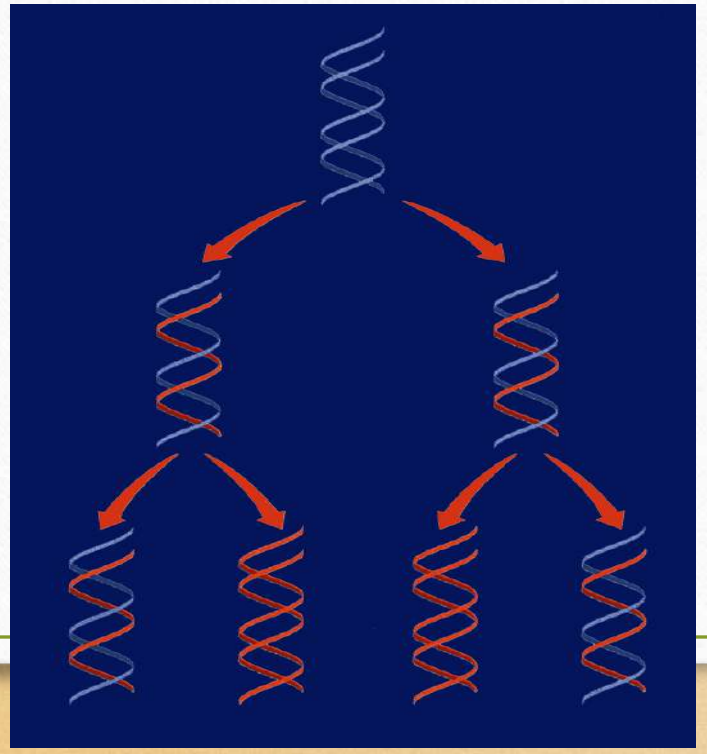
DNA Structure, DNA Replication, Mitosis, Protein Synthesis

Week 8

9/29 **DNA Replication** 11.1

Obj. TSW demonstrate base pairing rules of DNA Replication by constructing a 2-D model of DNA with paper. P. 68 NB

Replication Video



1. What is DNA replication?
2. Why does DNA replicate?
3. Diagram the of DNA being replicated

HW CH 11 1 page Notes P. 65 NB
Show video DNA Replication

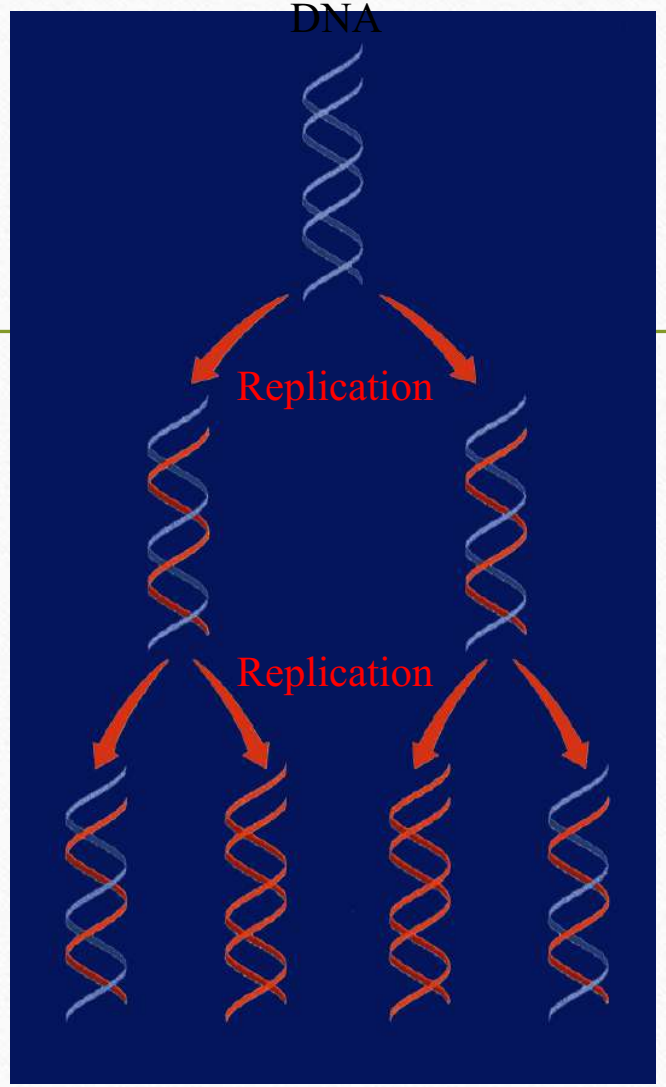
#1. Replication of DNA

Before a cell can divide by mitosis or meiosis, it must first make a copy of its chromosomes.

The DNA in the chromosomes is copied in a process called DNA replication.

Without DNA replication, new cells would have only half the DNA of their parents.

Replication of DNA



DNA Replication

- DNA replication: the DNA in chromosomes is copied in this process
- If I say a strand contains: AATTCC on one side, what will the complementary strand be? You can predict what the bases will be on the other side! Part of replication uses this logic.
- During DNA replication, each strand serves as a pattern, or template, to make a new DNA strand.

#3. Steps of DNA Replication

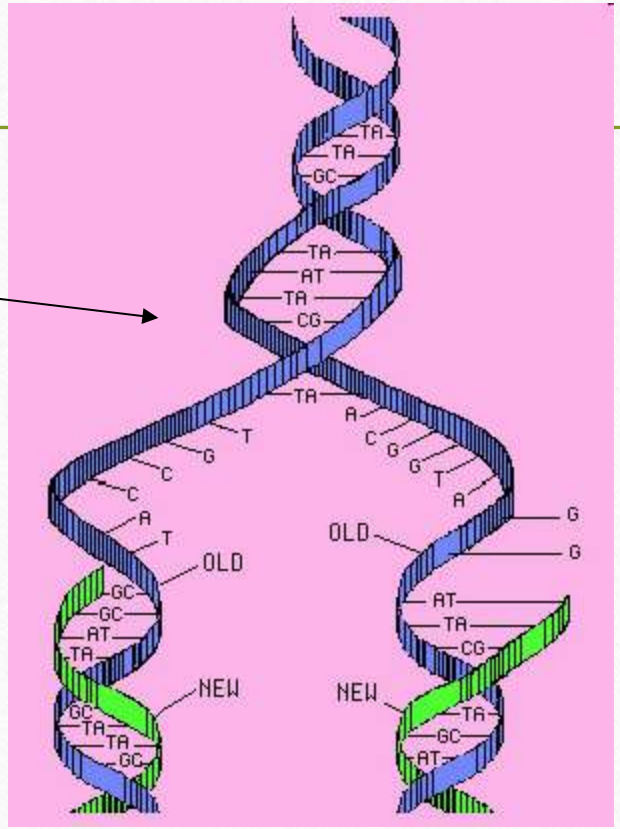
STEP 1. Separation of Strands: When a cell begins to copy DNA, the DNA unwinds, and the hydrogen bonds are broken. This allows the bases of nucleotides to be exposed.

- Unwinding!

- Hydrogen bonds broken!

  (like unzipping!)

STEP 2. A new Sugar- Phosphate backbone forms along the new strand forms.



DNA Replication 3’ to 5’ RULE

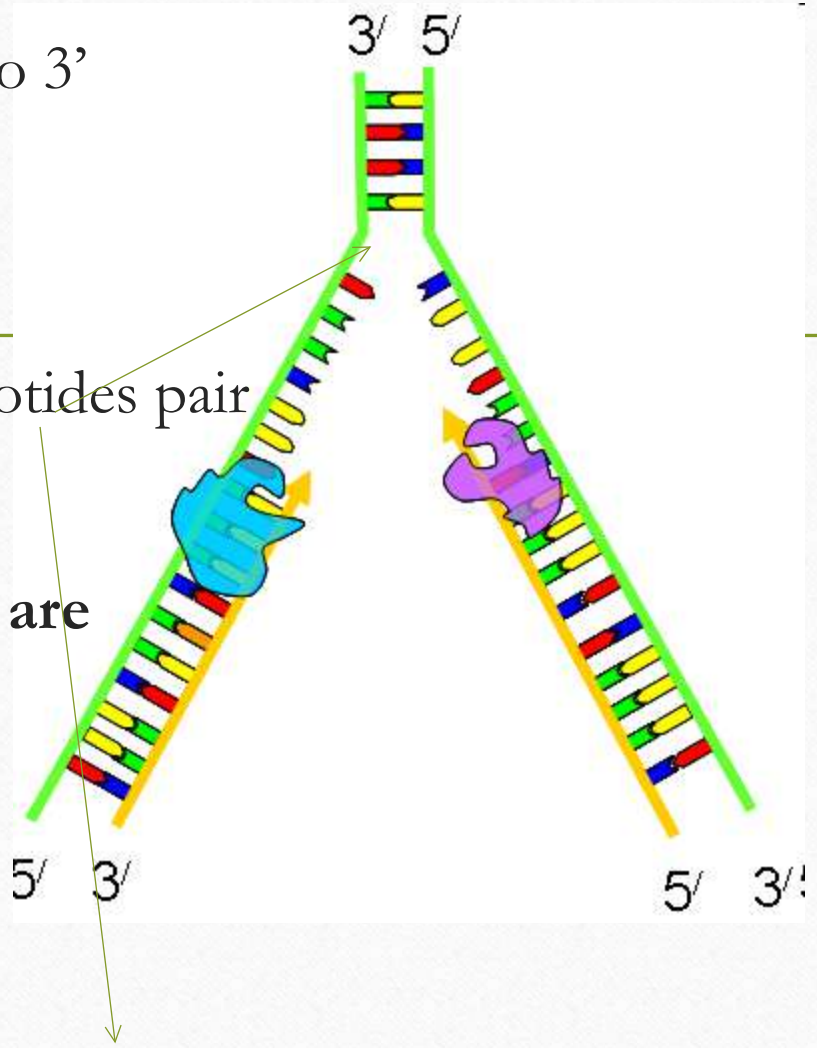
DNA strands go from 3’ to 5’ or 5’ to 3’

- When DNA strands pair,

  it is opposite

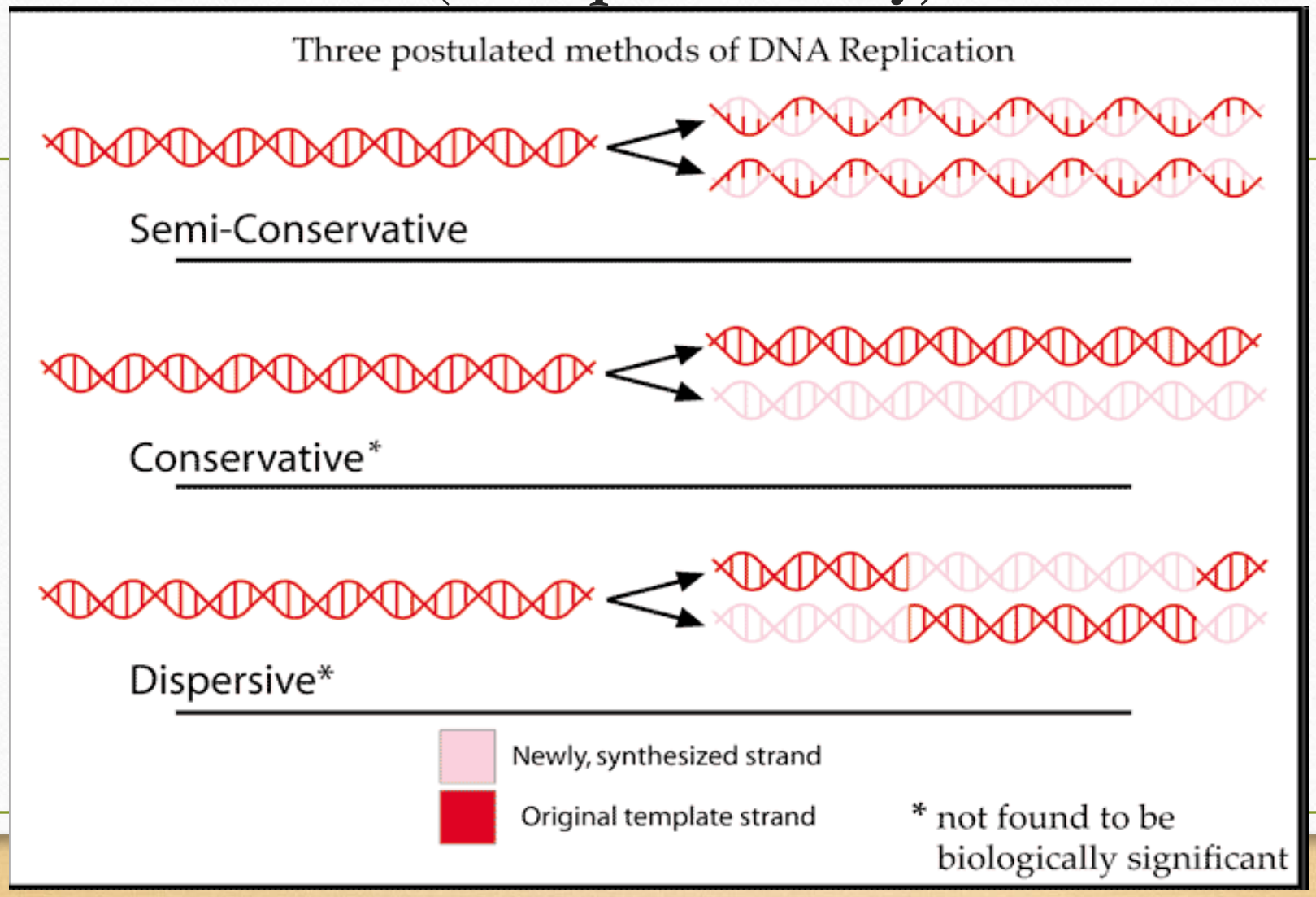
STEP 3. Base pairing: Free nucleotides pair with the exposed DNA bases.

STEP 4. Two molecules of DNA are Formed; each is half original & Half complementary.



