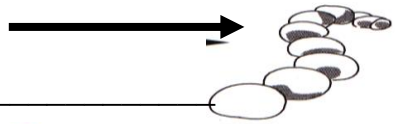
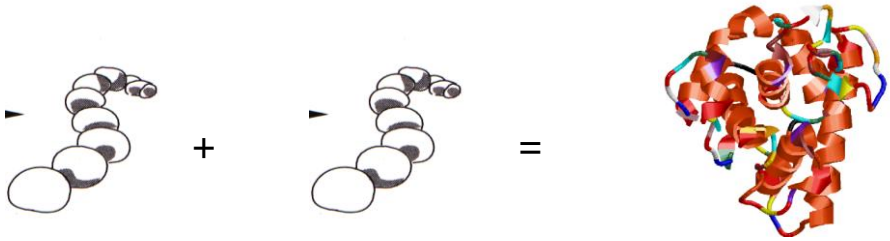
Transcription and Translation Notes (TNT)

But first, a little bit of review…

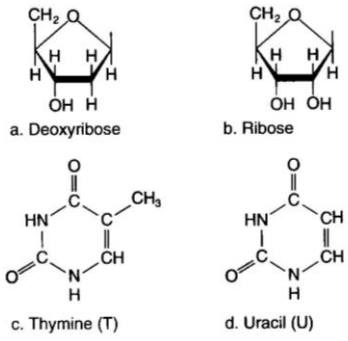
- You and your cells are mostly made of _____
- Proteins are made of _____ (20 different kinds)
- AA + AA + AA + AA = _____ 
- Polypeptde + Polypeptide = _____



- Different _____ = different _____ = different _____

Differences between DNA and RNA

- **D**eoxyribo**N**ucleic **A**cid
- _____
- 5-C sugar is _____
- Nitrogen bases:
  - _____
  - _____
  - _____
  - _____

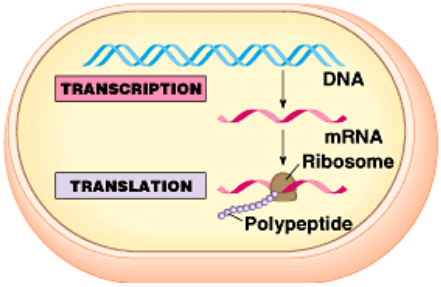


- **R**ibo**N**ucleic **A**cid
- _____
- 5-C sugar is _____
- Nitrogen bases:
  - _____
  - _____
  - _____
  - _____

Protein Production: The BIG PICTURE

Gene = _____ of DNA code with instructions for making a _____

Each gene has a code for making 1 specific _____



Part I: Transcription = make a _____ (or transcript) of the DNA gene code

1) The DNA gene code is copied into _____

   A) DNA Helicase enzymes open the DNA exposing the _____ and _____ strands

   B) RNA Polymerase binds to the _____ DNA at the _____ site in front of the gene code

   C) Many transcription factors bind to Polymerase causing it to play "_____"

   - _____ = GO ….._____ = STOP

   D) Once activated, Polymerase reads the _____ strand and builds a complimentary mRNA strand by following the _____ rules

   E) The mRNA continues to grow until the polymerase finds a _____ sequence on the coding strand

   F) The completed primary mRNA is _____ from the DNA for processing

2) The _____ mRNA code is **processed** into _____ mRNA before leaving the nucleus

   A) 5' end has a methyl-guanine (mG) _____ added

   - helps the mRNA bind to a _____ with its ____ (ribosome recognition sequence)
   - helps protect the mRNA from "hungry" RNA eating _____ enzymes

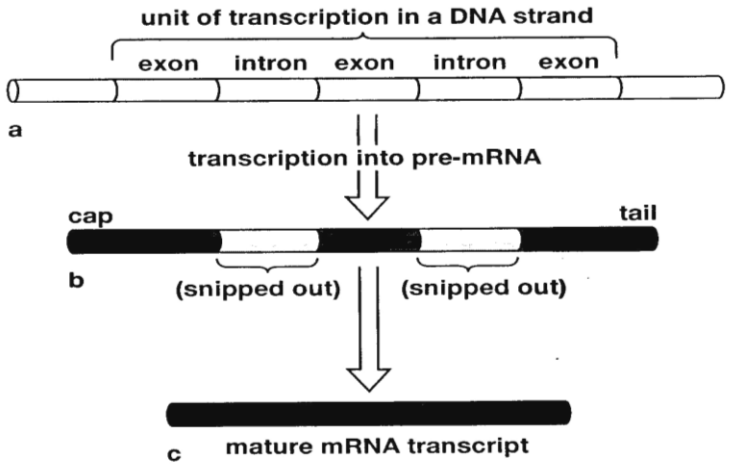
   B) 3' end has addition of 50 – 200 adenines = _____

