CORNELL NOTES
Directions: You must create a minimum of 5 questions in this column per page (average). Use these to study your notes and prepare for tests and quizzes. Notes will be stamped after each assigned sections (if completed) and turned in to your teacher at the end of the Unit for scoring.

UNIT 3: INTRODUCING BIOLOGY
Chapter 8: From DNA to Proteins

I. Identifying DNA as the Genetic Material (8.1)

A. Griffith finds a "**transforming principle**"

1. Griffith experimented with the _____that cause pneumonia.

2. He used **two forms** and _____ them into mice

a. The S, or smooth form (_____)

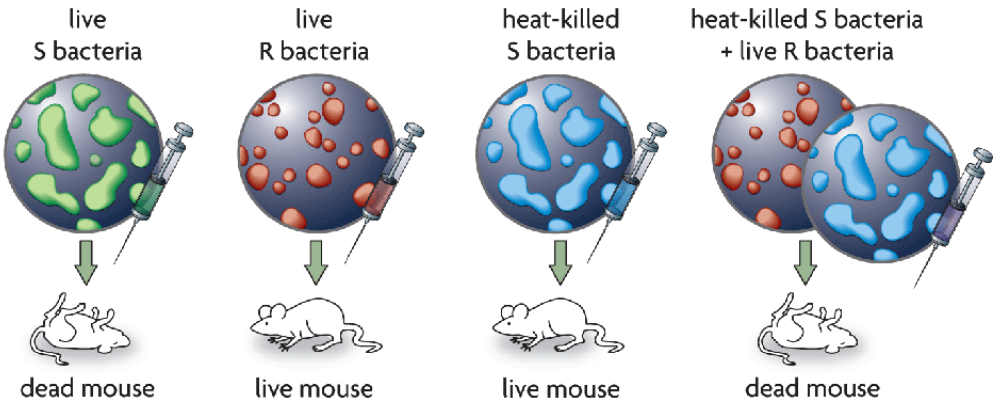
b. R form, or rough (**not** _____).

3. S form or bacteria **killed with** _____ mice **unaffected**

4. Injected mice with **combination of heat-killed and live R bacteria**

a. **Mice** _____

b. Griffith concluded that a **transforming material** passed from dead S bacteria to live R bacteria, making them deadly.



B. Avery identifies _____ as the **transforming principle**

1. Experimented with R bacteria and _____ made from S bacteria

2. Allowed them to observe transformation of R bacteria

3. Developed process to _____ **their extract**

a. Performed series of tests to find out if transforming principle was _____ or _____

b. Performed **chemical tests** that showed no _____ were present.

c. Test revealed that _____ **was present**

4. Performed tests with _____

a. Added enzymes to break down **proteins**- **transformation** _____ **occurred**.

b. Added enzymes to break down **RNA**- **transformation** _____ **occurred**.

c. Added enzymes to break down **DNA**- **transformation** _____ **to occur**.

d. **Concluded** _____ **was transforming factor**

C. Hershey and Chase confirm that DNA is the genetic material

1. Alfred Hershey and Martha Chase provided conclusive evidence that _____ **was the genetic material** in 1952

2. Studied _____ that infect bacteria (**bacteriophage**)

a. Bacteriophage is simple- **protein** _____ surrounding **DNA** _____

1). **Proteins** contain _____ buy **very little phosphorus**

2).. **DNA** contains _____ and **very little sulfur**

b. **Experiment No.1**- Bacteria infected with phages with **radioactive sulfur** atoms- **no radioactivity inside** _____

c. **Experiment No.2-** Bacteria infected with phages with **radioactive phosphorus** atoms- **radioactivity found inside** _____

d. Concluded phages _____ had entered bacteria but _____ had not. **Genetic material must be DNA**