Semi-conservative Replication p. 65 NB

Half of the DNA is **Original** the other half is new (**Complementary**)



DNA Replication Practice p. 65 NB

- **Directions:** Using one half of the a DNA helix, show what the correct pairing would be, skip lines in your NB.

1. ATT CGT TAC CAC CTC
2. TAT TAG GCA ATA TTC
3. GTG TGA TTA ATA GCC
4. CTA AAG GAA TAG GAT
5. GAT GAA TAC CCA CGA
6. TAA TAT GCA CAT TAC
7. GAA CCT TAC GGG GTG
8. TAT AAC CAG GAG TTT
9. ATC CGT AGT GTA AAT
10. GGA TTA CCC TTA CCA

DNA Replication Lab p. 67 NB

Materials:

Scissors, tape, DNA template (on white piece of paper), blank white piece of paper, 4 of each nitrogenous bases (each one different color of paper).

Procedures:

1. Pair up with a partner
2. Get supplies: 2 Original Strands of DNA backbone (White), & 1 paper of 4 of each of the Nitrogen Bases
3. Base pair the nitrogen bases to the Deoxyribose sugar.
4. Draw your Hydrogen Bonds A=T; C≡G
5. Write **Original Strand** on the two white DNA Backbones.
6. After McAllister reviews your model, she will give you 2 Yellow Backbones that are the complementary strands to base pair your Original strand to.
7. Cut your Original Strand in ½, and base pair the complementary strand to it.
8. When you have finished your model, answer the questions below in your notebook **P.47NB**

Questions:

1. List the 3 functional groups & the 4 nitrogenous bases found in DNA.
2. List the rules for base pairing in DNA.
3. What are the two main functions of DNA?
4. Draw DNA Replication with two different colors.

DNA Replication Activity Tape your Replicated DNA p. 67 NB

1. What is Semi–Conservative Replication?
2. What are the two main functions of DNA?
3. Why is DNA Replication important?

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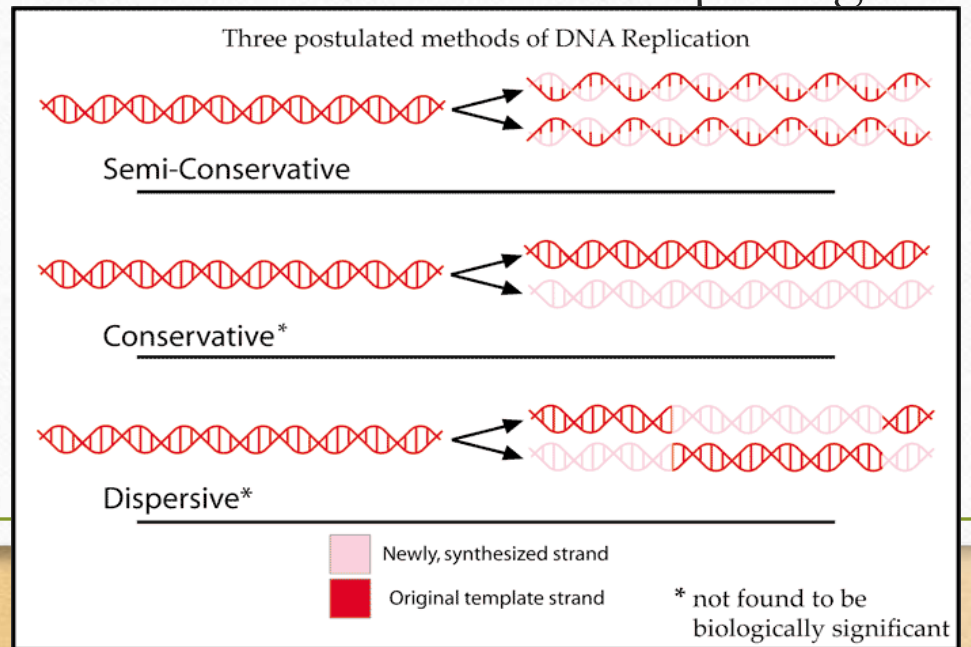
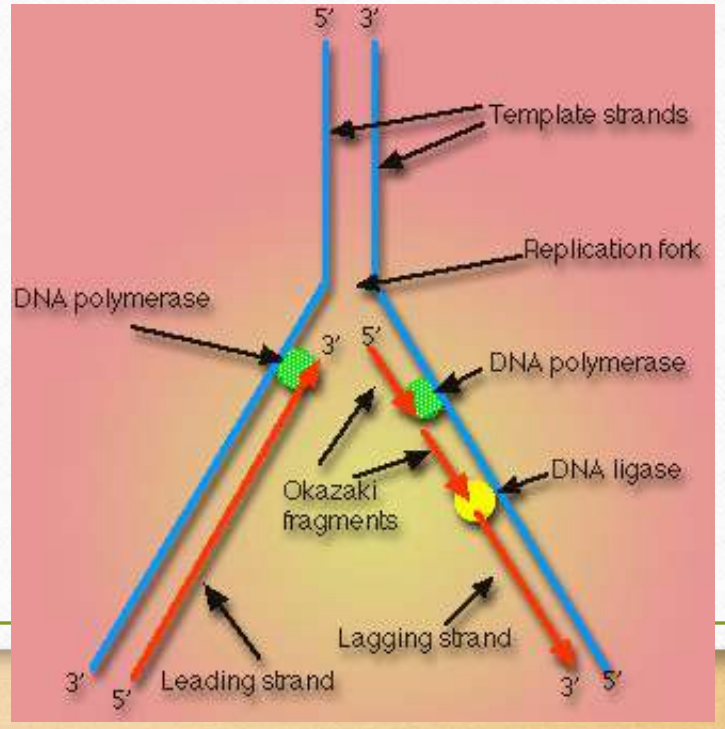
4. List the 3 functional groups & the 4 nitrogenous bases found in DNA.
5. Draw DNA Replication with two different colors.
6. List the rules for base pairing in DNA.

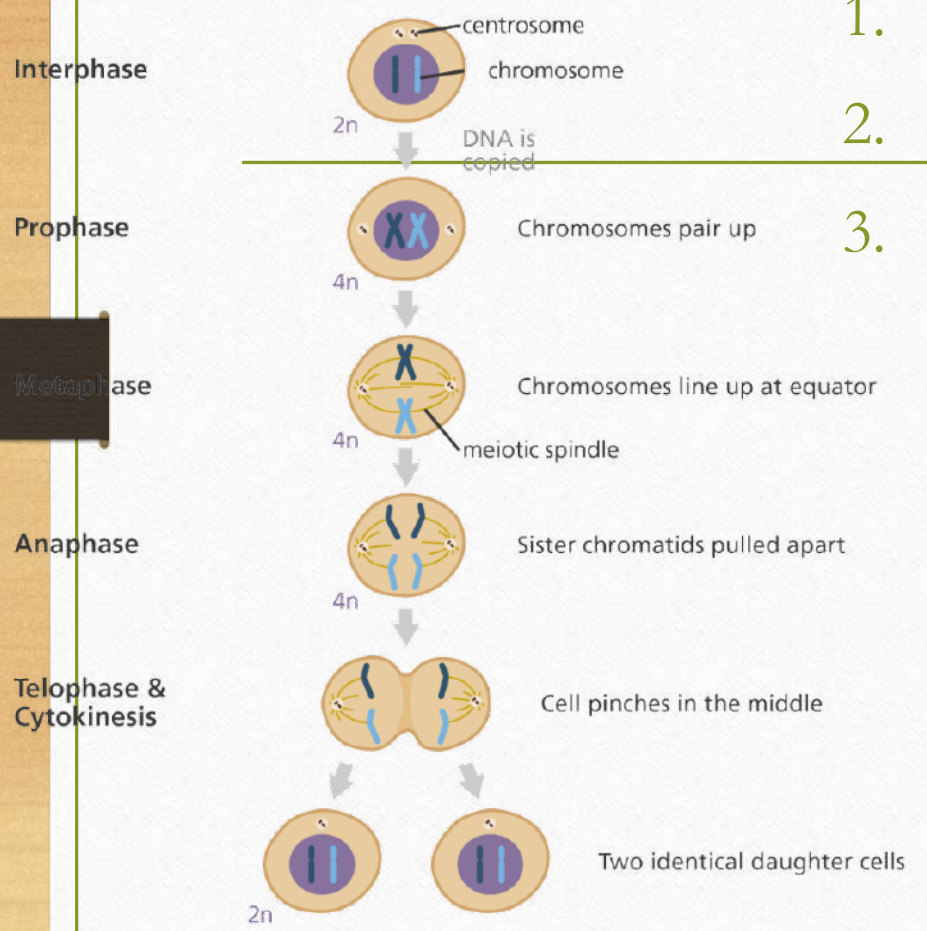


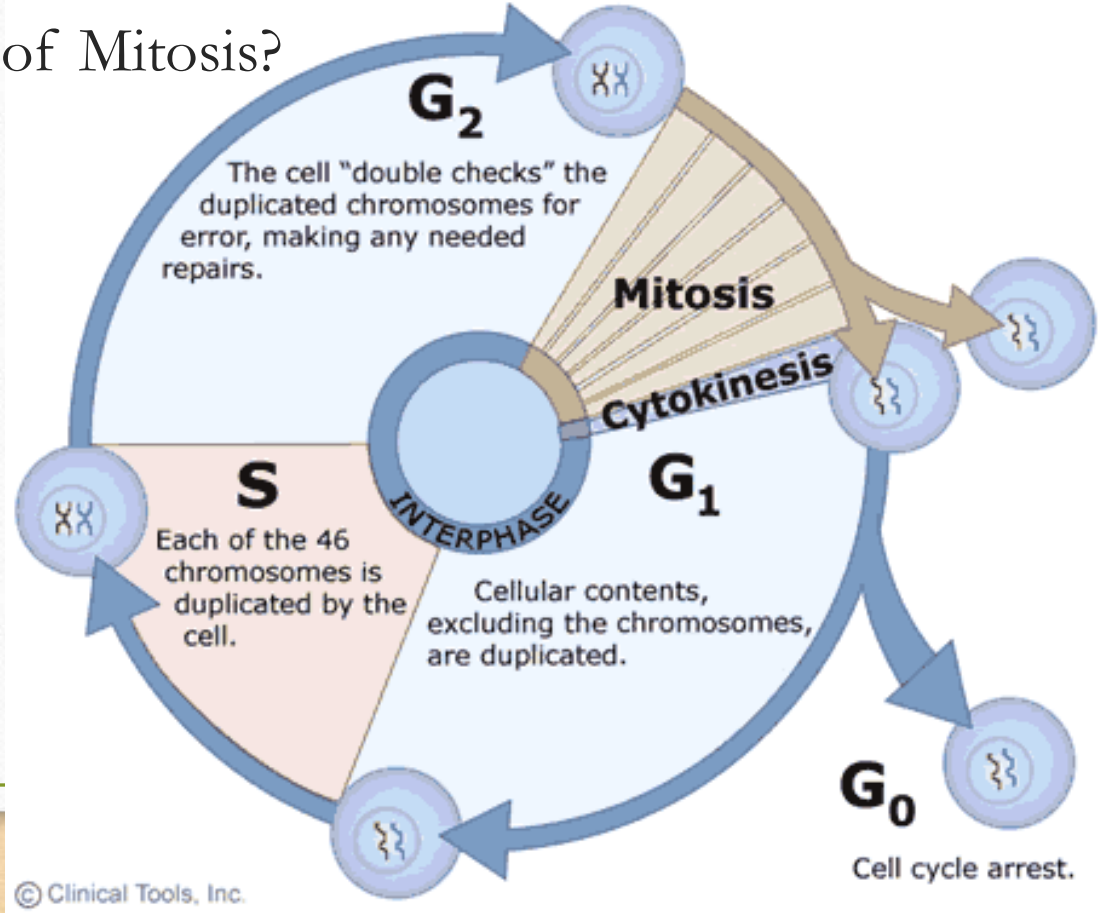


9/29 Cell Growth & Reproduction: Mitosis CH 8.2

Obj. TSW understand the cell cycle and processes at each stage. P. 68 NB

1. What is mitosis?
2. Draw the Cell Cycle.
3. What is the result of Mitosis?





Problem Solving Lab 8.2 P. 204BB

p. 69 NB

- Read the Observe & Infer section.
- Read the Solve the Problem.
- Answer the three "Thinking Critically" questions p. 61NB

1. Growth 1 phase- Rapid Growth & metabolism of Interphase is the most variable in length.
2. The two types of cells have different functions and one is more complex than the other.
3. The cycle of some types of cells is faster then others because of the complexity of the proteins made by the cell or the need to produce cells due to rapid wear and tear – like skin cells compared to muscles cells or nerve cells in the spine (do not regenerate).

Mitosis Practice p. 65NB

Get 2 white boards/ lab station

Get 1 Expo marker / 2 students

Draw a nucleus and place your replicated chromosomes inside the nucleus.

- With the yellow and red chromosomes, practice the 4 stages of Mitosis, drawing and erasing the nucleus as the stages dictate.
- After you show them to me/us, Then **draw the phases of Mitosis** on

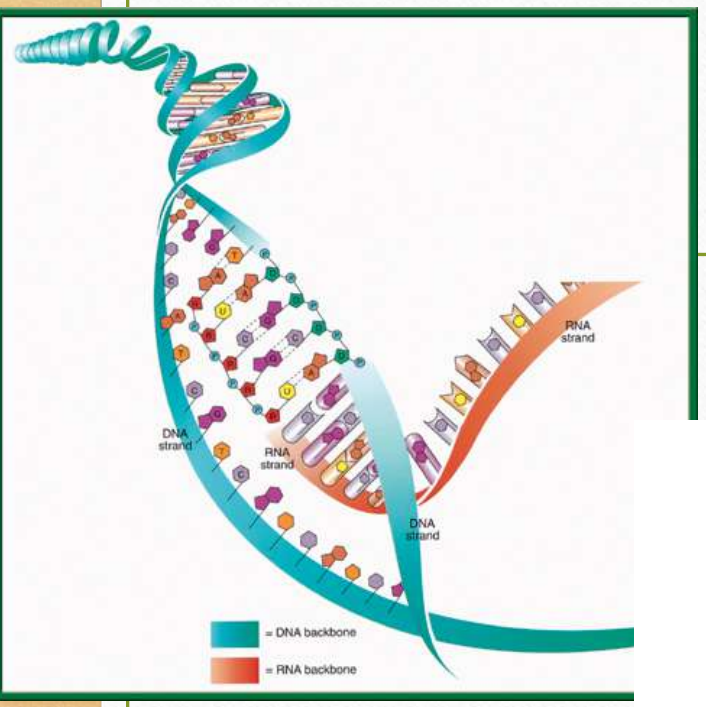
page 63 NB.

