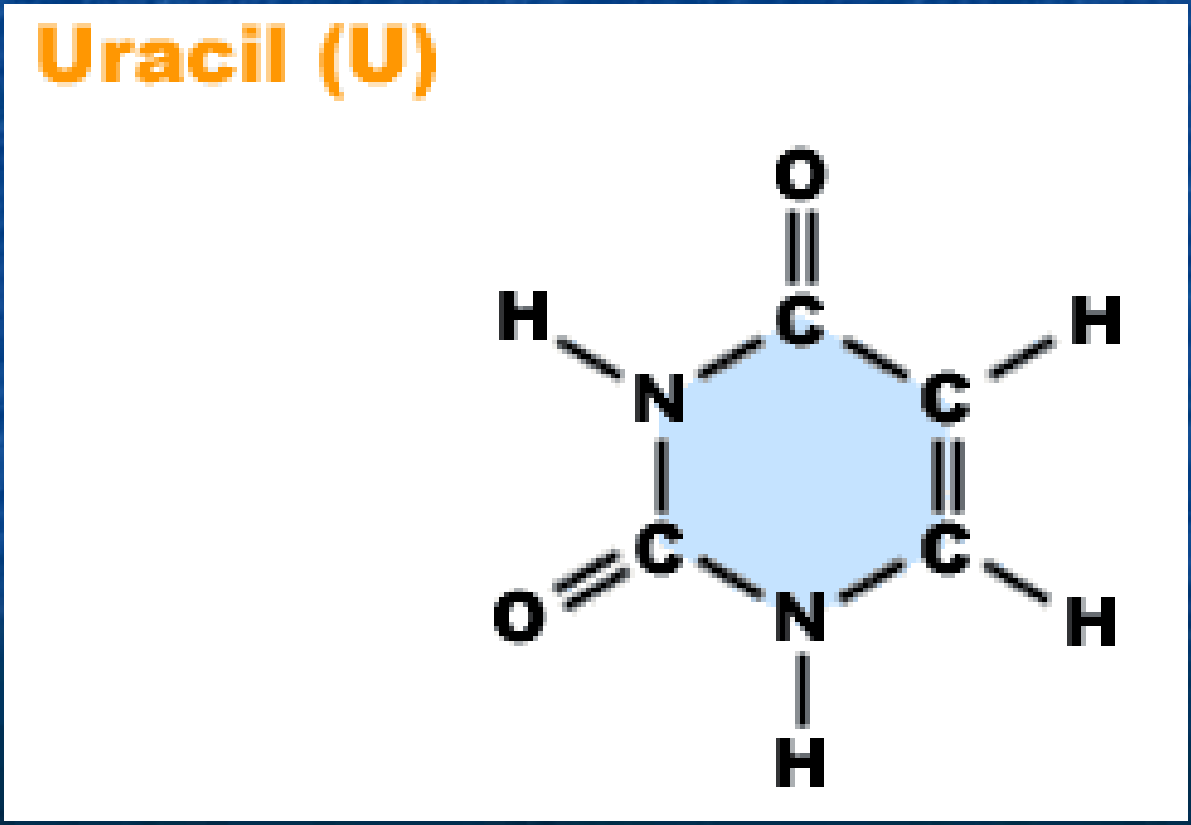
- Process of Transcription
  - DNA is unzipped by an enzyme
  - Only one side fills with RNA nucleotides by the action of another enzyme RNA polymerase
    A-U, G-C (NO THYMINE = T)
  - As the RNA strand separates the DNA strands reattach as before the process started
  - The result is the original DNA plus a new RNA strand