II. Structure of DNA (8.2)

A. **DNA** is composed of _____ **types of nucleotides**

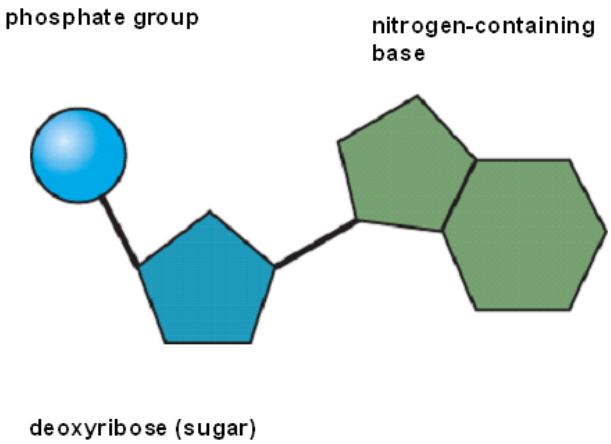
1. **DNA** is long _____ composed of _____ called **nucleotides**.

a. Each nucleotide has _____ parts

1). _____ **group**

2). Ring-shaped _____ called **deoxyribose**

3). _____**-containing base**



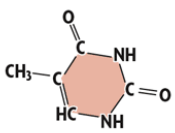
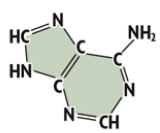
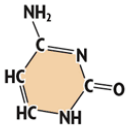
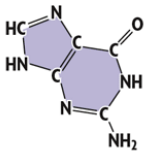
b. Scientists first believed that DNA was made of equal parts of four different nucleotides (same in all organisms

2. In 1950 Erwin Chargaff changed thinking by analyzing _____ of several different organisms

a. Found **same four** _____ of DNA **in all organisms**

b. _____ of 4 bases were **different** in organisms

c. Found amount of adenine equals thymine and amount of cytosine equals amount of guanine. __ **=** __ **and** __ **=** __ (called _____ **rules**)

PYRIMIDINES = SINGLE RING			PURINES = DOUBLE RING		
Name of Base	Structural Formula	Model	Name of Base	Structural Formula	Model
thymine			adenine		
cytosine			guanine		

B. Watson and Crick developed accurate model of DNA's _____-dimensional structure

1. Used previous work of other scientists and hypothesized that DNA might also be a **helix**

a. Rosalind **Franklin** and Maurice **Wilkins** used **x-ray crystallography** and suggested DNA _____ **shape**

b. Work of Hershey, Chase, Chargaff, and Linus Pauling

2. In _____ Watson and Crick published their **DNA model** in a paper in the journal Nature

a. **DNA was** _____ _____

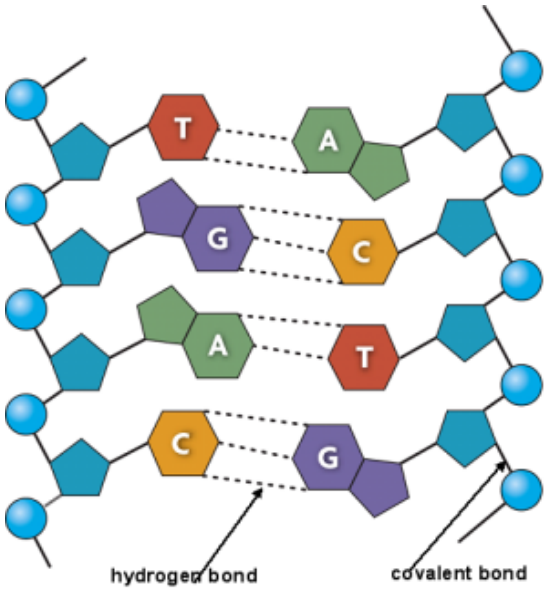
b. Strands are _____ (they fit together and are the opposites of each other- **pairing of bases according to Chargaff's rules**