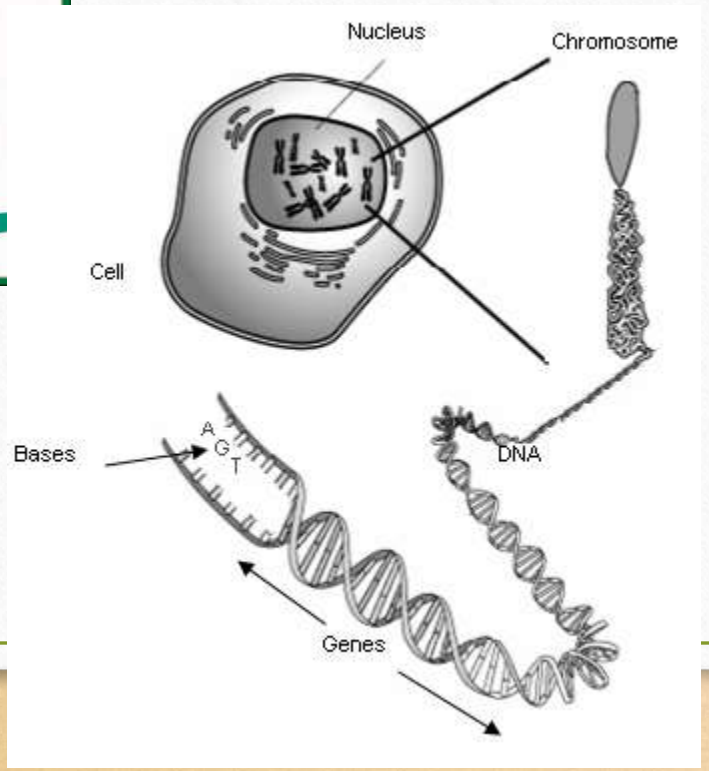
Mitosis Rules p. 65 NB

- Create a Mental model of how a cell cycle works that shows an end result of 2 identical cells after Mitosis with the same number of chromosomes.
- Set up rules for what a cell can and can not do.
- What steps does the cell have to go through to create two new identical cells.
- Result of Mitosis: 2 identical cells with the same # of chromosomes that make tissues, that form organs, that are part of an organ system and make an organism.

10/3 RNA (Ribonucleic Acid) CH 11.2

Obj. TSW compare and contrast the structure and function of DNA and RNA in the Warm Up, and from the video. P. 72 NB





1. Describe how RNA's structure differs from DNA's structure in three ways?
2. Identify and describe the functions of the three types of RNA.
3. What is the main difference between Transcription and DNA Replication?

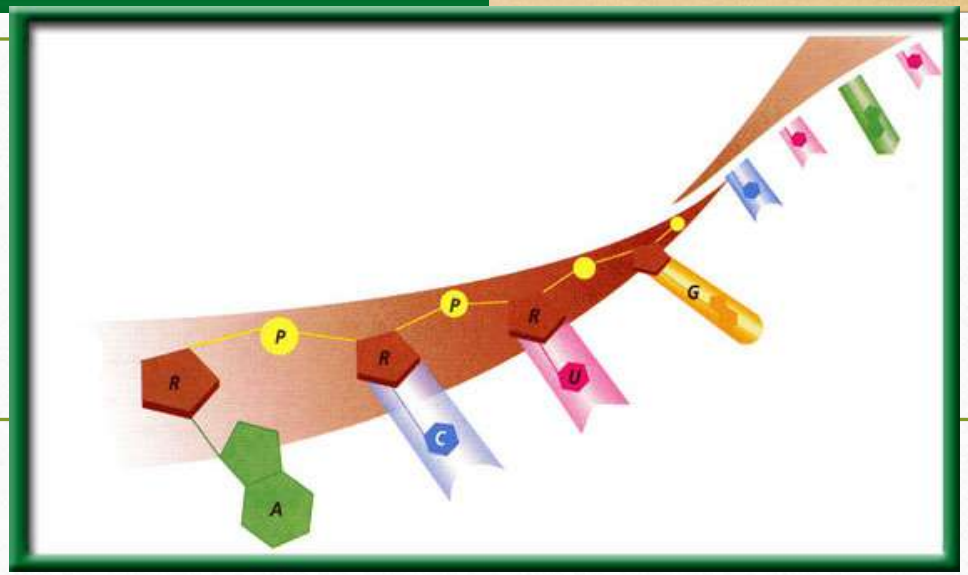
Study for DNA Quiz: CH 11 Tuesday

Work on your Lab – Final Lab due Friday

Science Article: Endosymbiotic Theory p. 65 NB

- Read the article quietly.
- Read the article out loud.
- Pair up and write the Claim, Evidence and Reasoning
- Discuss as a class: Endosymbiotic Theory
- Turn the Paper over and write the AXES Paragraph on Endosymbiotic Theory

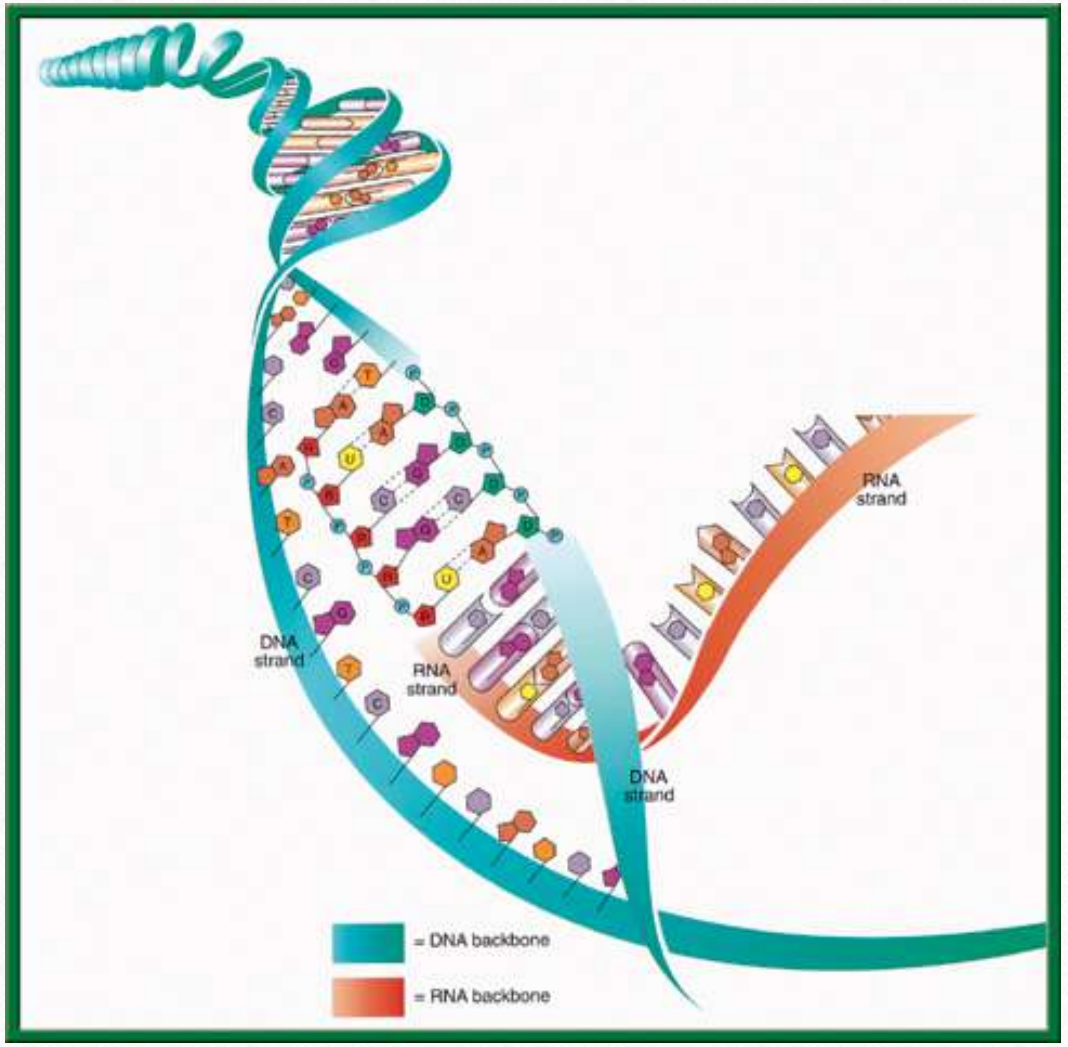
#1. RNA



RNA like DNA, is a nucleic acid. RNA structure differs from DNA structure in three ways.

First, RNA **is single stranded**—it looks like one-half of a zipper —whereas DNA is double stranded.

#1. Transcription



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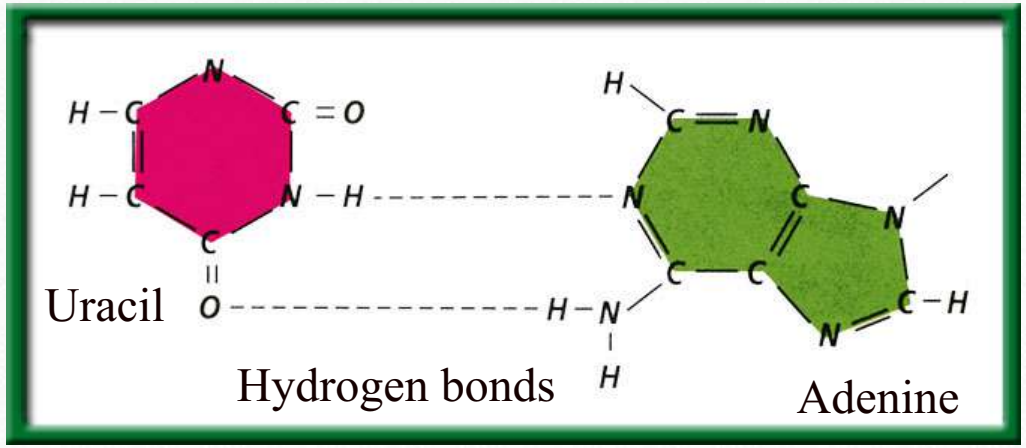
RESOURCES

#1. RNA

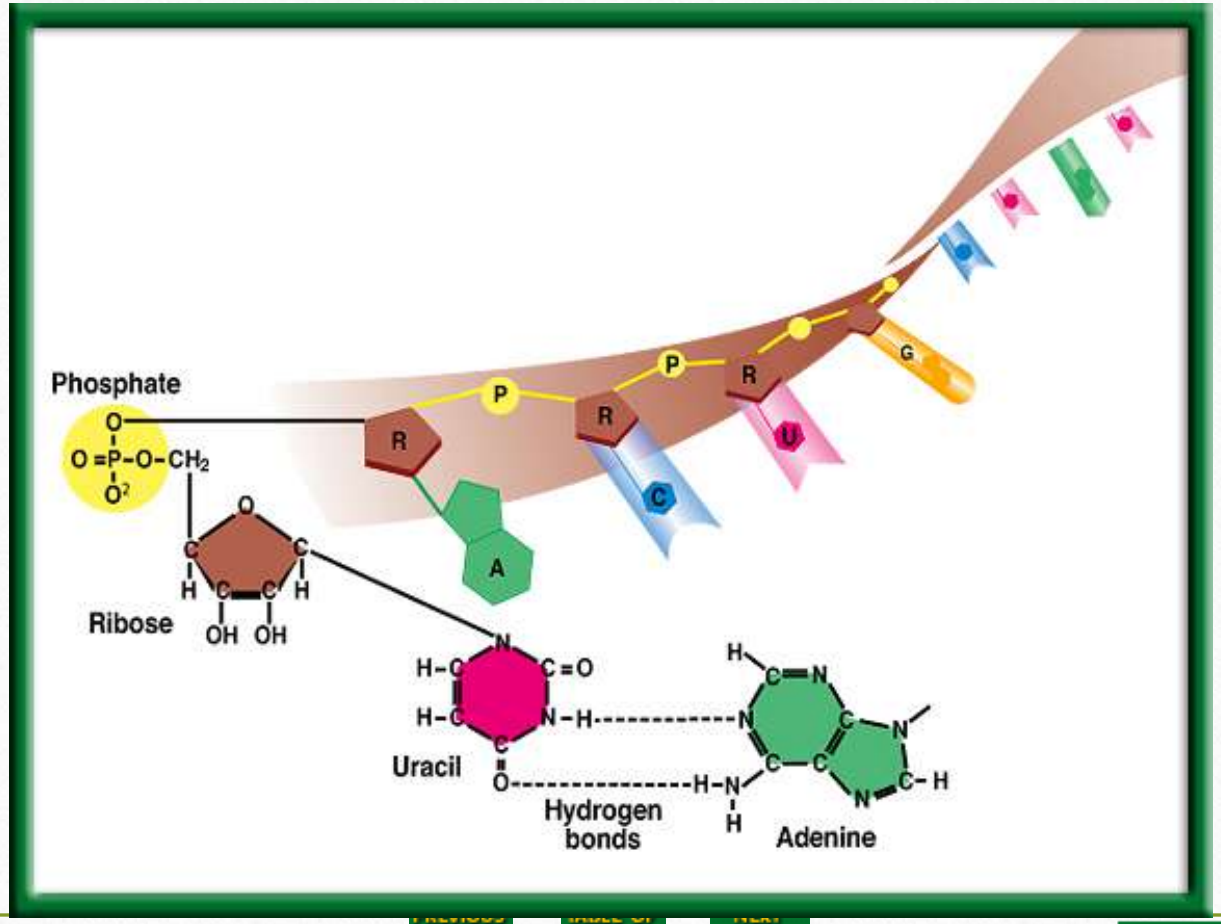
Both DNA and RNA contain four nitrogenous bases, but rather than thymine, RNA contains a similar base called uracil (U).



