What happens after DNA Replication???

Transcription, translation, gene expression/protein synthesis!!!!

Protein Synthesis/Gene Expression

- Why do we need to make proteins?
  - To build parts for our body as instructed by DNA.
- What are proteins made of?
  - Amino Acids linked together.
- How does our body know how to link them together?
  - It reads the DNA blueprint.

Does DNA make proteins all by itself?

- NO!!!!!!!!!!!!!!!!!!!!
  - The instructions are transferred from a gene (segment of DNA) to an RNA molecule.
  - This process is called transcription.
  - WAIT!!!! What is RNA???

RNA (Ribonucleic acid)

- Type of nucleic acid (made of nucleotides).
- Single stranded.
- Has a sugar called ribose (hence the name).
- Contains Nitrogen bases cytosine, guanine, adenine, and uracil.
  - ***This means that A pairs with U, but T still pairs with A.
- 3 types or RNA: mRNA, tRNA, rRNA.
- Does not stay in the nucleus, carries the code to ribosomes in the cytoplasm.

	DNA	RNA
Has Ribose		
Has Deoxyribose		
Has adenine		
Has guanine		
Has uracil		
Has thymine		
Has cytosine		
Double strand		
Single strand		
Stays in nucleus		
Leaves nucleus		

	DNA	RNA
Has Ribose		X
Has Deoxyribose	X	
Has adenine	X	X
Has guanine	X	X
Has uracil		X
Has thymine	X	
Has cytosine	X	X
Double strand	X	
Single strand		X
Stays in nucleus	X	
Leaves nucleus		X

Transcription and Translation

- Transcription: The process by which genetic information is copied from DNA to RNA.
- Translation: information from mRNA is used to make proteins.
- Long story short: DNA -> goes through replication -> transcription -> translation -> proteins are made (gene expression / protein synthesis.

Steps of Transcription

- RNA polymerase: the primary transcription enzyme
  - RNA Polymerase binds to promoters causing the DNA to unwind and separate.
  - Then it attaches to the first DNA nucleotide of the template DNA chain.
  - Begins adding complementary RNA (mRNA) nucleotides to the newly formed RNA molecule.
  - At the termination signal, RNA polymerase releases DNA and RNA.
  - From this we get 3 different RNA molecules that are all involved in protein synthesis.

Three Types of RNA

- Messenger RNA (mRNA): copies the DNA of a gene in a process called transcription.
- Ribosomal RNA (rRNA): takes the mRNA code and translates it into a protein in a process called translation.
- Transfer RNA (tRNA): brings one specific amino acid to the rRNA.

Codons and Anticodons

- Codon: the basic unit of the genetic code: a sequence of 3 adjacent nucleotides in DNA or mRNA that encodes an amino acid
- Anticodon: 3 nucleotide sequence in a tRNA molecule that is complementary to, and base pairs with a specific codon in mRNA