   - helps _____ the mRNA from "hungry" RNA eating ribonuclease enzymes

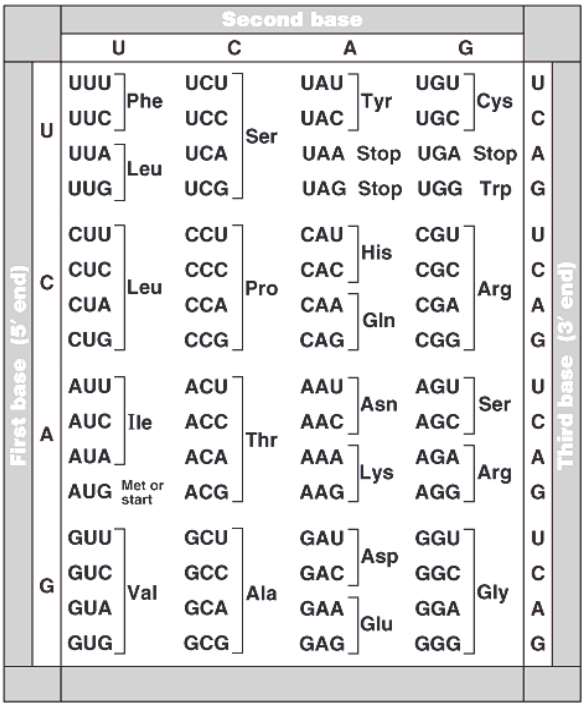
   C) Splice out and remove any "junk" RNA letters that do not code for _____

   - _____ ("junk" letters IN the way of the code) are spliced out
     - Alternative intron splicing may create a _____
     - Others speculate introns act as _____ factors that turn ON / OFF other genes
   - _____ ("good" code letters EXpressed) are linked to make a mature mRNA

3) The mature mRNA carries the gene code from the nucleus through a _____ to a ribosome in the cytoplasm



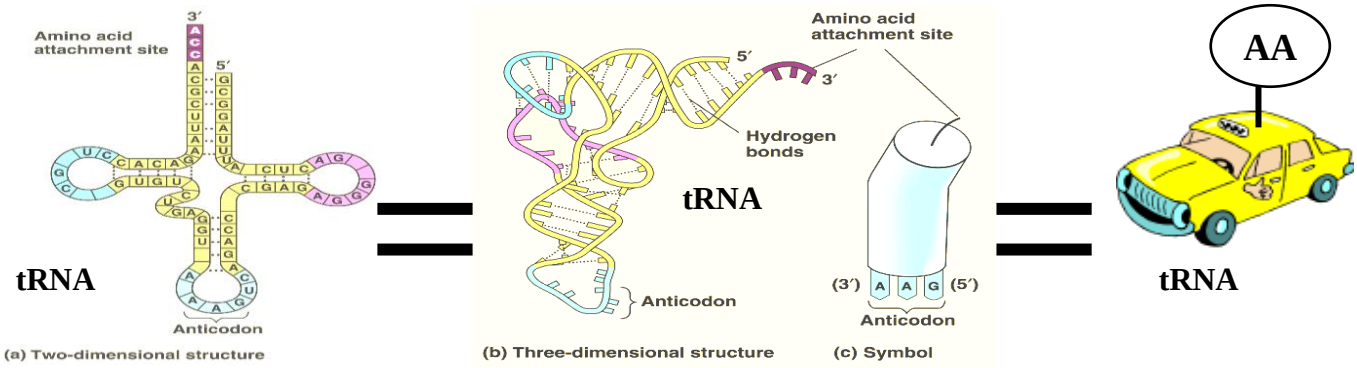
Codons in mRNA					
First base	Second base U	Second base C	Second base A	Second base G	Third base
U	UUU, UUC Phenylalanine; UUA, UUG Leucine	UCU, UCC, UCA, UCG Serine	UAU, UAC Tyrosine; UAA, UAG Stop	UGU, UGC Cysteine; UGA – Stop; UGG – Tryptophan	U C A G
C	CUU, CUC, CUA, CUG Leucine	CCU, CCC, CCA, CCG Proline	CAU, CAC Histidine; CAA, CAG Glutamine	CGU, CGC, CGA, CGG Arginine	U C A G
A	AUU, AUC, AUA Isoleucine; AUG – Start	ACU, ACC, ACA, ACG Threonine	AAU, AAC Asparagine; AAA, AAG Lysine	AGU, AGC Serine; AGA, AGG Arginine	U C A G
G	GUU, GUC, GUA, GUG Valine	GCU, GCC, GCA, GCG Alanine	GAU, GAC Aspartic Acid; GAA, GAG Glutamic Acid	GGU, GGC, GGA, GGG Glycine	U C A G