Uracil forms a base pair with adenine in RNA, just as thymine does in DNA.

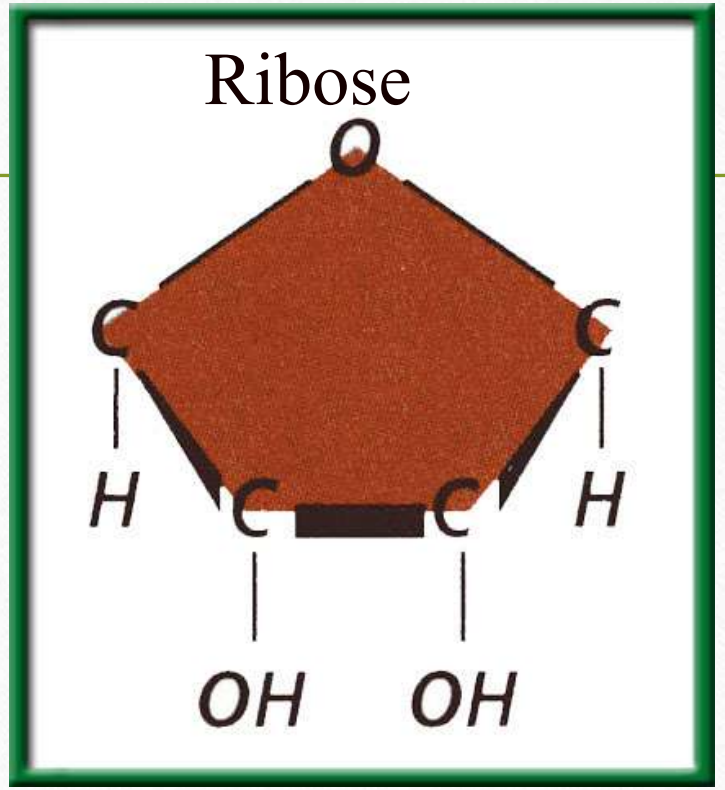
#1. **Second:** Chemical Difference of DNA and RNA

Uracil is the Nitrogen base that replaces **Thymine**



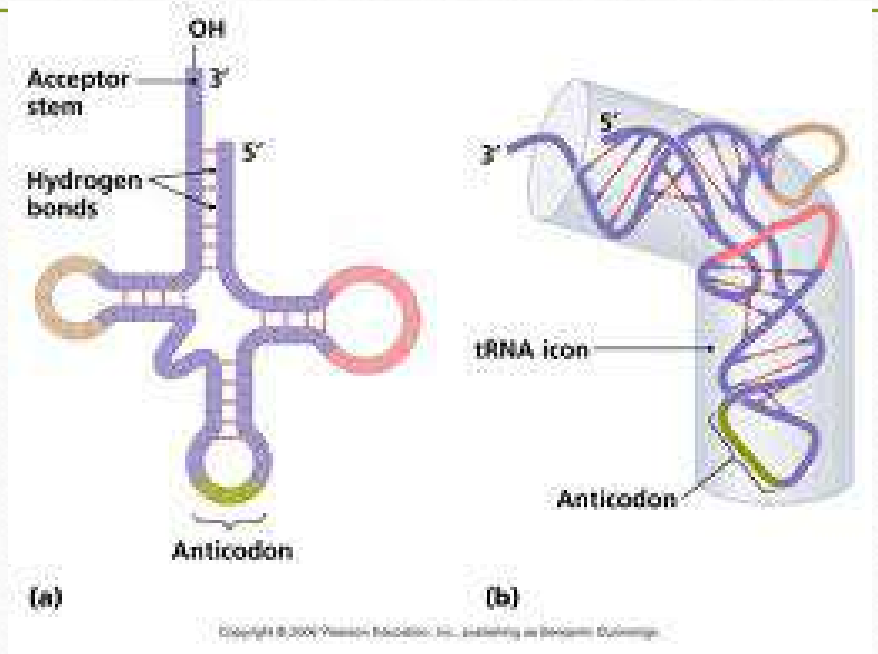
#1. RNA

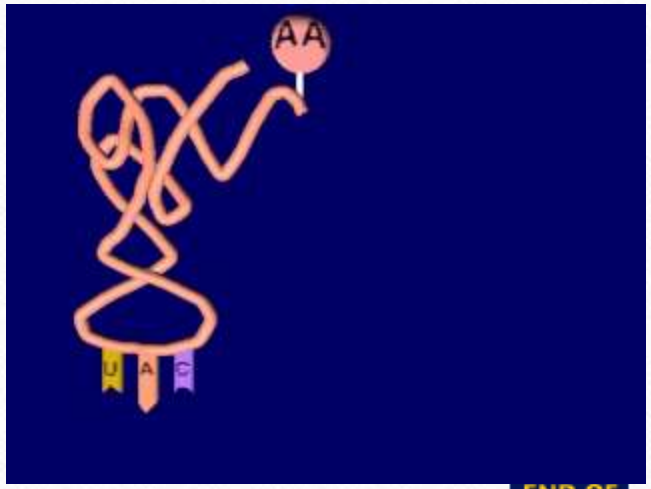
Third: The sugar in RNA is **Ribose**; DNA's sugar is deoxyribose.



#2. RNA

Transfer RNA (tRNA) is the supplier. Transfer RNA delivers amino acids to the ribosome to be assembled into a protein.





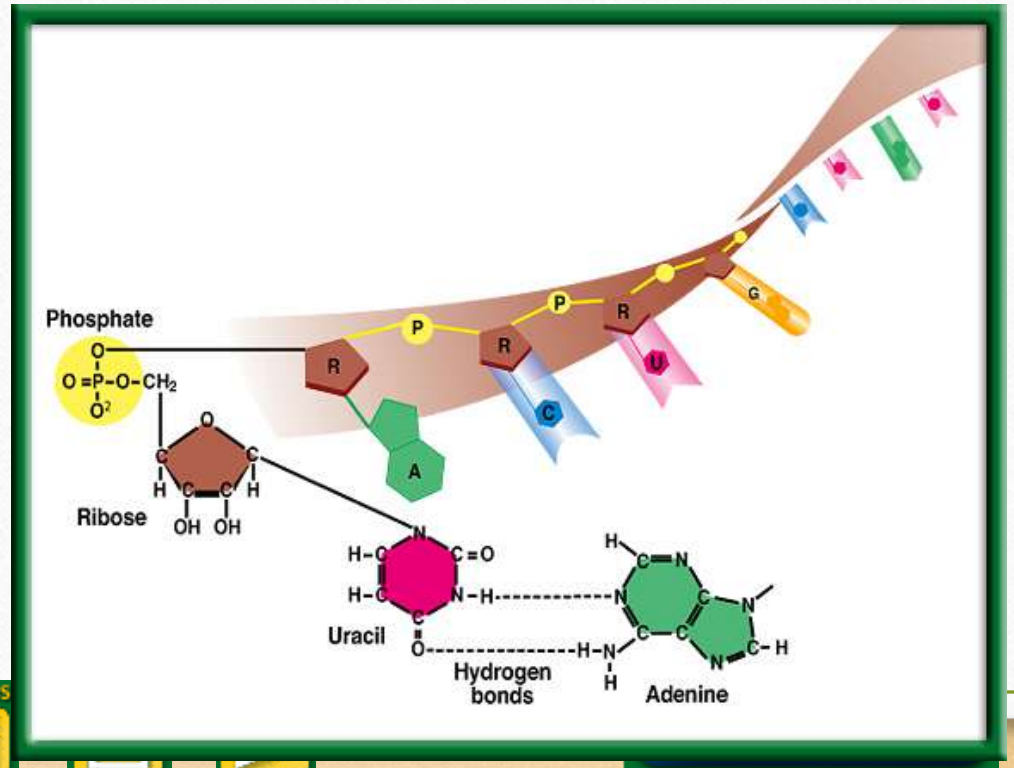
Click image to view movie

#2. RNA

There are three types of RNA that help build proteins.

Messenger RNA (mRNA), brings instructions from DNA in the nucleus to the cell's factory floor, the cytoplasm.

On the factory floor, mRNA moves to the assembly line, a ribosome.



Protein Synthesis – Monday!!!!! 10/3

- 1 large bag of M & M's –
- 1 large bag of Gummy Bears –
- 4 bags of Marshmallows-
- 1 stick of Butter – McAllister
- 1 box Rice Krispy Cereal -

DNA Quiz Thursday 10/5

1 piece of Binder Paper & pencil or pen. Write your name on the top right hand side.

1. What is the name of the molecule that holds our genetic information?
2. What is the shape of that molecule?
3. Where is that molecule located in the cell?
4. What are the 4 Nitrogen Bases that code for Amino Acids?
5. Write how the Nitrogen base pair together.
6. What is the bond that holds the nitrogen bases together?
7. Draw & Write the three parts of a nucleotide.
8. What is DNA Replication?
9. What are the two functions of DNA?
10. How is RNA different from DNA?

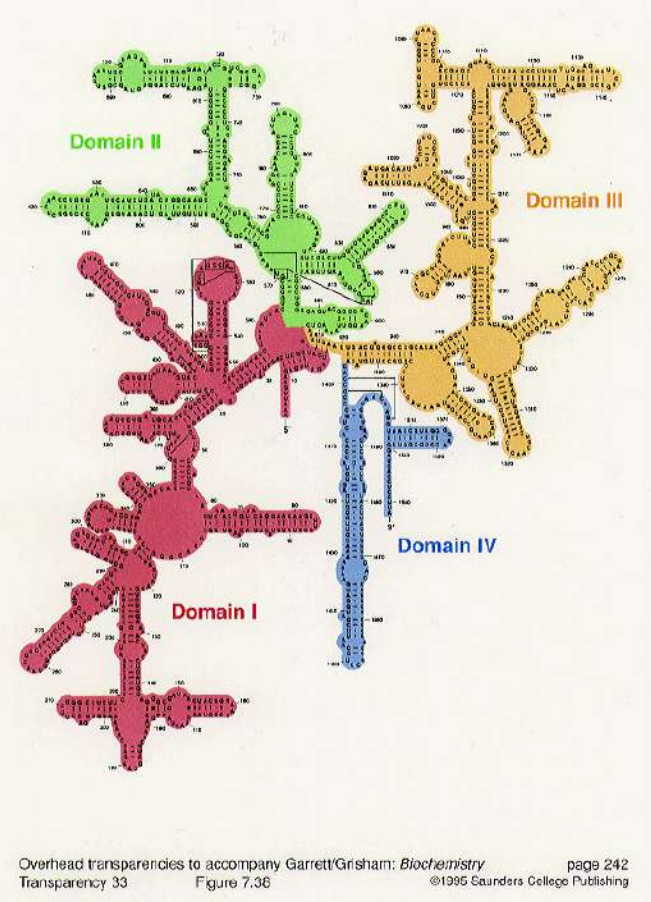
Genes Expression = Proteins

You learned earlier that proteins are polymers of amino acids.

The sequence of nucleotides in each gene contains information for assembling the string of amino acids that make up a single protein.

#2. RNA

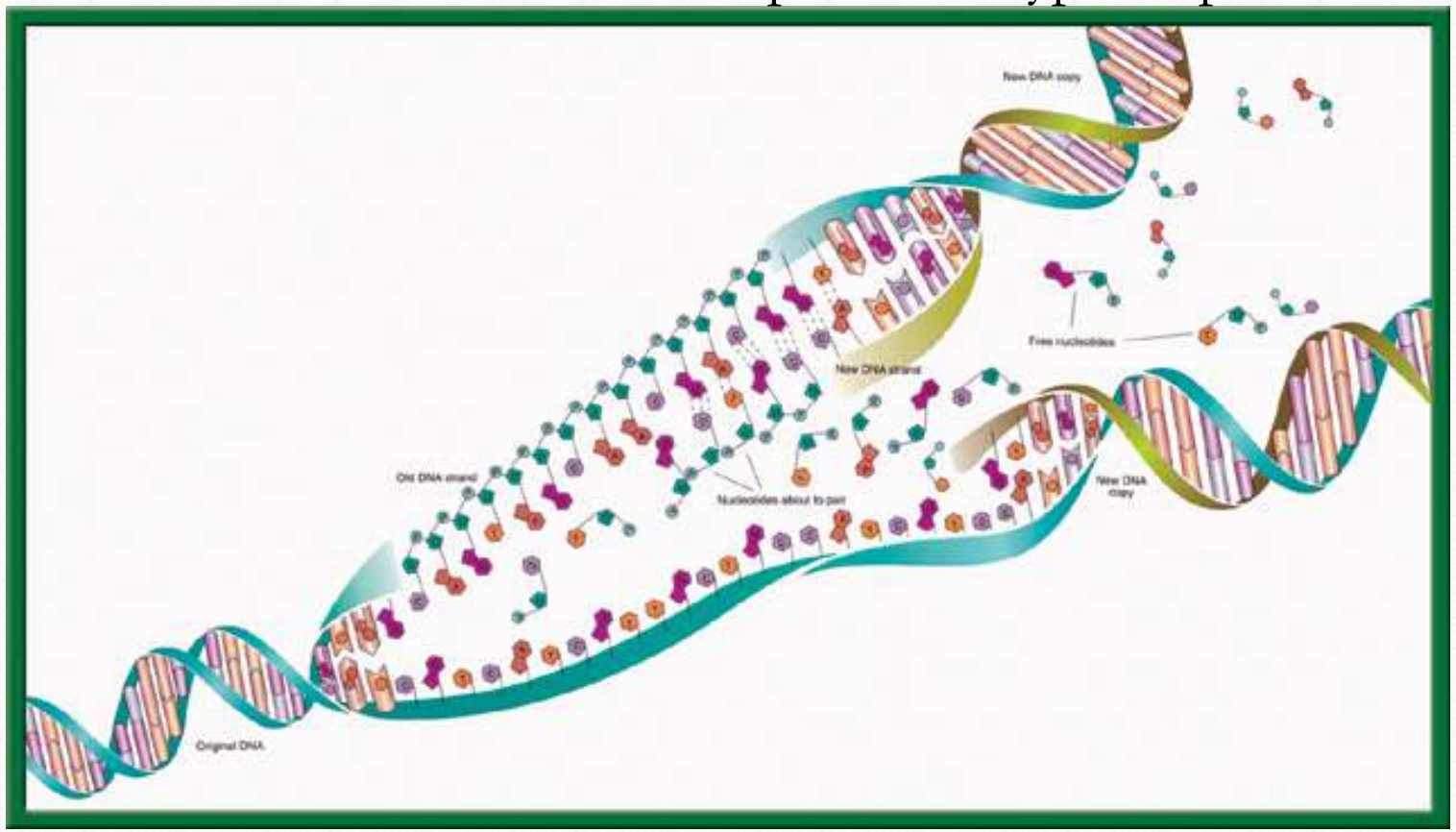
The ribosome, made of ribosomal RNA (rRNA), binds to the mRNA and uses the instructions to assemble the amino acids in the correct order.