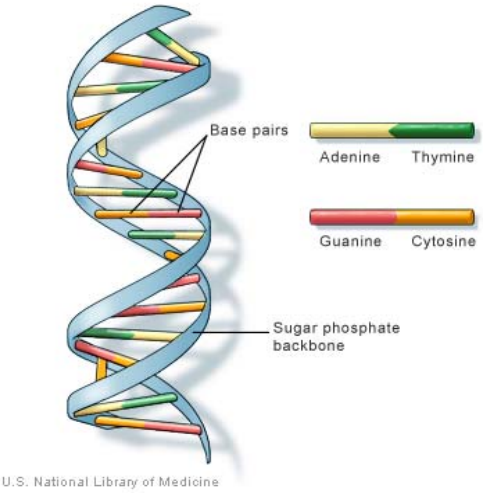
3. Nucleotides always _____ in the same way

a. **Backbone formed by** _____ bonds that connect _____ of one nucleotide to _____ of another

b. **Two sides** held together by **weak** _____ **bonds between bases**

c. **Base pairing rules- A with** __ and **C with** __





III. DNA Replication (8.3)

A. Replication copies the _____ information

1. **Replication** creates **exact** _____ of itself during the _____ cycle

2. Replication assures every cell has complete set of identical _____ information

B. Proteins (_____) carry out the process of **replication**

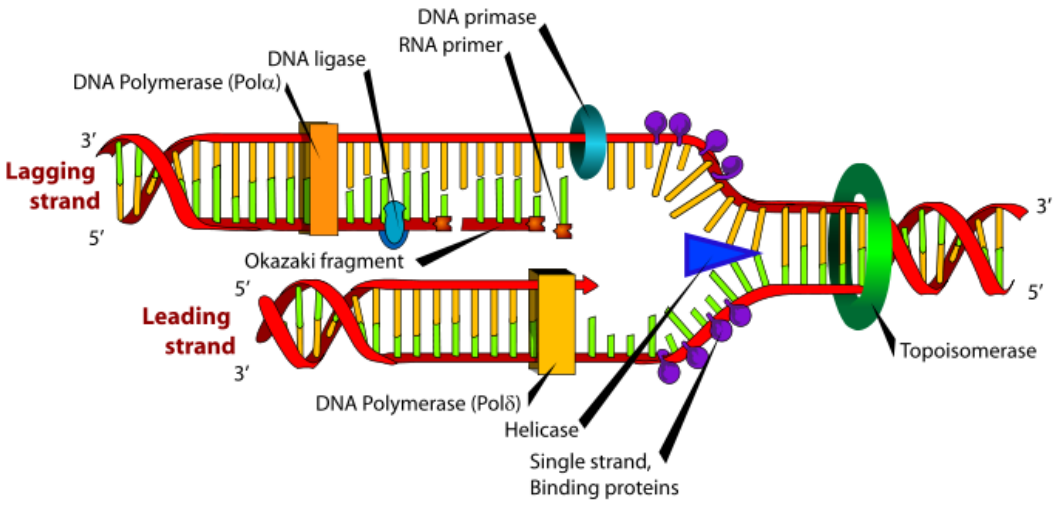
1. **Enzymes** begin to _____ **double helix** (DNA polymerases)

a. _____ bonds are broken

b. Molecule separates exposing _____

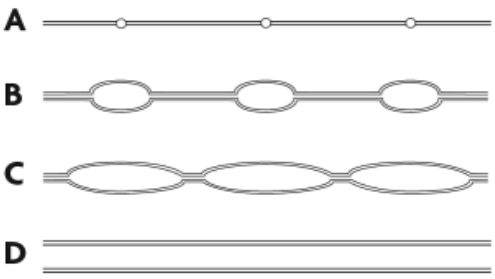
2. **Free-floating nucleotides** pair up one-by-one forming _____ strands to template

3. **Two** _____ **molecules of DNA formed**



C. **Replication** is _____ and _____

1. Process takes just a few hours



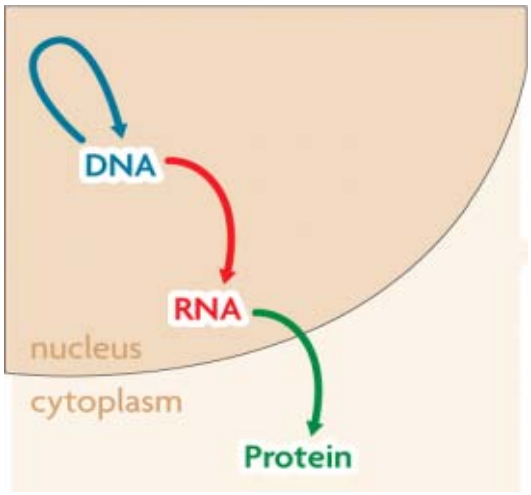
2. DNA replication **starts at many points** in eukaryotic chromosomes.