Part II: Translation: convert from mRNA language into _____ language

- First the mRNA binds to a _____ in the cytoplasm or on the RER using its _____in the CAP
- The mRNA is read ___letters at a time (_____)
- Each CODON represents one specific _____

- There are ___ possible 3 letter combinations BUT only ___ amino acids….
  SO, some Codons code for more than one amino acid
- Once the mRNA reaches the _____, and the _____ are read,
- Transfer RNA (tRNA) "_____" service delivers the correct _____ to the ribosome



- tRNA binds to the mRNA CODON with its matching 3-letter _____
- tRNA first Attaches to the ribosome at the ____site (A = _____)
- The ribosome _____ down the mRNA to read the next codon
- This also causes the tRNA to slide from the A site to the ___ site (P = _____ the growing polypeptide)

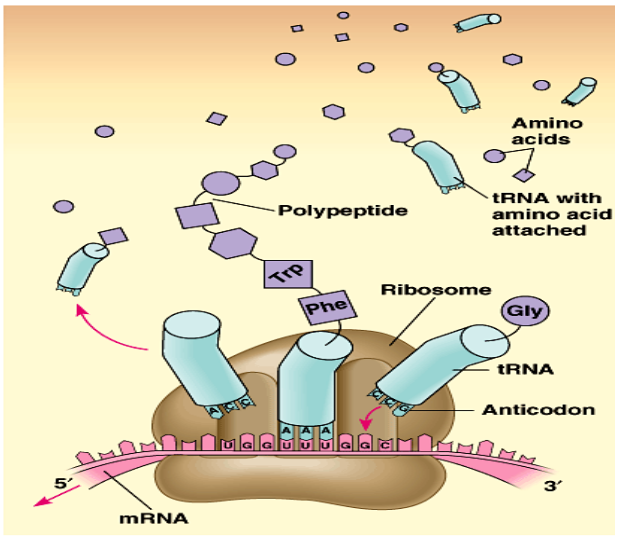
UAC CCA AGU GGA ←

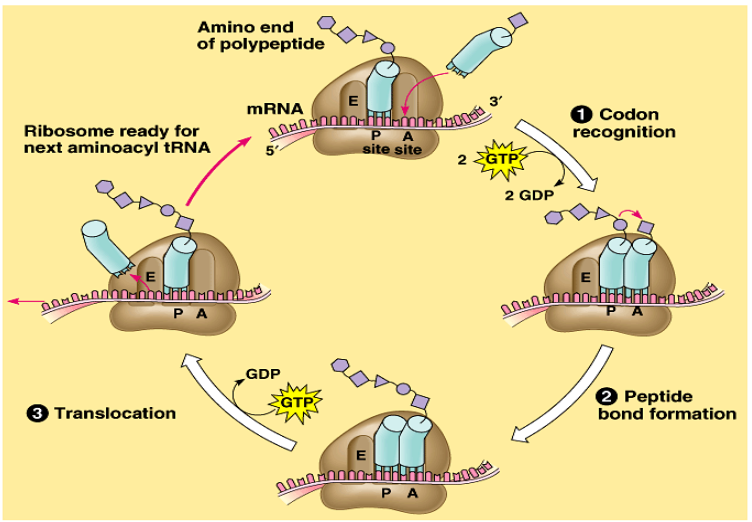
CCU ←

 ←

Gly ←

- tRNA releases its ____"passenger" which bonds to other AA to make a _____
- The _____ tRNA leaves the ribosome to pick up other ___ passengers
- The protein is completed when a _____ codon is read





Ribosome

P A

CCG UUA CCU UAC GCA CGA GAC CCG

AUG

GGA

Tyr

CGU

_____?

Leu

Ala

GCU

Pro

_____

➢ _____= changing the letter codes in a gene

A. Mutation _____: DNA blueprints can acquire mutations in various ways

1. During DNA _____:
   - ➢ Base pairing mistakes can happen but most are _____

2. Exposure to powerful _____ :
   _____ smoke, smokeless tobacco,
   exhaust from burning petroleum fuels & coal, pesticides, herbicides, alcohol, gasoline, sawdust from CCA wood, paints, mineral spirits and oils, asbestos

3. Exposure to powerful _____:
   _____ (nuclear fuel and bombs),
   _____ (at hospitals and dental offices)
   _____ (from sunlight and tanning beds)

B. Mutation _____:

		original gene		**mutated** gene
1. _____ = add 1+ letters	Ex:	TAGACAT	→	TAGACCAT
2. _____ = lose 1+ letters	Ex:	TAGACAT	→	TGACAT
3. _____ = switch 1+ letters	Ex.	TAGACAT	→	TAGAGAT