What Process is this?

What are the steps?

What is the name for this particular type of process?



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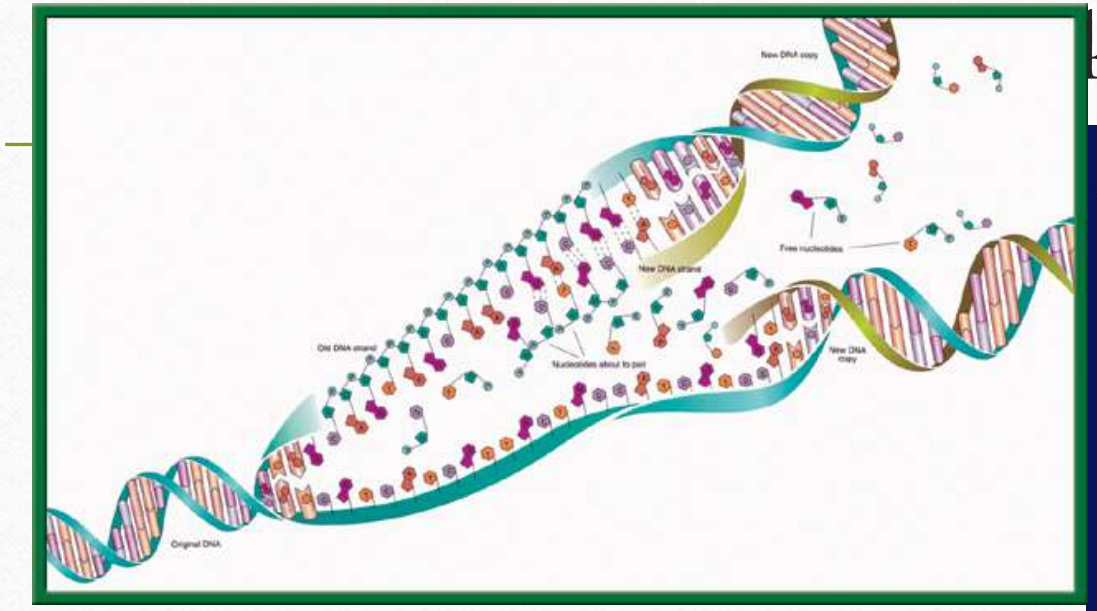
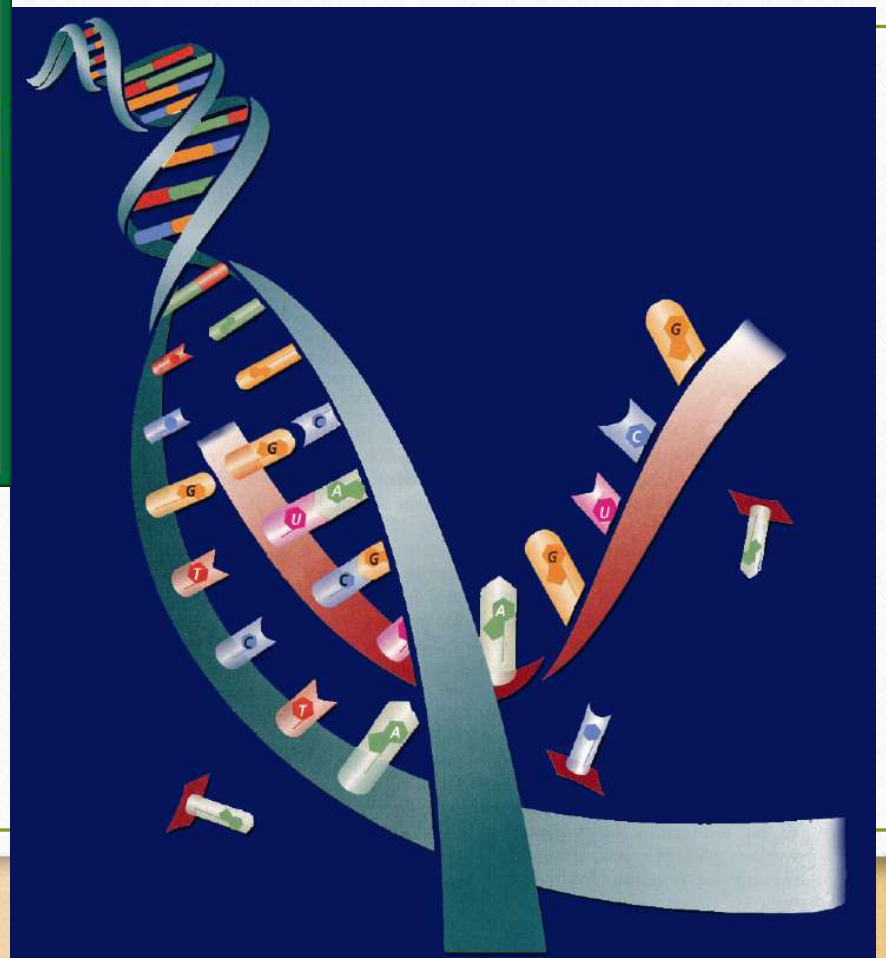
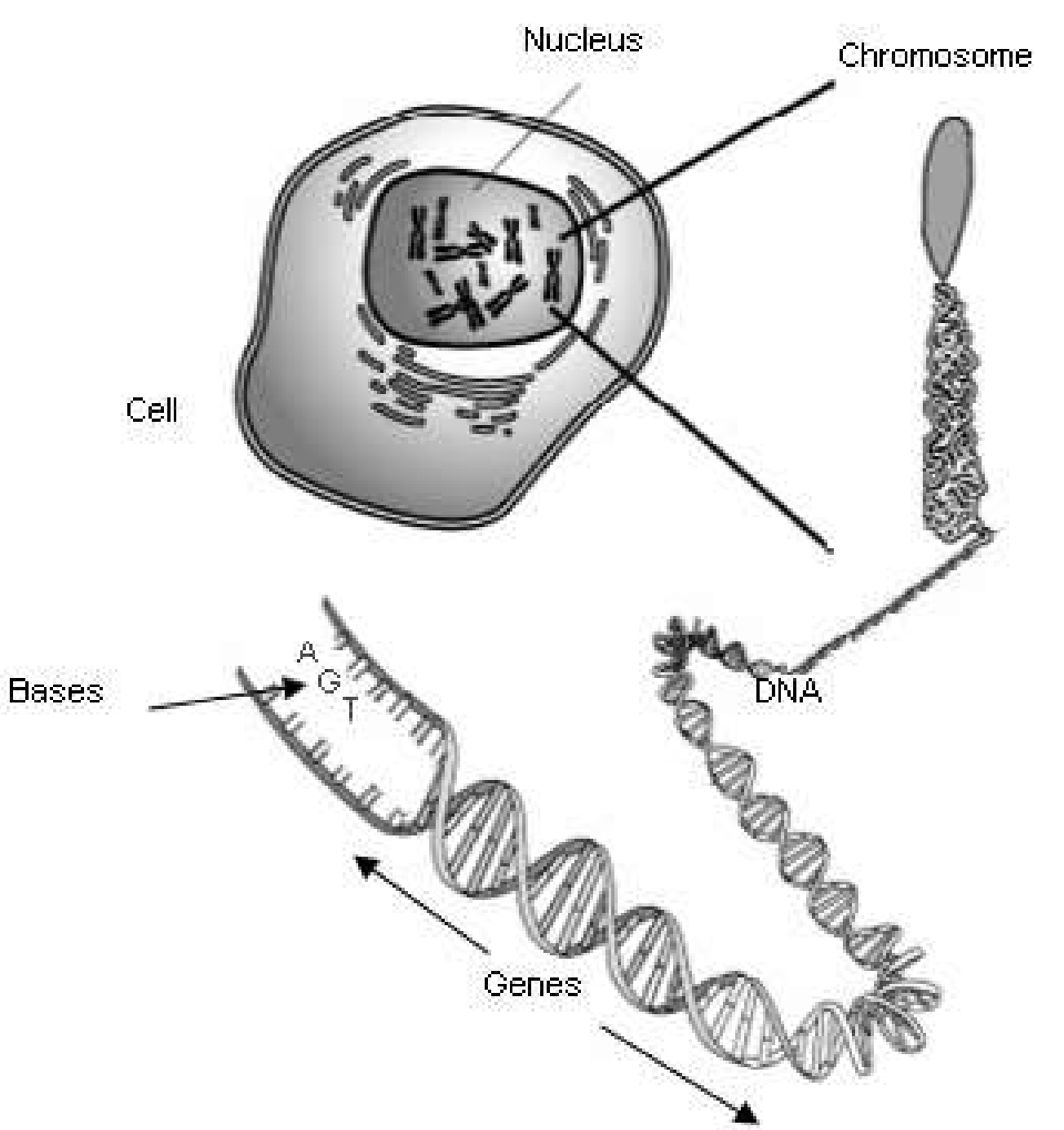
#3. The difference of DNA Replication & Transcription (Making Proteins)



DNA Replication – makes more DNA for more cells.

Transcription – first process of making proteins.




Nucleus
Chromosome
Cell
DNA
Bases
A
G
T
Genes

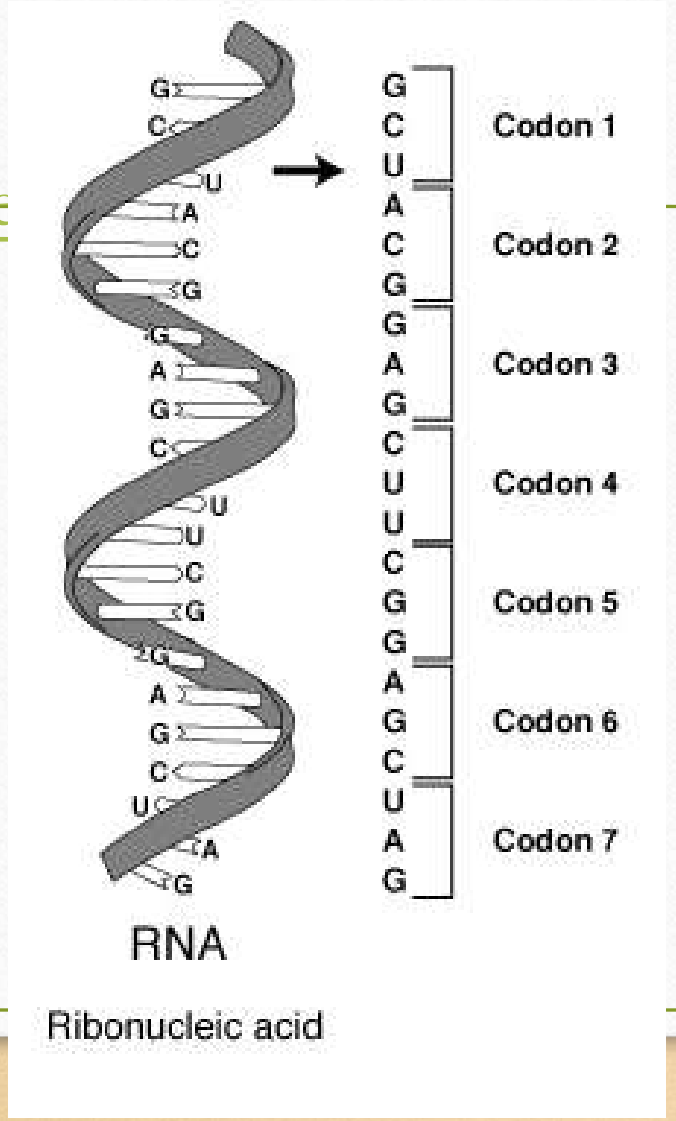
Record Book Time!!!
We love **theaet.com**
CA0577

- Objective: By Wednesday October 11th, I have everyone's SAE Agreement. 20 points.

1. Log on: Explore AET.com if you don't know what your SAE is yet to help you make a decision. Also talk to McAllister.
2. Log on: theaet.com if you know your SAE to get started entering your description, time, objectives, finances. Please always write in complete sentences, this will be part of your agreement, signed by me and your parents.
    1. Click Profile, Your Activities Experience Manager SAE(Add New) Enter you Description, Time, Finances, and Learning Objective
    2. When you are done entering all your information for your SAE, Click on the Blue "PDF Agreement"& read it. Edit what you need. Tell me to Print, Take Home and get signed.
    3. Don't forget your PICTURES!!!! Load them into your Project.