3. DNA polymerases can **find and** _____ **errors**.

IV. Transcription (8.4)

A. _____ carries DNA's instruction

1. Francis Crick defined the **central dogma of molecular biology**



a. _____ **copies DNA**

b. _____ **converts DNA message into intermediate molecule, called RNA**

c. _____ **interprets an RNA message into string of amino acids, called polypep-tide (protein)**

2. In **prokaryotic cells** processes take place in _____

3. In **eukaryotic cells** processes are _____

a. **Replication** and **Transcription** in _____

b. _____ occurs in **cytoplasm**

4. RNA acts as _____ between nucleus and protein synthesis in cytoplasm

5. RNA differs from DNA in _____ significant ways

a. Sugar in RNA is _____ not deoxyribose

b. RNA has the base _____ in place of thymine

c. RNA is _____ **stranded** not double

B. Transcription makes three types of _____

1. Transcription copies sequence of _____ (one **gene**) and is catalyzed by RNA polymerases

a. DNA begins to _____ at specific site (gene)

b. Using **one strand of DNA**, _____ strand of **RNA** is produced

c. RNA strand detaches and DNA reconnects

2. Transcription produces ___ kinds of RNA

a. **Messenger RNA (mRNA)-** _____ for translation

b. **Ribosomal RNA (rRNA)-** forms part of _____

c. **Transfer RNA (tRNA)-** brings _____ _____ from the cytoplasm to a ribosome to help make growing _____

3. The transcription process is similar to replication

a. Both occur in _____

b. Both involve unwinding of _____

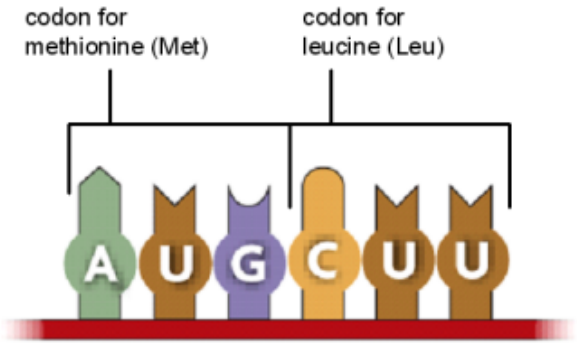
c. Both involve _____ base pairing

V. Translation (8.5)

A. **Amino acids** are **coded** by _____ **base sequences**

1. Translation **converts mRNA** messages into _____

2. A _____ is a sequence of **three nucleotides** that codes for an **amino acid.**



Segment of mRNA

a. RNA could code ____ **different combinations**

b. Plenty to cover the ____ **amino acids** used to build proteins in human body and most other organisms

c. Many amino acids coded by more than one _____

d. Also special codons

1). _____ **codon**- signals start of translation

2). _____ **codon**- signals end of amino acid chain

The genetic code matches each RNA **codon** with its amino acid or function.

First base	Second base U	Second base C	Second base A	Second base G	Third base
U	UUU phenylalanine (Phe)	UCU serine (Ser)	UAU tyrosine (Tyr)	UGU cysteine (Cys)	U
	UUC	UCC	UAC	UGC	C
	UUA leucine (Leu)	UCA	UAA STOP	UGA STOP	A
	UUG	UCG	UAG STOP	UGG tryptophan (Trp)	G
C	CUU leucine (Leu)	CCU proline (Pro)	CAU histidine (His)	CGU arginine (Arg)	U
	CUC	CCC	CAC	CGC	C
	CUA	CCA	CAA glutamine (Gln)	CGA	A
	CUG	CCG	CAG	CGG	G
A	AUU isoleucine (Ile)	ACU threonine (Thr)	AAU asparagine (Asn)	AGU serine (Ser)	U
	AUC	ACC	AAC	AGC	C
	AUA	ACA	AAA lysine (Lys)	AGA arginine (Arg)	A
	AUG methionine (Met)	ACG	AAG	AGG	G
G	GUU valine (Val)	GCU alanine (Ala)	GAU aspartic acid (Asp)	GGU glycine (Gly)	U
	GUC	GCC	GAC	GGC	C
	GUA	GCA	GAA glutamic acid (Glu)	GGA	A
	GUG	GCG	GAG	GGG	G