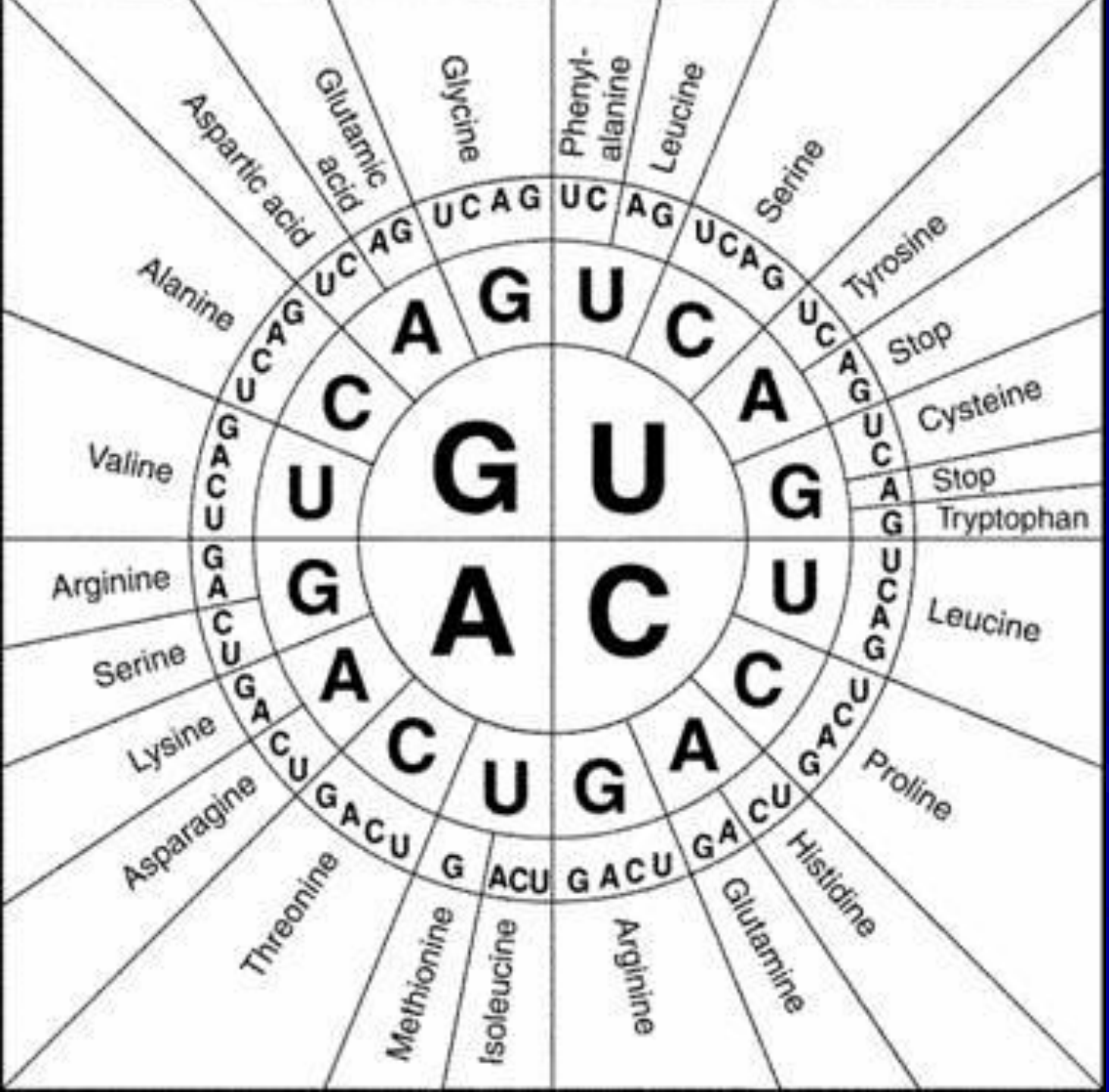
The Genetic Code

- Genetic code: a sequence of bases in DNA or RNA that translates into the sequence of amino acids in a protein
- How many amino acids are there?
  - 20
- How many bases are needed to express one amino acid?
  - Three

The Genetic Code

First Base	Second Base				Third Base
	U	C	A	G	
U	phenylanine	serine	tyrosine	cysteine	U
	phenylanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	(start) methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

Start at the letter on the left, then move to the top, and then the letter on the right to determine the correct amino acid.