10/4 **Protein Synthesis: Transcription** 11.2 Week 8

Obj. TSW be able to explain the process of Transcription by making mRNA strand from DNA through practice. P.74 NB



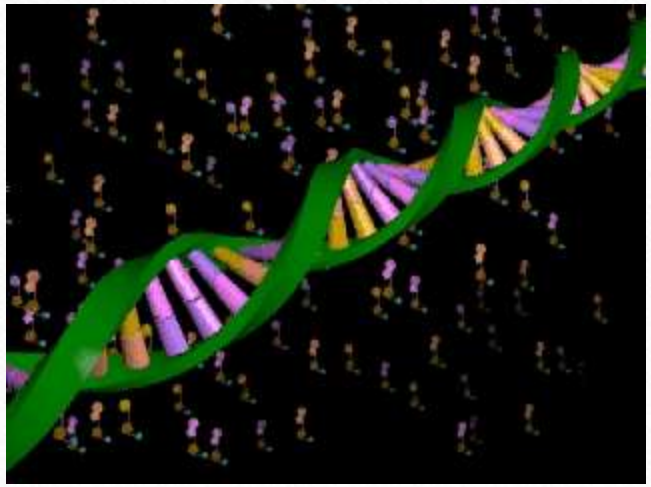
1. What is transcription?
2. Where does Transcription happen?
3. Why is a codon important to making a protein?

Cracking the Code

- Answer the Questions on the ½ sheet of paper

Transcription

In the nucleus, enzymes make an RNA copy of a portion of a DNA strand in a process called transcription.



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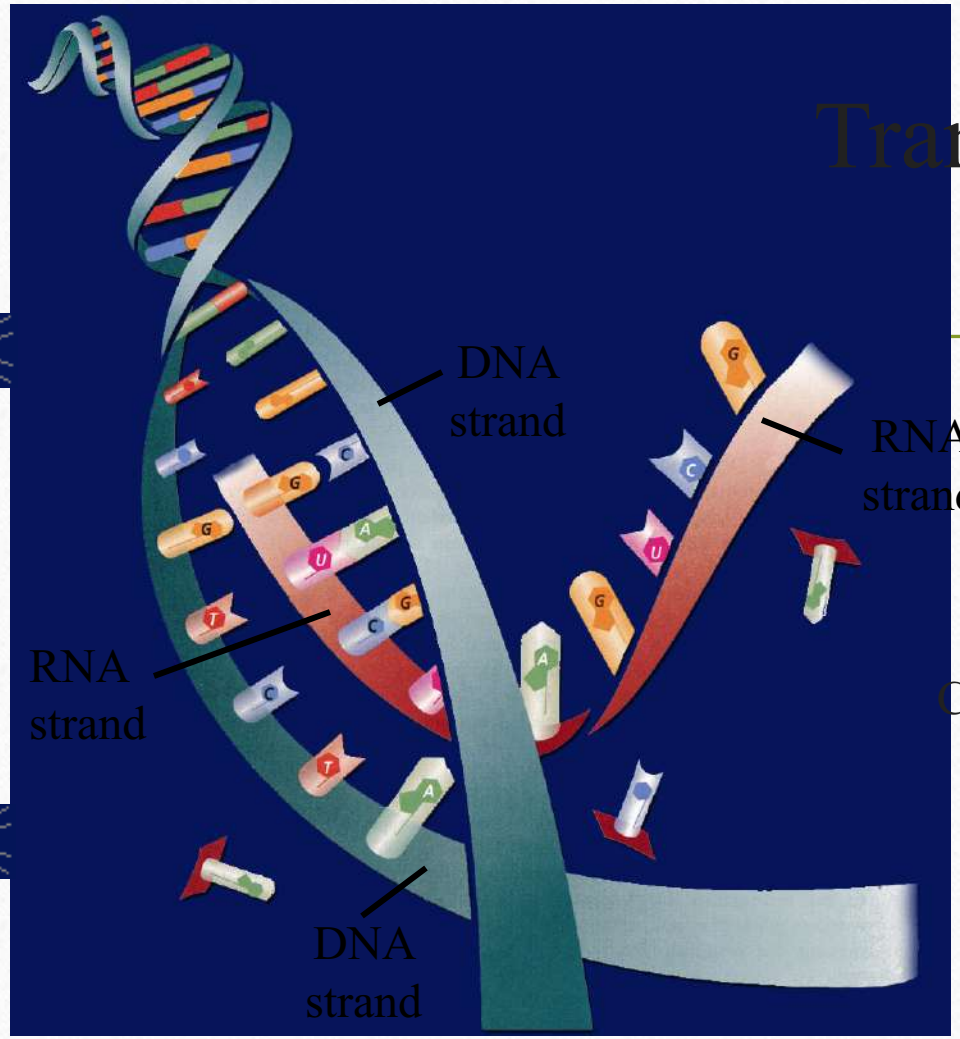
Transcription

A



B

C

Transcription

The main difference between transcription and DNA replication is that transcription results in the formation of one single-stranded RNA molecule rather than a double-stranded DNA molecule.

RNA Processing = Gene Expression

Not all the nucleotides in the DNA of eukaryotic cells carry instructions—or code—for making proteins.

Genes usually contain many long noncoding nucleotide sequences, called introns, that are scattered among the coding sequences.

Question 1

How does DNA control the structures and functions of a cell?

Answer

DNA determines the structure of proteins. Some proteins become important cell structures. Other proteins, such as enzymes, control chemical reactions that perform key life functions.

HW CH 11 DNA & Genes p.41 NB

1. Deoxyribose
2. Nitrogenous Base
3. Nucleotide
4. Base Pair
5. Hydrogen Bond
6. Phosphate
7. Adenine (A) & Nitrogen Bases
8. Cytosine
9. *Nucleotides
10. DNA Replication
11. Double Helix

HW CH 11 DNA &Genes*

1. DNA – Double RNA – single
2. DNA – Deoxyribose RNA – Ribose
3. DNA – ATCG RNA – AUCG
4. Amino Acids
5. Amino Acids
6. Proteins
7. Codon*
8. Threonine

QUIZ

8. What is DNA Replication?
9. What are the two functions of DNA?
10. What are three differences of RNA from DNA?
11. What RNA has stop codons, and what is their function?
12. How are codons and anticodons different?
13. Write the equation for Protein Synthesis.
14. Transcribe & Translate the DNA sequence:ATC, TCA, TAC

DNA Quiz

7. What is the backbone of the molecule made of?

8. What is a gene?

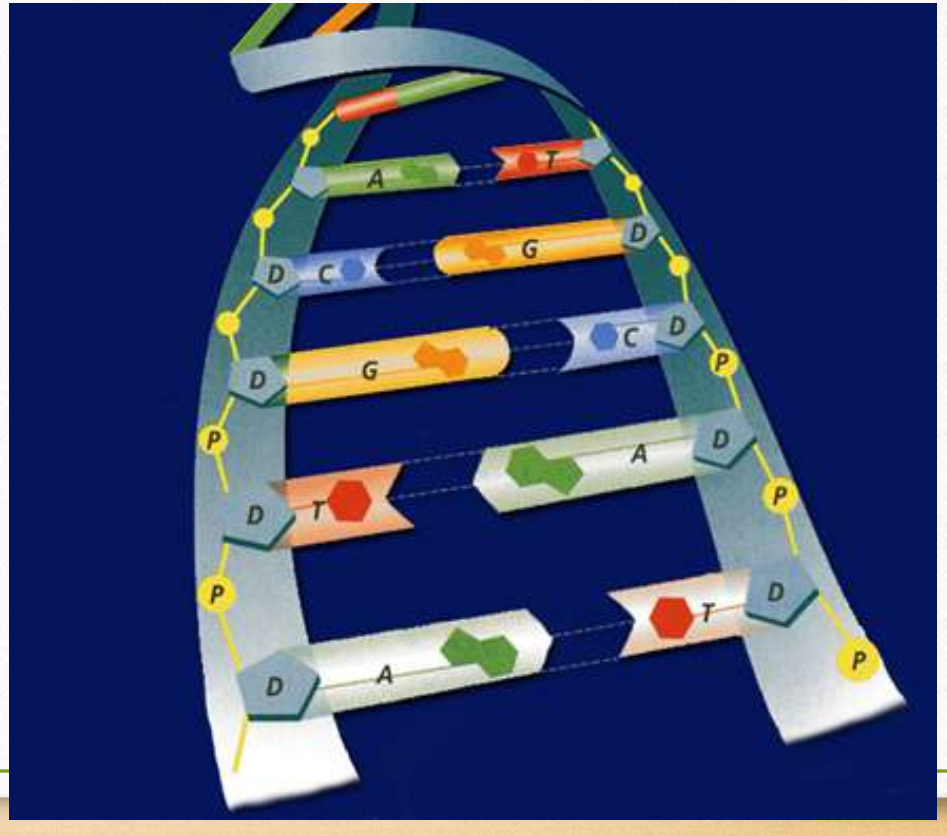
9. What does DNA code for? What is it's purpose?

10. Write the formula for Protein Synthesis

When you are finished turn you paper upside down and wait quietly to have me pick it up.

POP QUIZ Write your name on your binder paper.

1. What is this molecule? Spell it out.
2. What is the shape of the molecule?
3. What are the two purposes/ functions of this molecule?
4. Write the three names for the parts of a nucleotide. Be specific.
5. The Nitrogen bases are: Adenine, Cytosine, Guanine, & Thymine – Base Pair them together correctly.
6. What holds the Nitrogen bases together?
7. DNA is a Nucleic Acid, write an example of another one.
8. Can a Nucleic Acid leave the nucleus?
9. What is DNA Replication?
10. What is the name for how DNA Replications?



Question 2

The process through which the order of bases in messenger RNA codes for the order of amino acids in a protein is:

A. transcription

B. translation

C. replication

D. point mutation

The answer is B.

Question 3

Why would scientists use nucleotide sequences to identify bodies of crime victims?

Answer

In comparing nucleotide sequences in the DNA of a crime victim with nucleotide sequences from a possible close relative of the crime victim, scientists can determine if the two are related.

HW CH 11

9.Phenylalanine Codon are (UUU) (UUC)

10. Codon

11. Amino Acid

12. Amino Acid

13. Stop codons = UGA, UAG, UAA

14. Tryptophan & Methionine

Making RNA p. 71 NB

- Backbone= Phosphate & Sugar (Red & White)
- Nitrogen Bases= Adenine (Blue)=Thymine (Green)

Cytosine (Yellow)=-Guanine (Orange)

Uracil (Pink) RNA

- Hydrogen bond (clear barbell)
- http://learn.genetics.utah.edu/

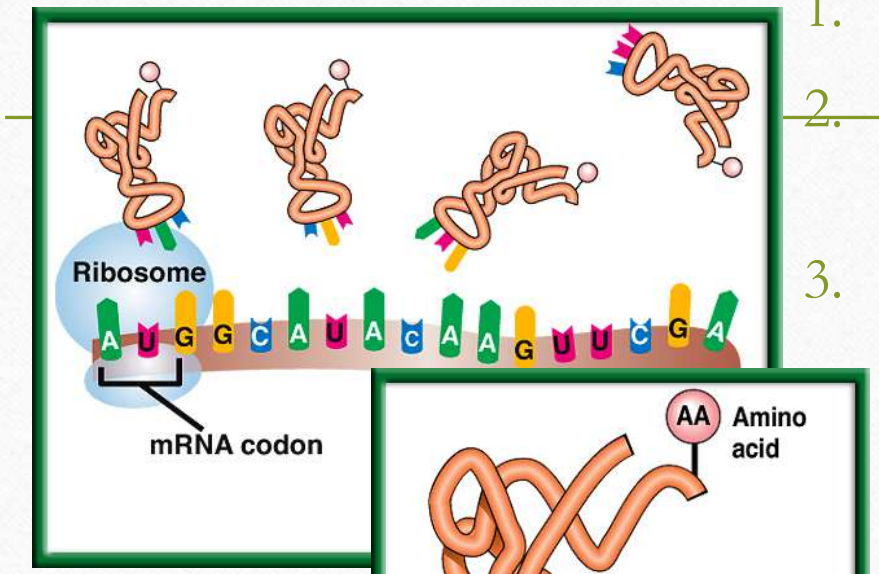
WS - DNA Model Discussion questions P. 71 NB

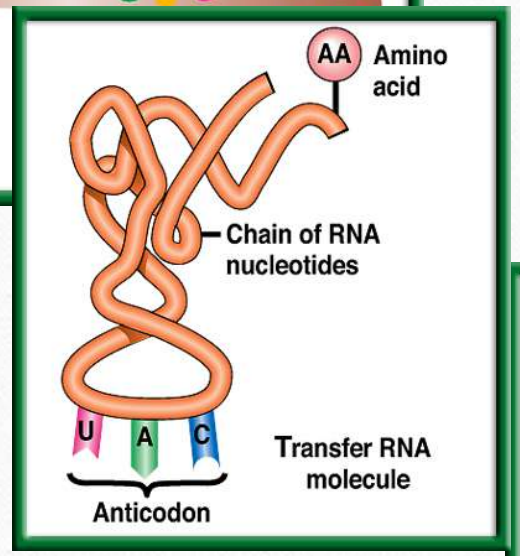
1. How is RNA different from DNA, Name 3 ways.
2. What Nitrogen base replaces Thymine in RNA?
3. Why is RNA made, if DNA holds the genetic code?