Transcription

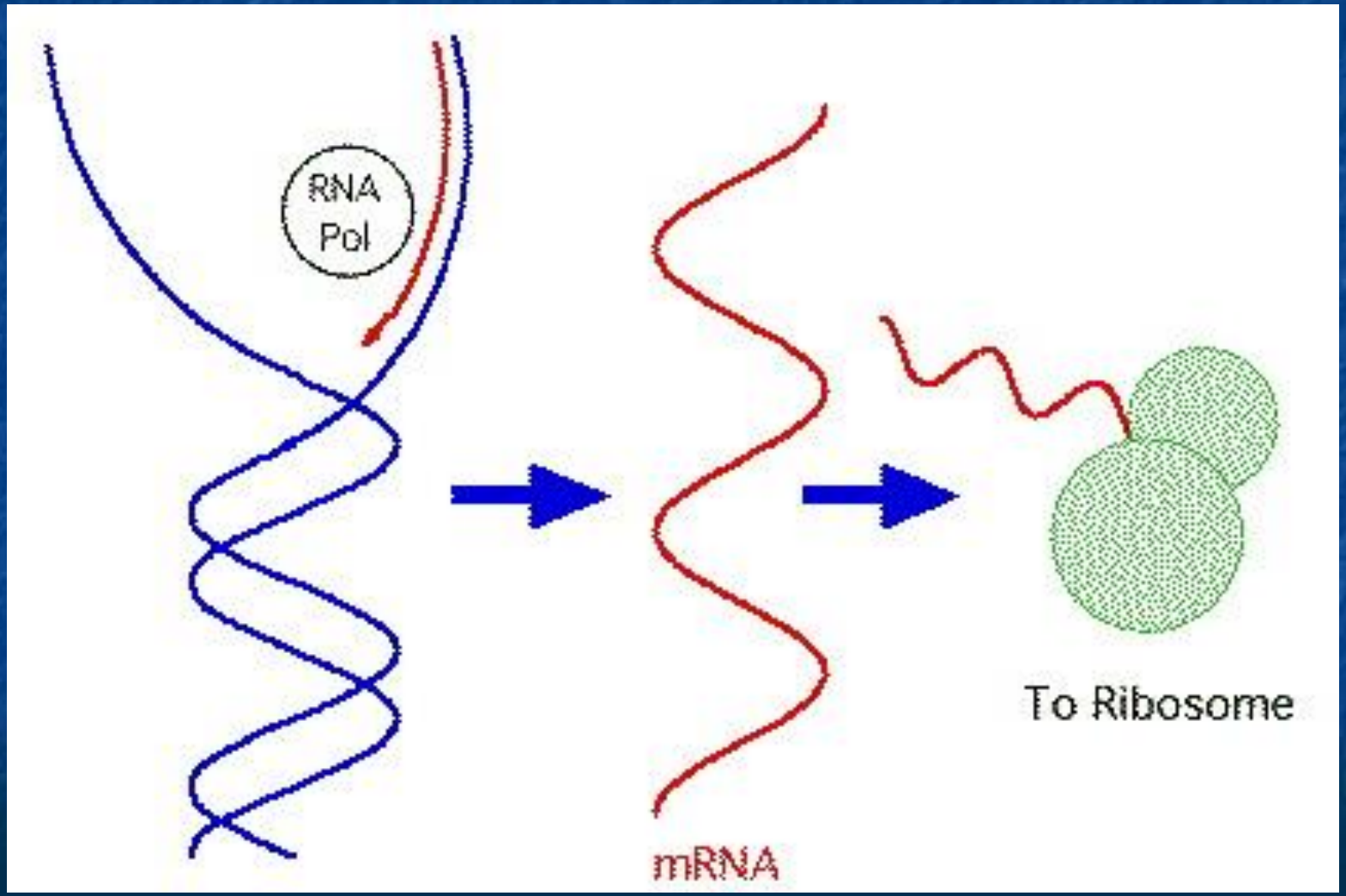


Transcription

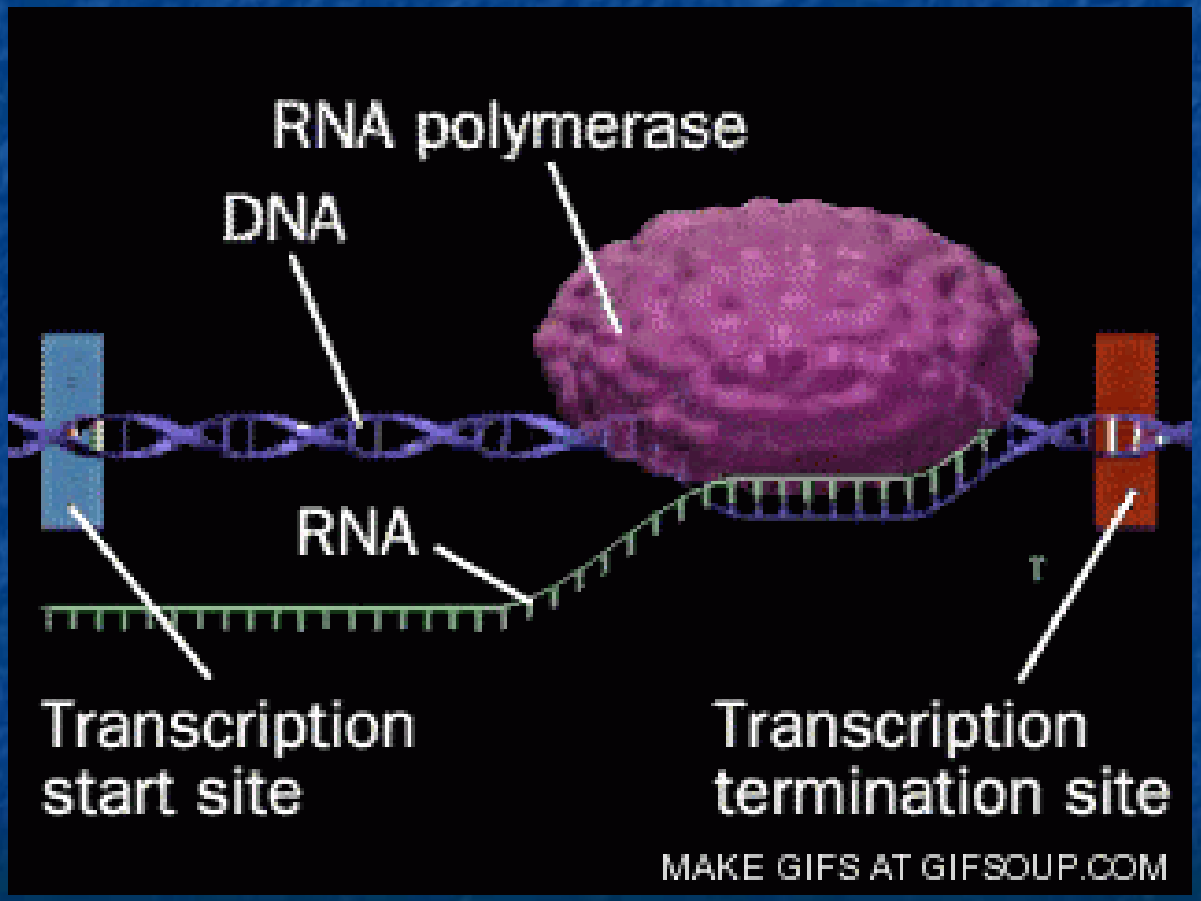
- Uracil – a base only found in RNA



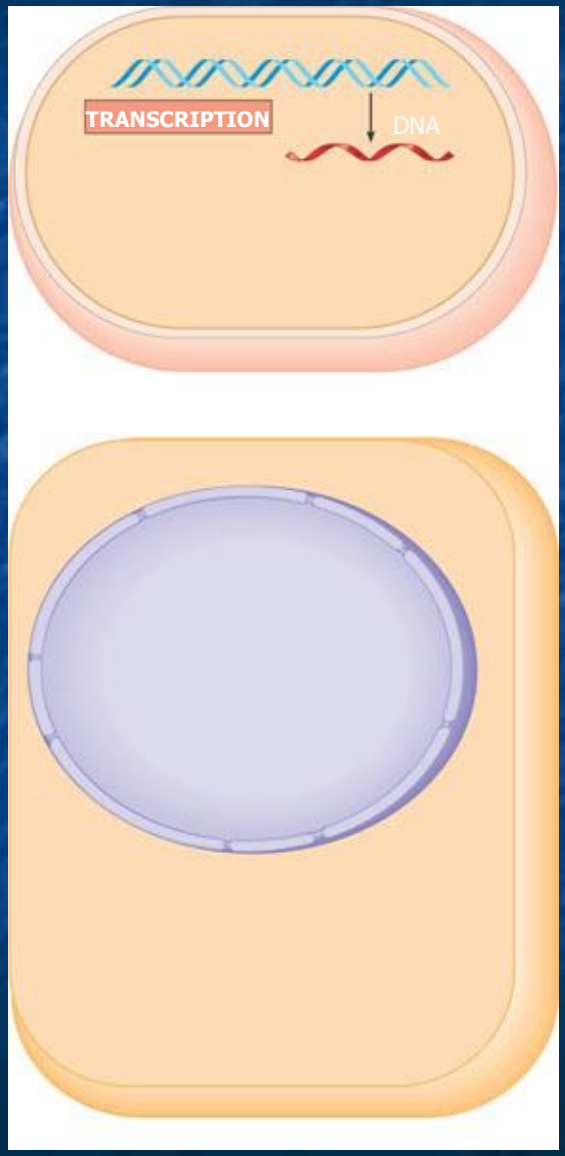
Transcription



Transcription



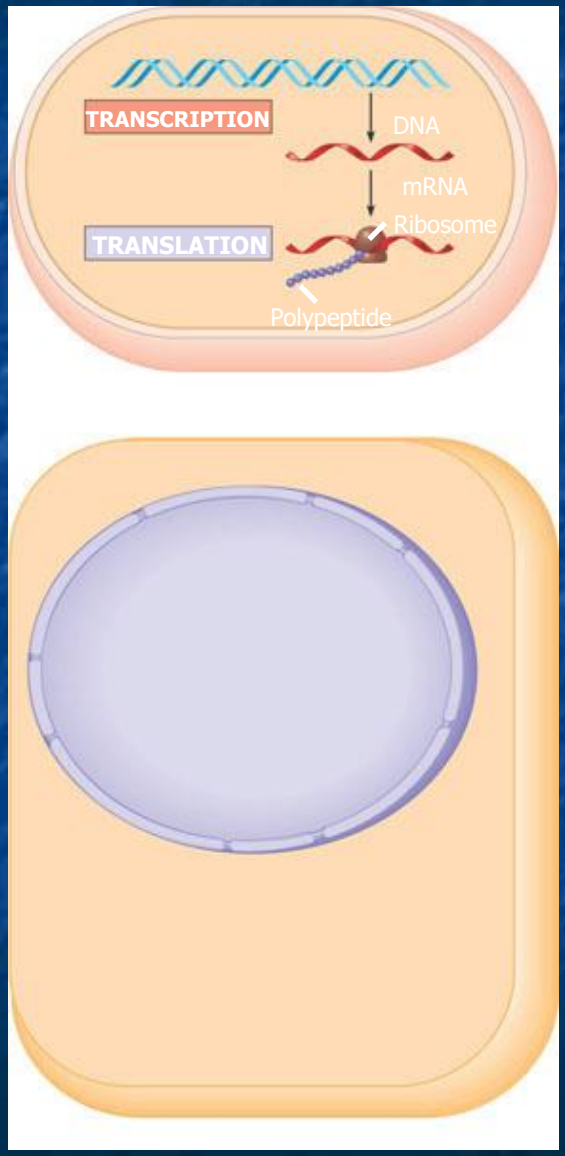
Overview: the roles of transcription and translation in the flow of genetic information (layer 1)



Prokaryotic cell. In a cell lacking a nucleus, mRNA produced by transcription is immediately translated without additional processing.