1. Find the first base, C, in the left column.
2. Find the second base, A, in the top row. Find the box where these two intersect.
3. Find the third base, U, in the right column. CAU codes for histidine, abbreviated as His.

3. This **code is** _____- same in almost all organisms

a. Suggests **common** _____

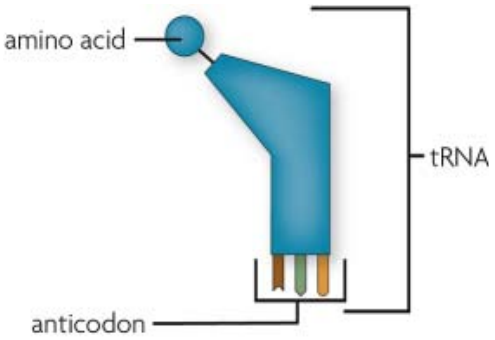
b. Means scientist can insert gene from one organism into another to make functional protein

B. **Amino acids** are <u>linked</u> to become a _____

1. Two important "tools" needed to translate a codon into an amino acid

a. _____- site of protein synthesis

b. **tRNA**- carries free-floating _____ _____ from cytoplasm to **ribosome**



1). tRNA attaches to specific _____ _____

2). Has "3-letter" _____ that recognizes a specific **condon**

2. Translation occurs in _____ of cell

a. **mRNA** binds to _____

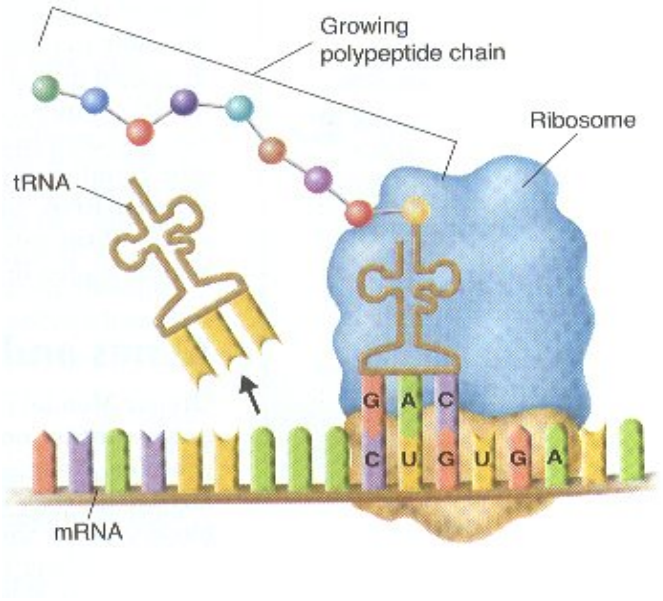
b. _____ pulls mRNA strand through **one codon at a time**

c. Exposed codon attracts _____ **tRNA** bearing an **amino acid**

d. **Amino acids** _____ **together** and tRNA molecule leaves to find another amino acid

e. Ribosome moves down mRNA attaching more amino acids until reaches _____ codon.