10/5 **Protein Synthesis: Translation** 11.2

Obj. TSW explain the process of Protein Synthesis by working on their Protein Synthesis foldable and transcribing and translating DNA sequences from their Mini Lab 11.1 P. 76NB

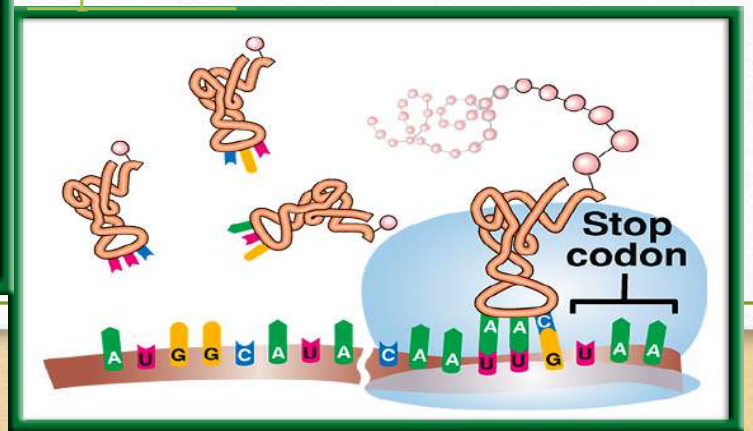
Learn.genetics.utah.com.edu/



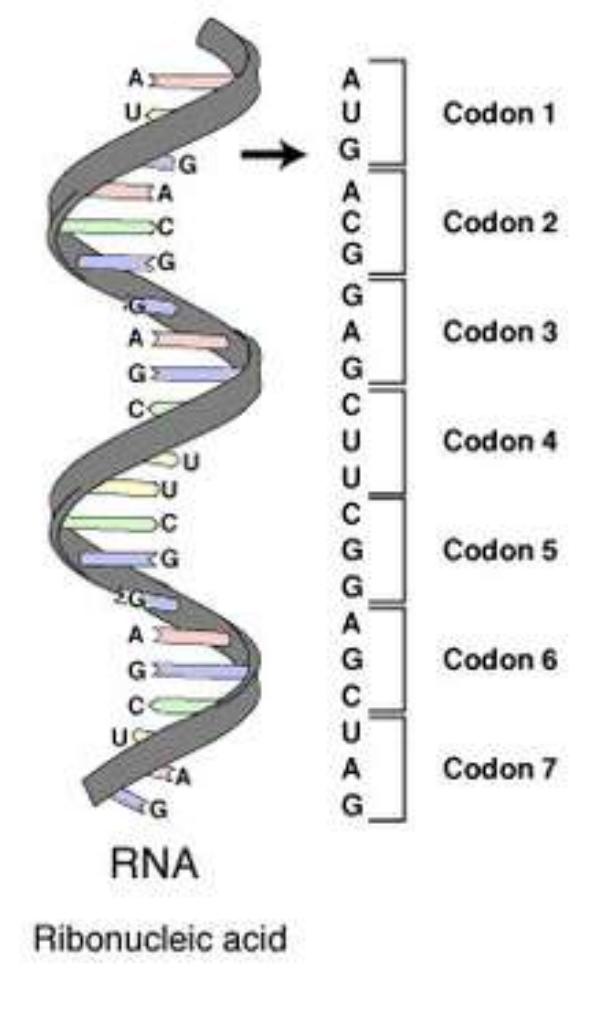


1. Compare & Contrast Codon and Anticodon.
2. What is the role of tRNA in Protein Synthesis?
3. Why are Stop Codons important in Translation?

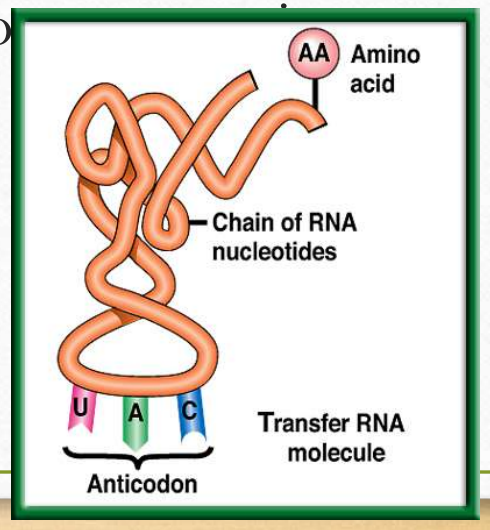
http://www.dnatube.com/video/3448/DNA-Replication



#1. Codon & Anticodon



- A **Codon** is a nucleotide triplet sequence on mRNA, it codes for an amino acid.
  - AUG ACG GAG
- An **Anticodon** is a nucleotide triplet sequence on tRNA that carries the Amino acid
  - UAC
- Both are RNA & Each triplet pairs to code for a particular Amino acid to fo

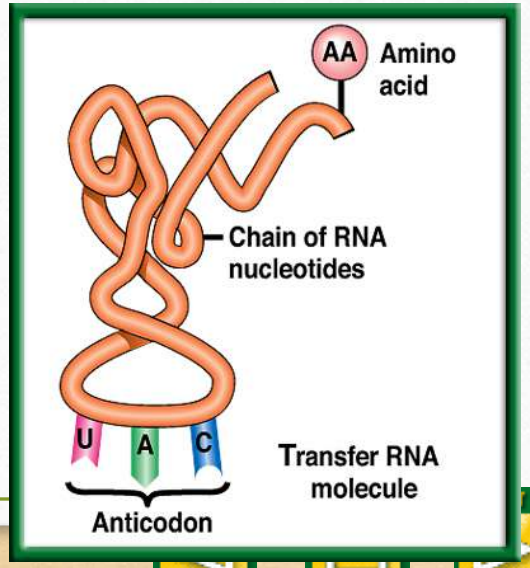


#2. The role of transfer RNA - tRNA

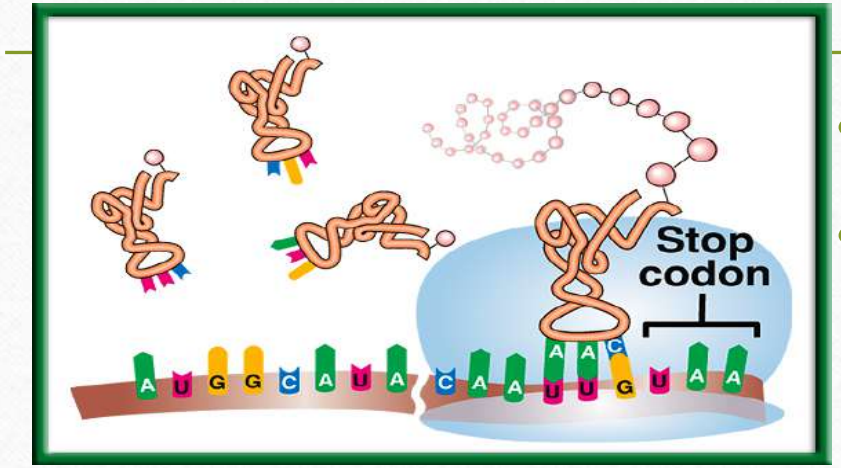
As **translation** begins, a ribosome attaches to the starting end of the mRNA strand. Then, **tRNA** molecules, each **carrying a specific amino acid**, approach the ribosome.

When a **tRNA anticodon pairs with the first mRNA codon**, the two molecules temporarily join together.

Usually, the first codon on mRNA is AUG, which codes for the amino acid methionine.



#3. Stop Codons



- Without the stop codon, the protein would continuously be made.
- More Protein is not necessarily better.
- Name the 3 codons for STOP:
  - UAA, UAG, UGA

The Genetic Code P.292 BB

The Messenger RNA Genetic Code

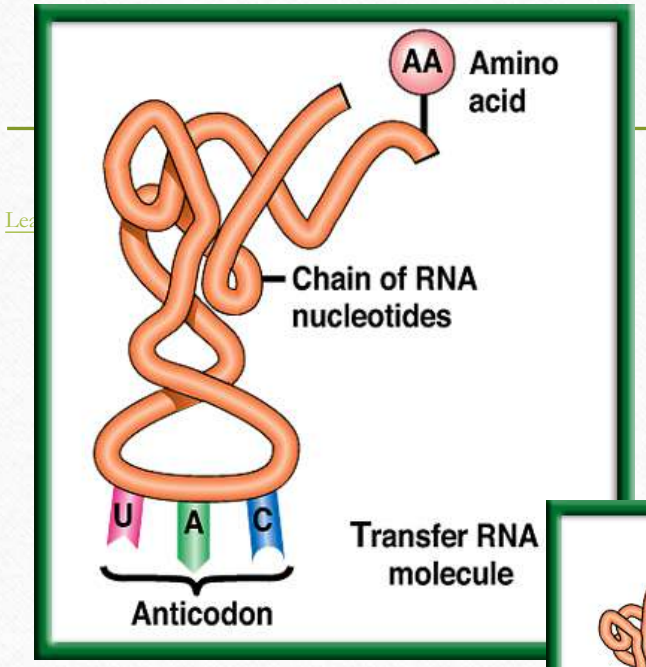
First Letter	Second Letter				Third Letter
	U	C	A	G	
U	Phenylalanine (UUU)	Serine (UCU)	Tyrosine (UAU)	Cysteine (UGU)	U
	Phenylalanine (UUC)	Serine (UCC)	Tyrosine (UAC)	Cysteine (UGC)	C
	Leucine (UUA)	Serine (UCA)	Stop (UAA)	Stop (UGA)	A
	Leucine (UUG)	Serine (UCG)	Stop (UAG)	Tryptophan (UGG)	G
C	Leucine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

END OF SLIDE

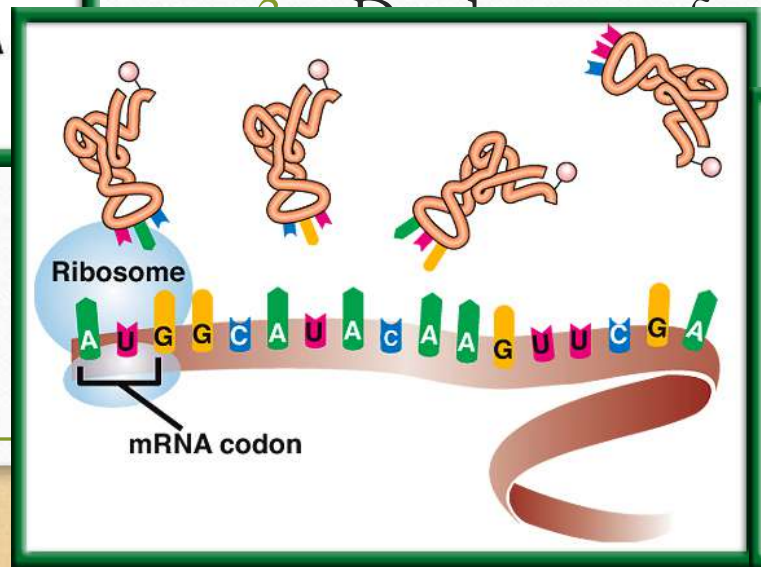
? PREVIOUS SLIDE TABLE OF CONTENTS NEXT SLIDE RESOURCES

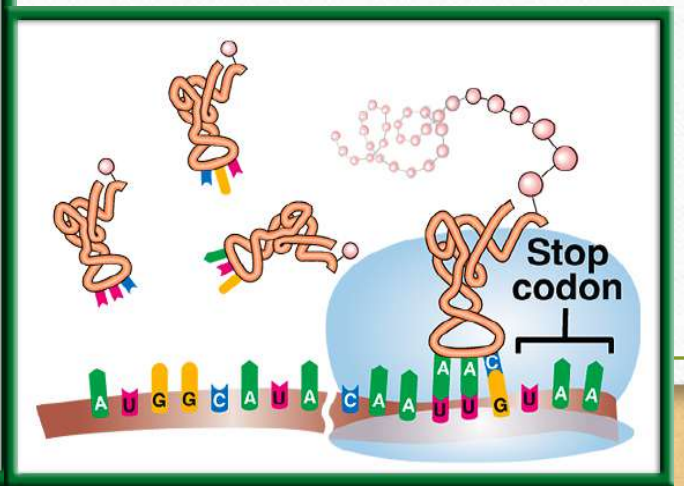
10/9 **Protein Synthesis: Translation** 11.2

Obj. TSW explain the process of Protein Synthesis by diagramming all the steps in their notebook. P. 78 NB



1. When making proteins, If a template DNA strand read TAC GGT, AGT what would a complementary strand of mRNA be?
2. What Amino Acids would the 3 codons code for?
3. [illegible]: GCA, TGC, ATC

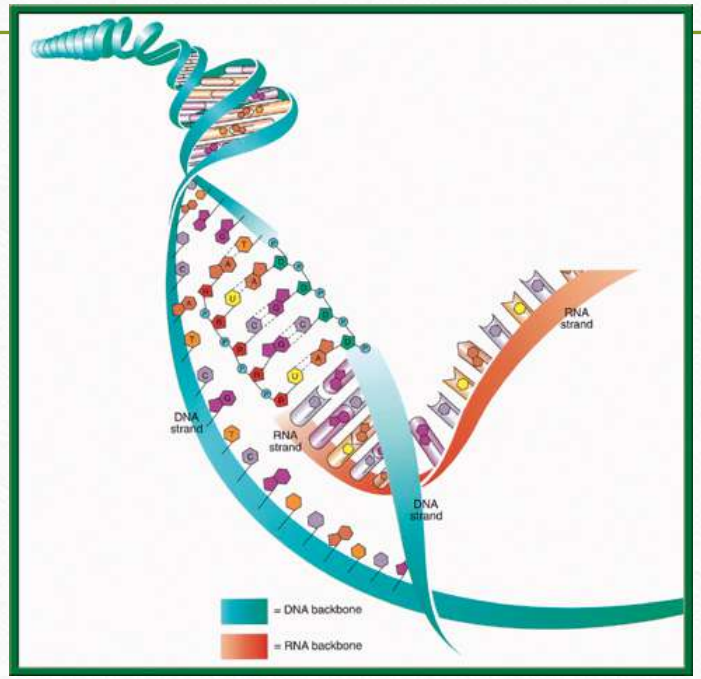


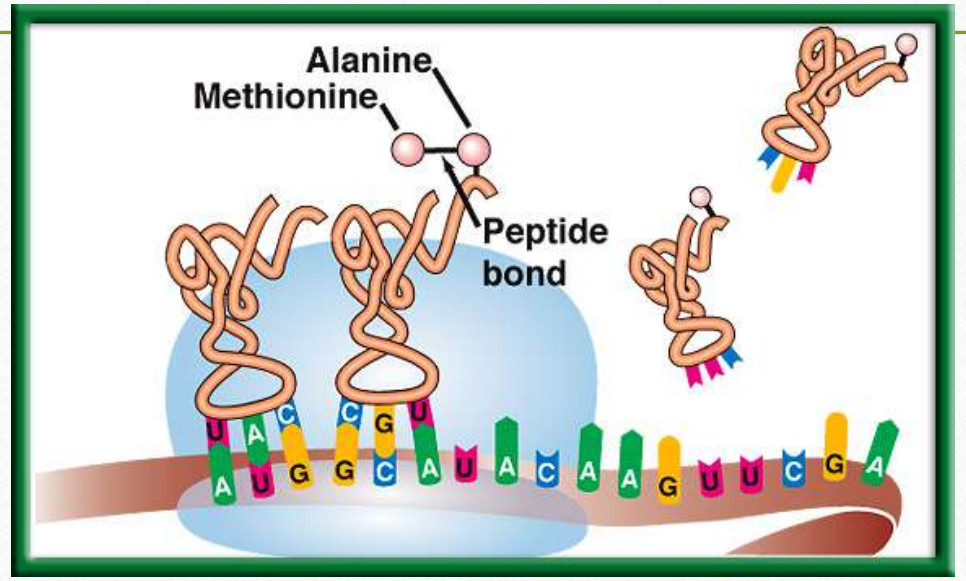


Protein Synthesis

DNA -> **transcription** -> RNA -> **translation** -> proteins

p. 59 NB





Mini Lab 11.1 P. 67NB P. 293 BB

DNA → transcription →RNA →translation → Protein

- Copy this table in your notebook.