Eukaryotic cell. The nucleus provides a separate compartment for transcription. The original RNA transcript, called pre-mRNA, is processed in various ways before leaving the nucleus as mRNA.

Overview: the roles of transcription and translation in the flow of genetic information (layer 2)



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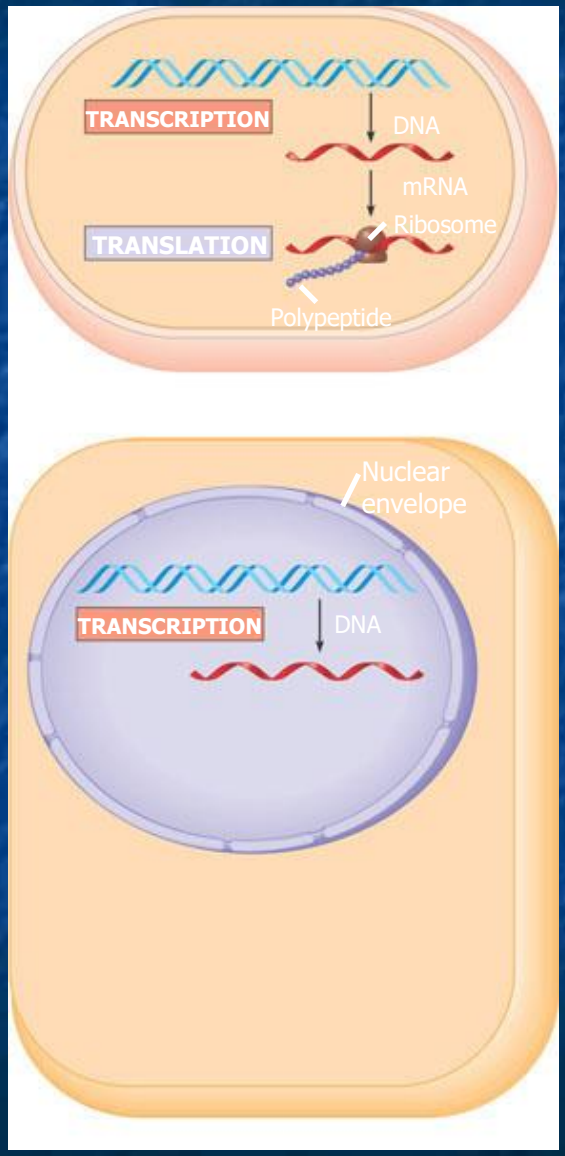
Overview: the roles of transcription and translation in the flow of genetic information (layer 3)



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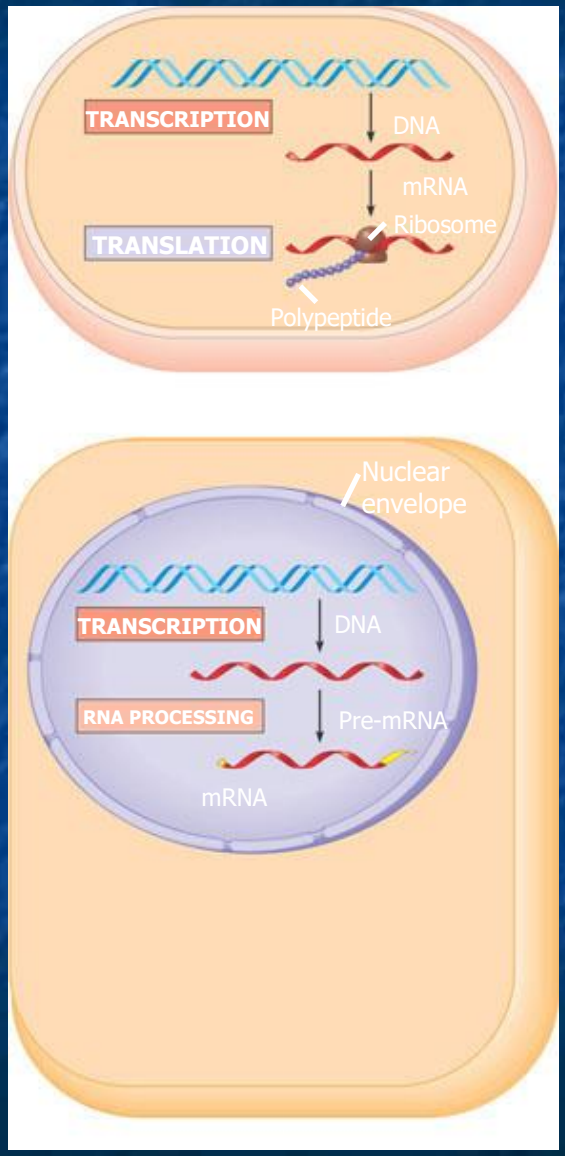
Overview: the roles of transcription and translation in the flow of genetic information (layer 4)