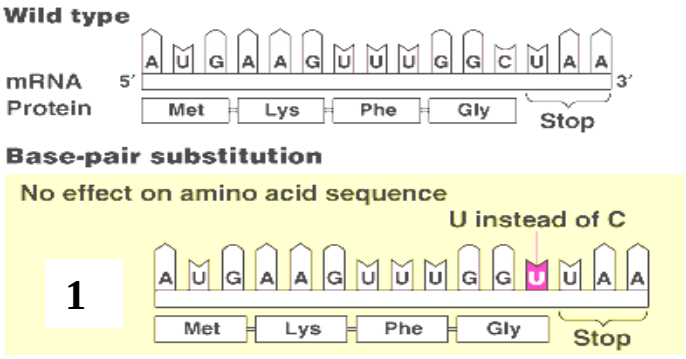
C. Mutation _____: Was the protein produced any different shape than the original?

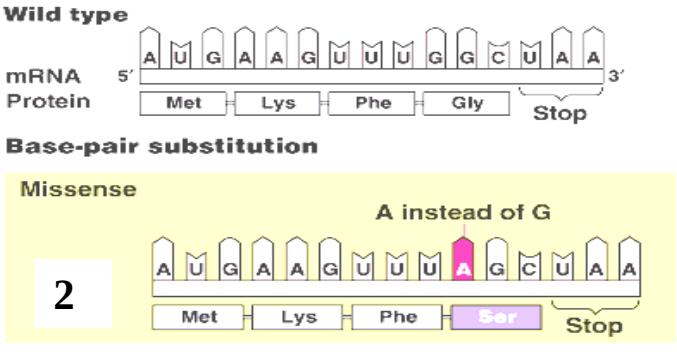
1. _____ effect = protein remains the same → _____ shape
2. _____ effect = protein has 1+ different AA → _____ shape change
3. _____ effect = protein has many different AA → _____ shape change

➢ Mutation Effects: None or Small or BIG?

1) Silent mutation = changes a CODON but still specifies the _____ AA = _____Effect

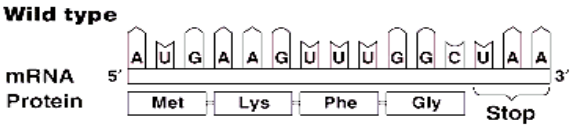
2) Missense mutation = changes a CODON that will specifies a _____ AA = _____ effect

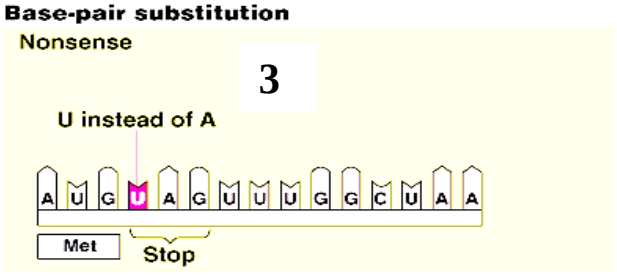


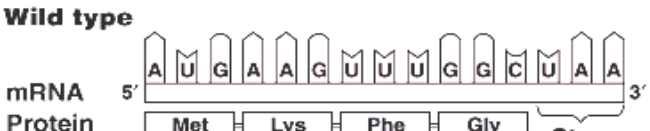


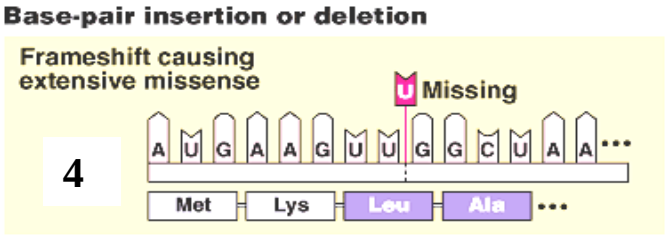
3) Nonsense mutation = changes a CODON to specify a _____signal in the middle of the protein = _____effect

4) Frameshift mutation = 1+ bases added or lost cause the triplet reading frame to be _____ over = _____ effect









- **Mutation Conclusions**
  - Any protein _____ than the original probably will NOT fold into the same 3-D _____ = NOT FUNCTION = cause a _____ problem
  - Most mutations have a _____ (–)effect that lowers an organism's chance for survival

Examples:

  - Some mutations have a _____ (+) effect for an organism in a certain environment that helps them better survive the challenges of life

Examples:

- Accumulating DNA mutations often leads to diseases like _____
- Only DNA mutations in _____ and _____ cells can be inherited
  - These _____ mutations often result in a variety of genetic _____
- Some viruses mutate _____ because mistakes during _____ of their genetic material are NOT fixed by proofreading repair enzymes
- This leads to new _____ of disease-causing viruses that sometimes emerge to cause major health _____
- This happens because people have little immunity to the viruses' newly-shaped _____ Ex.