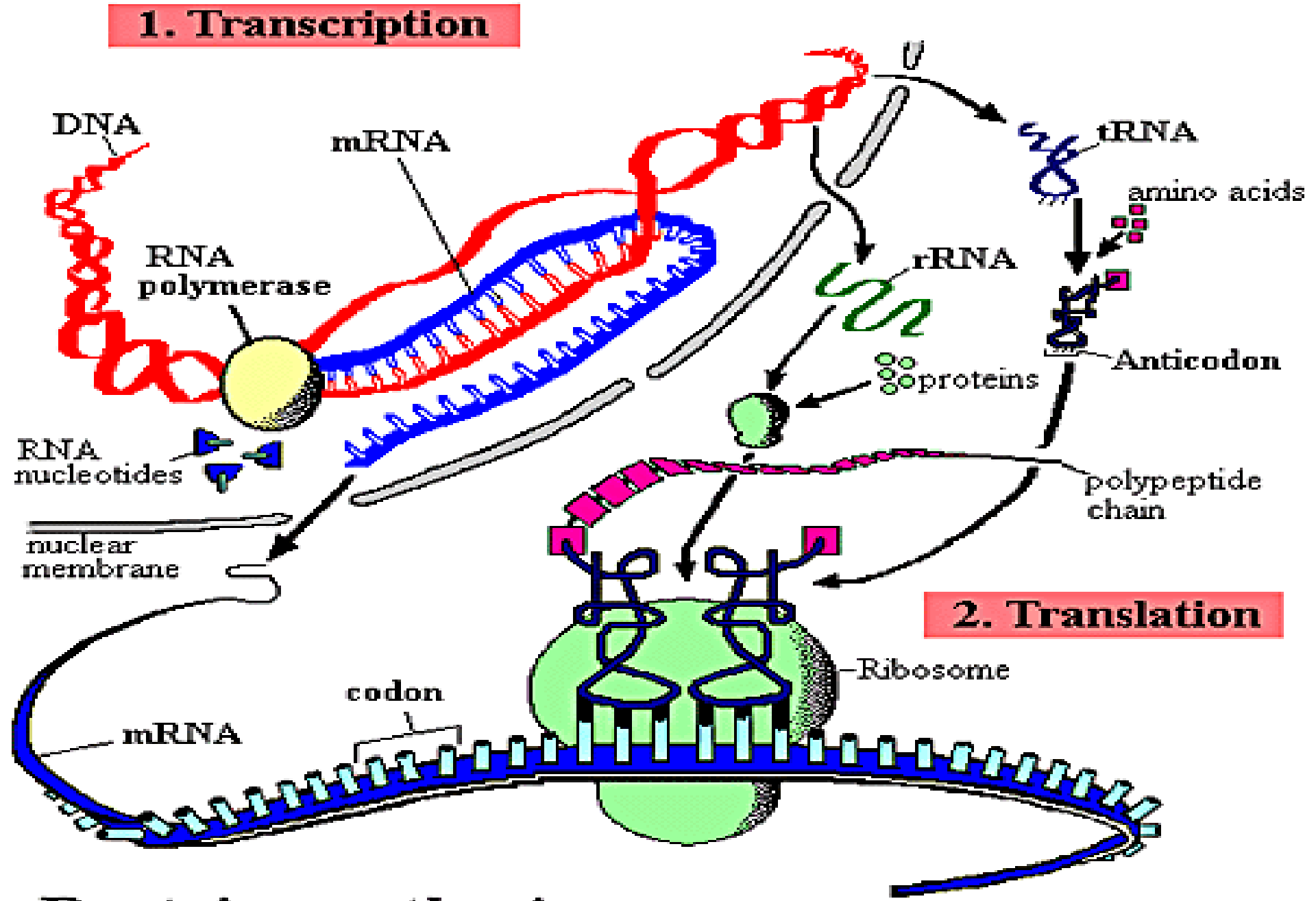


Start at the big letter in the center and then work your way to the outside to determine the correct amino acid.

3 Stages of Translation

- Initiation
  - Ribosome attaches at a specific site on the mRNA (the start codon, AUG)
- Elongation
  - Peptide bonds join each amino acid
- Termination
  - When a stop codon is reached, the protein is released

***Then it starts on the next one!!!



Protein synthesis

Hints

- Starting at DNA and working all the way through …
  - DNA to complementary DNA
    - A and T pair, C and G pair.
  - DNA to mRNA:
    - C and G pair
    - A in DNA pairs with a U
    - T in DNA pairs with A.
  - mRNA to tRNA:
    - A and U pair, C and G pair.
  - mRNA to amino acids: 3 letters at a time, use codon chart.

Let’s go through the whole process now!

- On the bottom of your page, on the left hand side write the following words:
  - DNA
  - Complementary DNA
  - mRNA
  - tRNA
  - Amino acid

Let's fill each section in:

- DNA: TACAACGGTCTCAGCACGATT
- What is the complementary DNA?
  - ATGTTGCCGAGAGTCGTGCTAA
- What is the mRNA? (remember, you want to look off of your original strand, not the complementary/daughter strand, and this time A goes to U)
  - AUGUUGCCAGAGUCGUGCUAA
- What is the tRNA?
  - UACAACGGUCUCAGCACGAUU

Continued…

- What are the amino acids? (Use Page 209 in the book, and remember to start listing them at the start codon. You are deciphering the code by looking at the mRNA.)
  - Methionine, leucine, proline, glutamic acid, serine, cysteine, STOP