f. Then lets go of **protein**



VI. Gene Expression and Regulation (8.6)

A. Your cells can control when gene is “turned on or off”

B. Different in _____ and _____ cells

C. Because cells are specialized in multicellular organisms, only certain _____ are expressed in each type of cell.

VII. Mutations (8.7)

A. Some mutations affect a **single** _____, while others affect an **entire** _____

1. **Mutation**- a change in an organism's _____

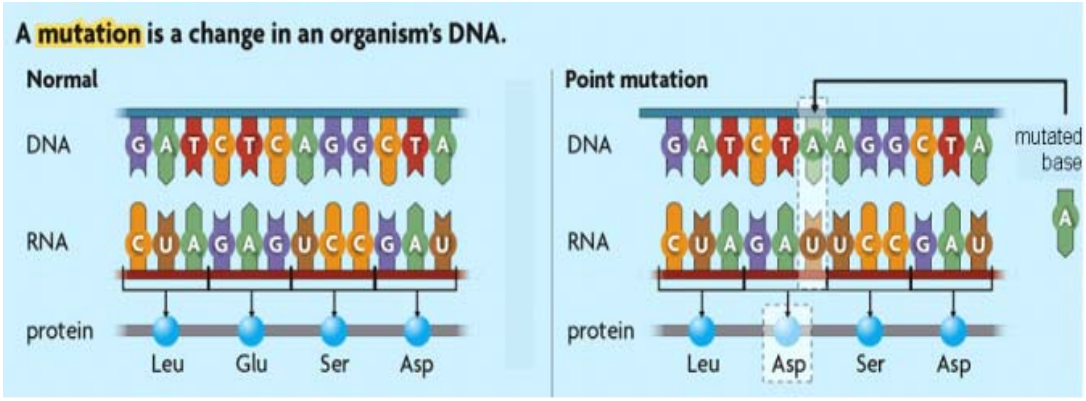
2. **Mutations** that affect a **single gene** usually happen during _____

3. **Mutations** that affect **group of genes** or **chromosome** happen during _____

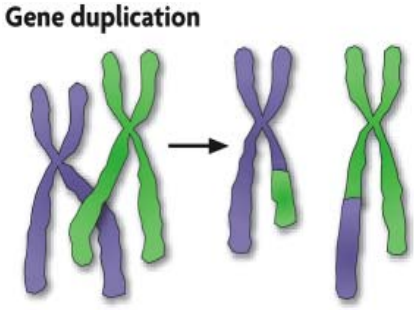
B. **Gene Mutations**

1. _____ **mutation**- one nucleotide is substituted for another

2. _____ **mutation**- involves insertion or deletion of a nucleotide in DNA sequence

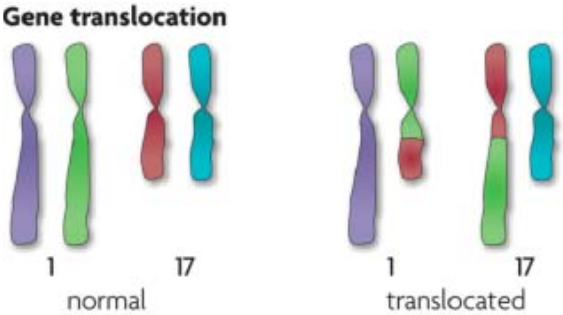


3. **Chromosomal mutations**-



a. **Gene duplication**-exchange of DNA segments through _____ over during meiosis

B. **Gene translocation**- results from the exchange of DNA segments between _____ chromosomes



C. **Mutations** may or may not affect _____

1. Impact on phenotype-

a. **Chromosomal mutations** affect many genes and have _____ **affect on organism**

b. Some gene mutations change phenotype.

1. A mutation may cause a premature **stop** _____**.**

2. A mutation may change **protein** _____ or the _____ **site**

3. A mutation may change _____ **regulation**

c. Some gene mutations do not affect phenotype

1. A mutation may be _____

2. A mutation may occur in a **noncoding** _____

3. A mutation may not affect _____ **folding** or the **active site**.

2. Mutations in _____ **cells** do not affect offspring.

3. Mutations in **sex cells** can be _____ or _____ to offspring.

4. **Natural selection** often removes mutant alleles from a population when they are less _____.

D. Mutations can be caused by several factors

1. _____ **errors** can cause mutations

2. _____, such as UV ray and chemicals, can cause mutations

3. Some _____ **drugs** use **mutagenic properties** to kill _____ cells.