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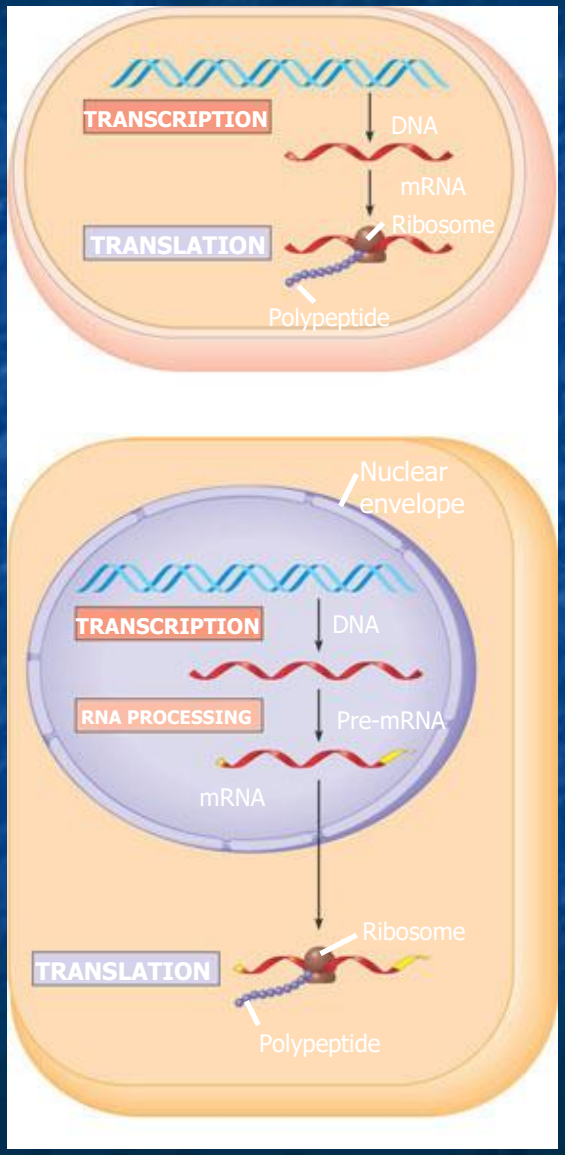
Overview: the roles of transcription and translation in the flow of genetic information (layer 5)