	A	B	C	D	E
DNA Base Sequence	Process	mRNA Codon	Process	tRNA Anticodon	Amino Acid
AAT					
GGG					
ATA					
AAA					
GTT					

Mini Lab 11.1 P. 67 NB P. 293 BB

DNA → transcription →RNA →translation → Protein

	A	B	C	D	E
DNA Base Sequence	Process	mRNA Codon	Process	tRNA Anticodon	Amino Acid
AAT	Transcription	UUA	Translation	AAU	Leucine
GGG		CCC		GGG	Proline
ATA		UAU		AUA	Tyrosine
AAA		UUU		AAA	Phenylalanine
GTT		CAA		GUU	Glutamine

Answer Analysis Questions 1 – 3

1. A.DNA instructions are located in the nucleus.

b. Transcription happens in the nucleus.

c. Translation happens in the Ribosome.

4. tRNA looks like a triangle with an Amino Acid on the end, and the other side has the Anticodon that base pairs with the codon on the mRNA.

5. Mutations would be more common, if the sequence of DNA was not strictly adhered to.

The Genetic Code

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

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Molecular Genetics p. 69 NB

DNA Replication – make more DNA for more cells to replace other cells.

DNA-DNA

A = T

T = A

C ≡ G

G ≡ C

Protein Synthesis – to make proteins

DNA RNA

A = U

T = A

C ≡ G

G ≡ C

Protein Synthesis

DNA: TAC CAC AAC

Transcription (nucleus)

mRNA: AUG GUG UUG

Translation (ribosome)

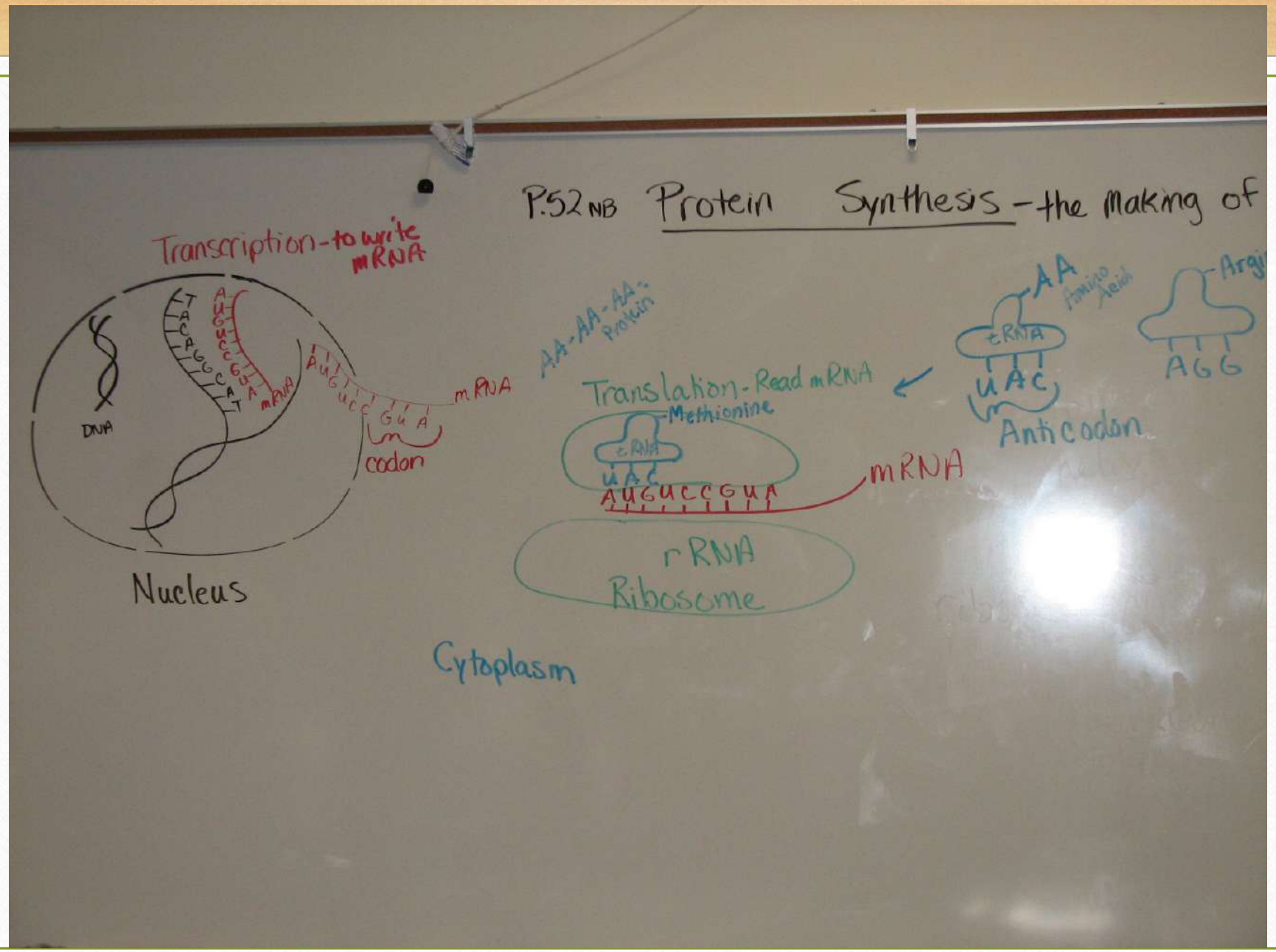
Protein: Methionine, _____, _____ Amino Acid Sequence

Protein Synthesis

Transcription Practice p. 69NB

- **Directions:** Using the DNA strand as a template, transcribe mRNA. Make sure to use the correct Nitrogen bases.

1. ATA CCT TAA CGC GTC
2. TAT TAG GCA AAA TTC
3. GTG TGA TTA ATA GCC
4. CTA AAG GAA TAG GAT
5. GAT GAA TAC CCA CGA
6. TAA TAT GCA CAT TAC
7. GAA CCT TAC GGG GTG
8. TAT AAC CAG GAG TTT
9. ATC CGT AGT GTA AAT
10. GGA TTA CCC TTA CCA


P.52 NB Protein Synthesis - the making of
Transcription - to write mRNA
DNA
mRNA
codon
Nucleus
AA-AA-AA-
Protein
Translation - Read mRNA
Methionine
tRNA
UAC
AUGUCCGUA
mRNA
rRNA
Ribosome
Cytoplasm
AA
Amino Acid
tRNA
UAC
Anticodon
AGG

Protein Synthesis – Gene Expression

1. DNA: ATA CCT TAA CGC GTC

2. DNA: TAT TAG GCA AAA TTC

AXES Paragraph P. 71 NB

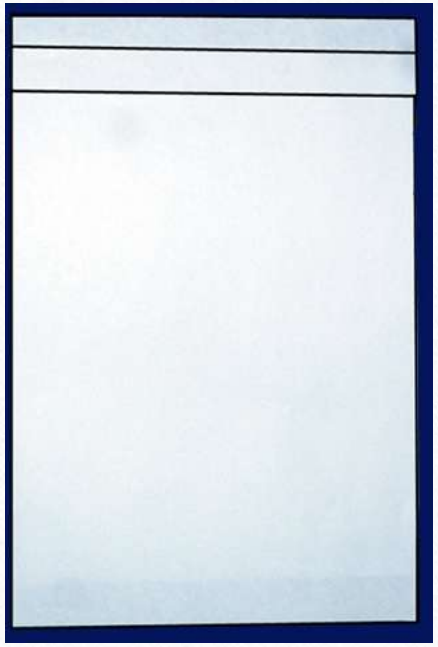
- Write a paragraph after building your DNA molecule that include the vocabulary words: Double helix, Nitrogen bases, Hydrogen bond, Nucleotide, Backbone, Deoxyribose, Phosphate, Adenine, Thymine, Cytosine, Guanine.

STEP 1

Collect 3 sheets of paper and layer them about 1.5 cm apart vertically. Keep the edges level.

P. 53 NB

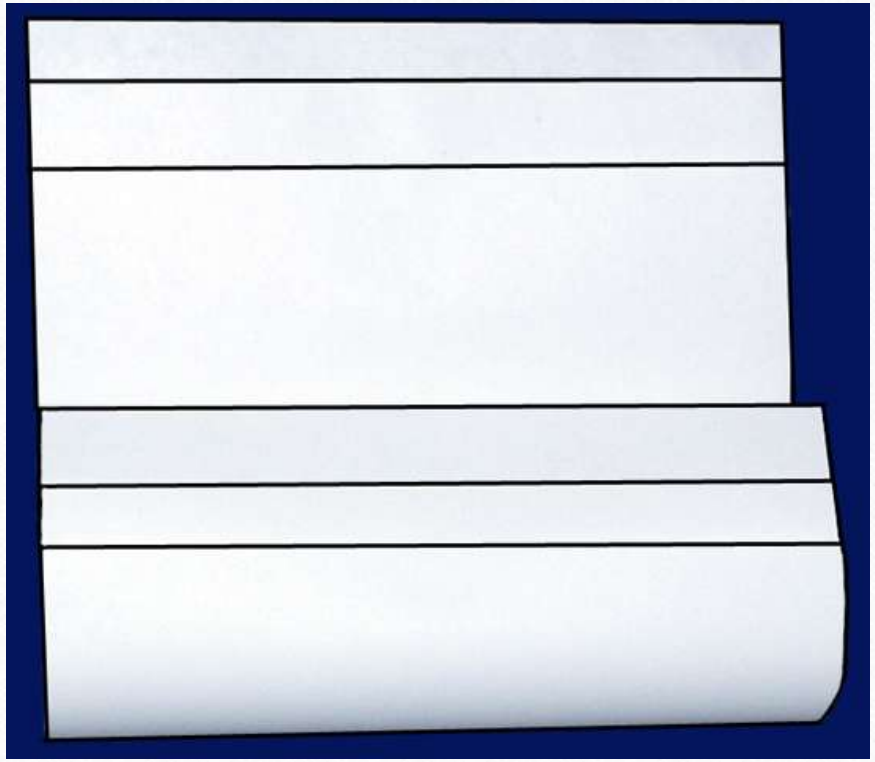
FOLDABLES™ Study Organizer



To return to the chapter summary click escape or close this document.

STEP 2

Fold up the bottom edges of the paper to form 6 equal tabs. P. 53NB



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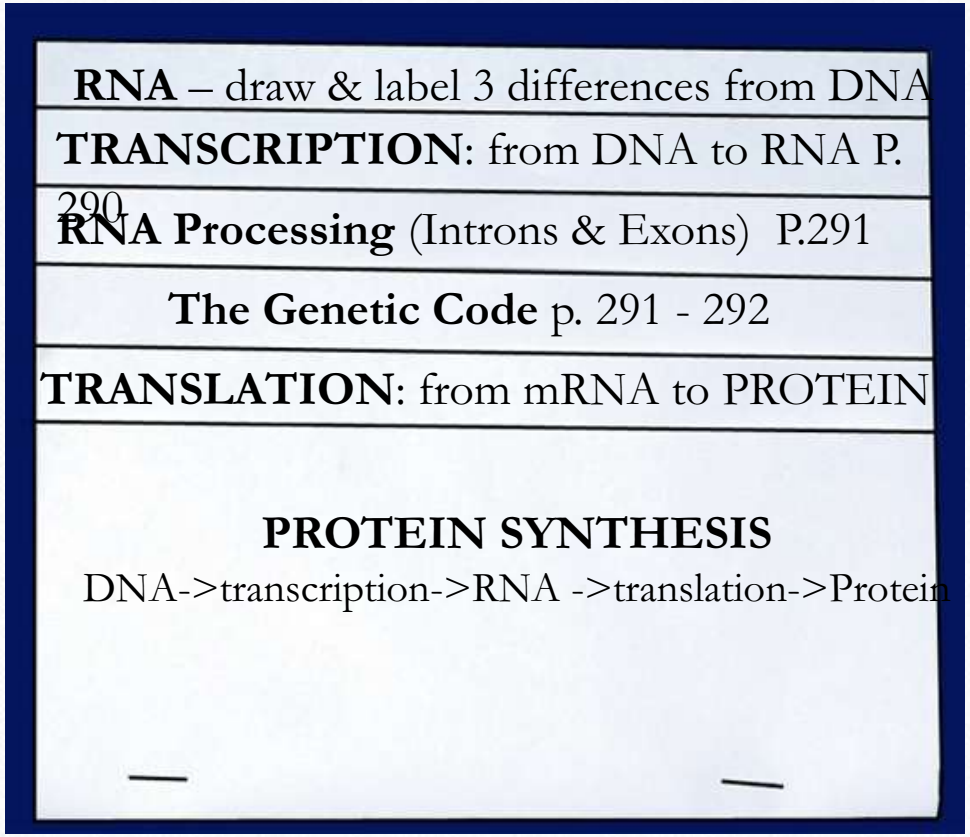
Chapter 11

Foldables Study Organizers

STEP 3

Fold the papers and crease well to hold the tabs in place. Staple along the fold. **Label** each tab. P. 53NB



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