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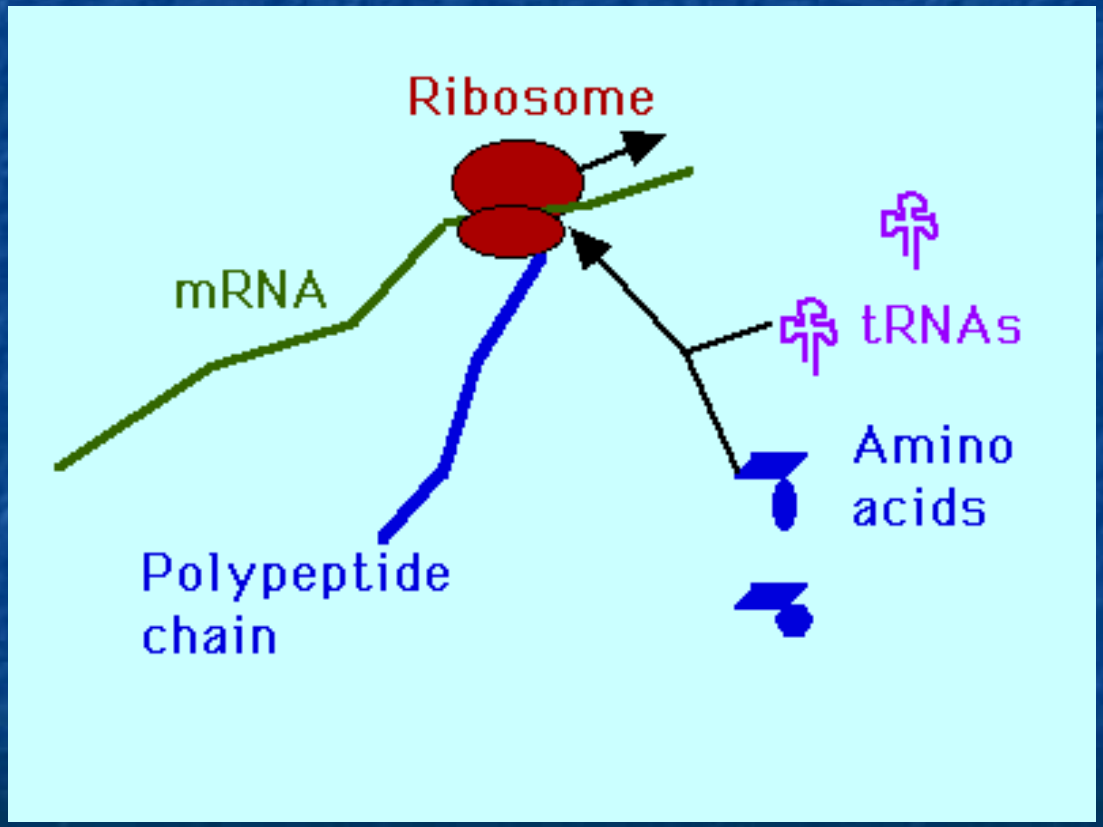
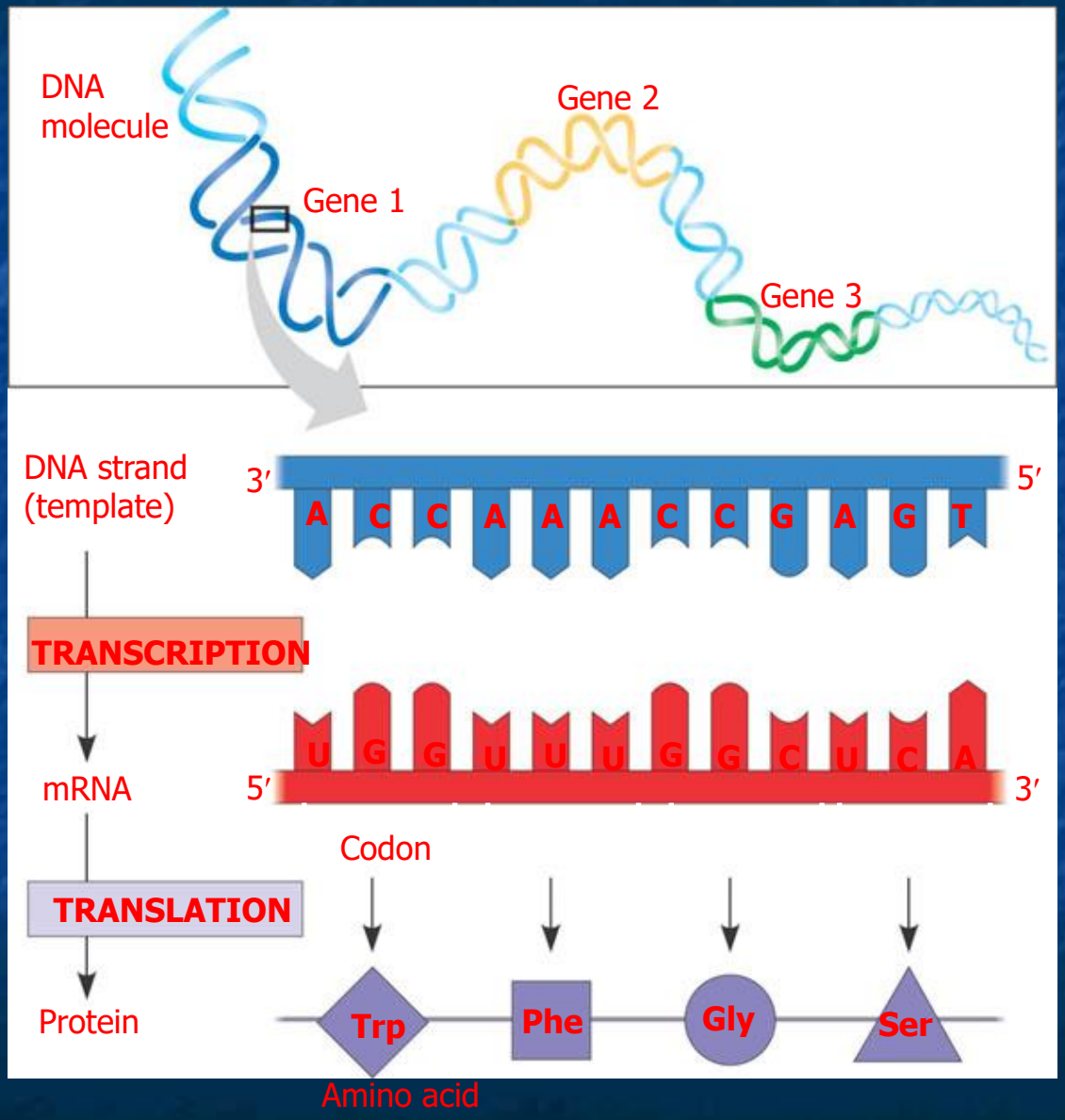
Eukaryotic cell. The nucleus provides a separate compartment for transcription. The original RNA transcript, called pre-mRNA, is processed in various ways before leaving the nucleus as mRNA.

Translation

- Translation is the reading of the RNA code to make proteins or polypeptides
- Translation is often called protein synthesis

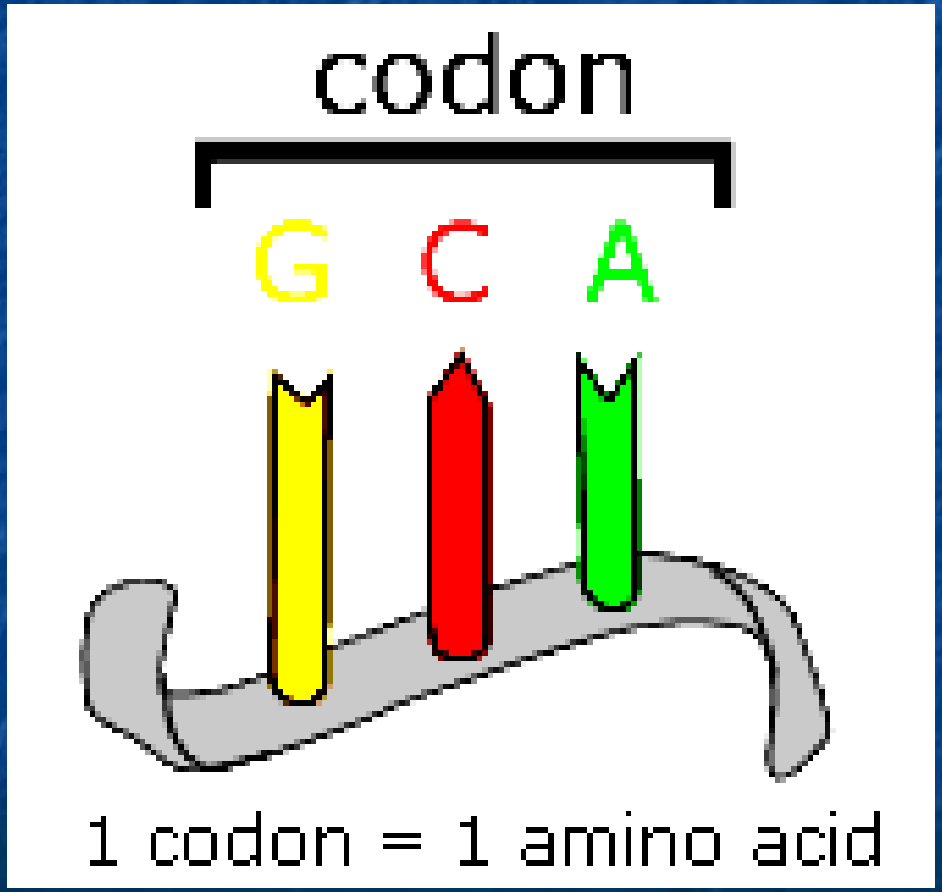


The triplet code

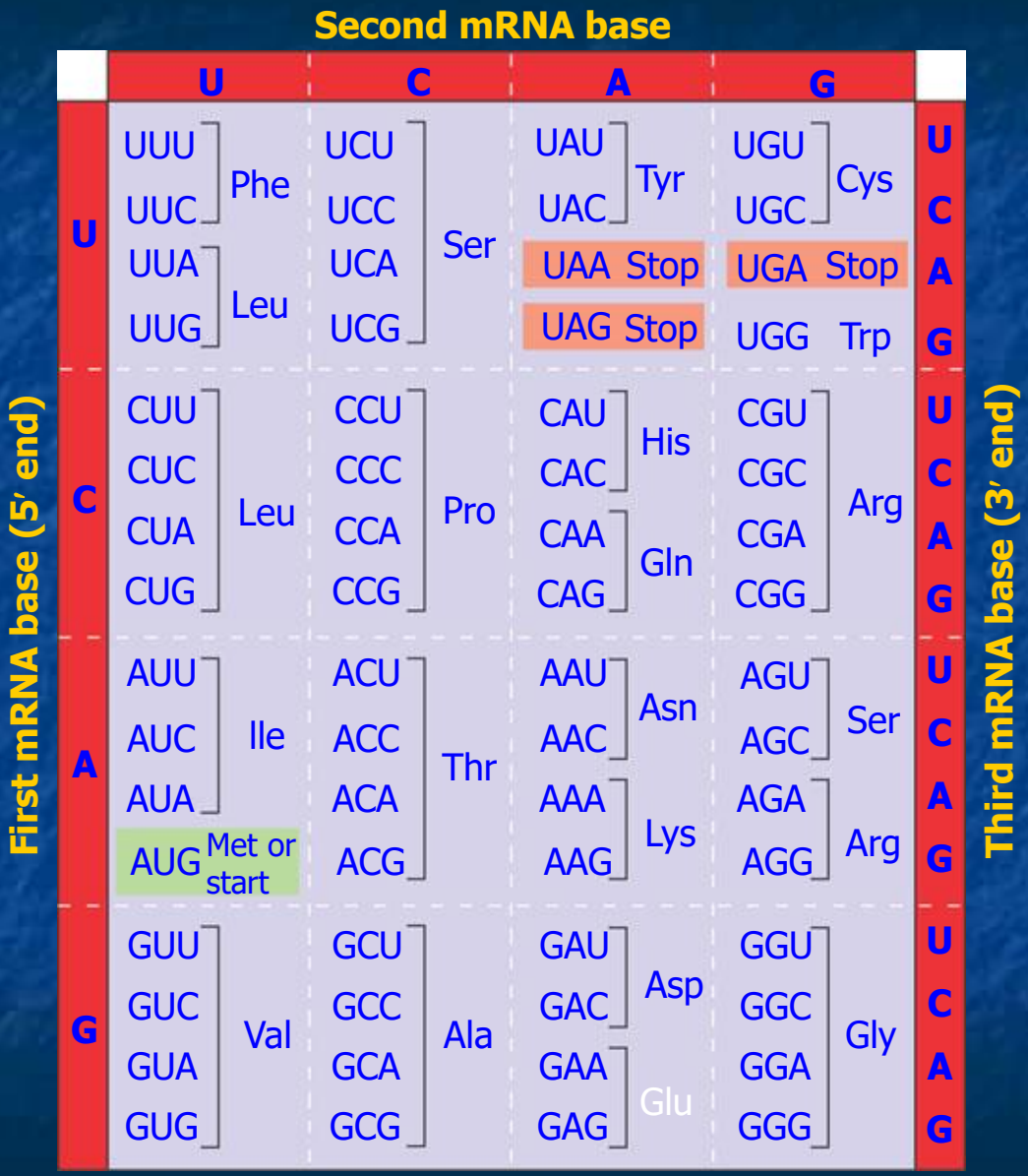


Translation

- Triplet codons - groups of three bases on mRNA that code for specific amino acids



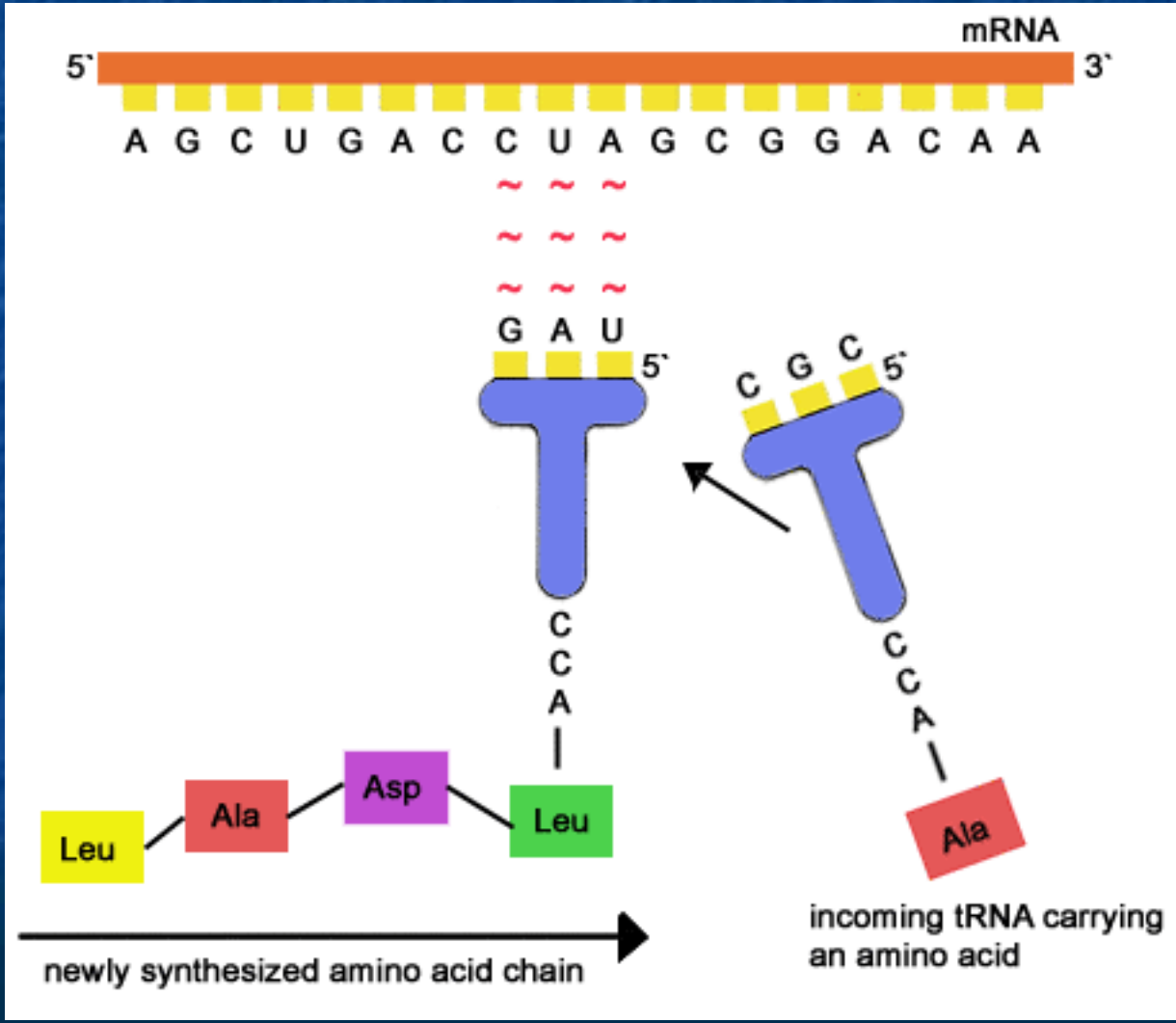
The dictionary of the genetic code



Translation

- mRNA is the message (the plan for the protein)
- rRNA "reads" the mRNA (the ribosome)
- tRNA molecules carry amino acids to the ribosome for assembly into proteins
- The ribosome allows only the correct tRNA to add its amino acid – others are rejected

Translation



Translation