DNA → RNA → PROTEIN NOTES

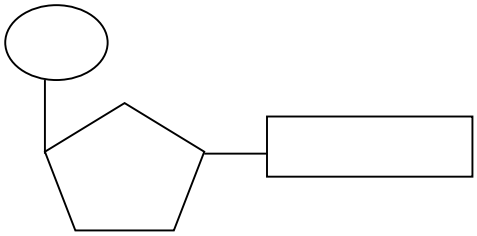
THE DISCOVERY AND STRUCTURE OF DNA (SB2a)

SCIENTISTS	WHEN?	IMPORTANT DISCOVERY
Frederick Mieshcer		Discovered _____ in the _____ white blood cells
Phoebus Levene		Determined the _____ of DNA First to use the term _____ Discovered the sugars _____ (RNA) and _____ (DNA)
Oswald Avery		Discovered that _____ transmitted _____ information not _____
Erwin Chargaff		Determined that nucleotides always appeared in the same _____: • amount of _____ = amount of _____ • amount of _____ = amount of _____
Alfred Hershey and Martha Chase		Confirmed that DNA was the genetic material using _____ DNA and proteins in _____ (viruses that infect _____)
Rosalind Franklin		Used *X-ray crystallography* to make an _____ of DNA _____ which showed DNA had ___ strands and was _____ (twisted)
James Watson and Francis Crick		Used the work of other scientists to create a _____ of DNA Determined the _____ structure of the DNA molecule Determined that DNA is a _____

What is DNA?

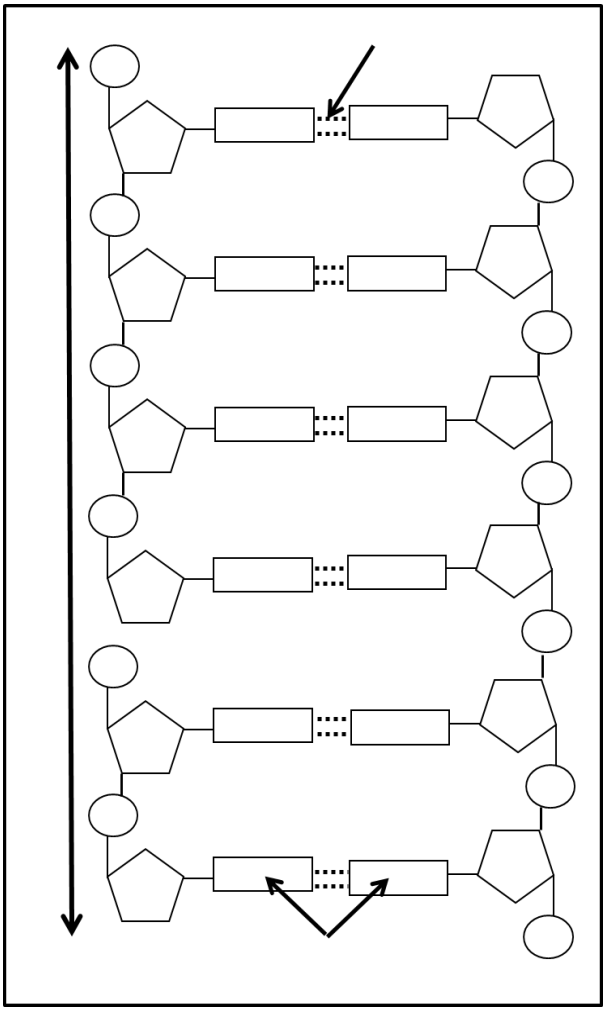
- ***DNA*** – a _____ _____ that stores an organism's _____ information
  - DNA stands for _____
  - Is made of _____
    - Gene – a _____ of _____ that codes for a particular _____, which produces a _____.
  - DNA provides _____ for inherited _____
- Made of _____ - the building blocks (or _____) of _____
  - 3 main parts
    - A _____ group
    - A _____ molecule
      - The sugar in DNA is _____
    - A nitrogen _____
      – Adenine (___) – Cytosine (___)
      – Guanine (___) – Thymine (___)

NUCLEOTIDE STRUCTURE



The Structure of DNA

- ***DOUBLE HELIX*** – 2 _____ strands that are linked in the _____ and _____ around each other
    - The strands are _____ (fit together like _____)
    - The two strands are assembled (_____) in _____ directions
- *DNA Backbone* – made of alternating _____groups and _____molecules
- *Rungs of the DNA Ladder* – The nitrogen bases _____ _____ and _____ the two strands
    - The _____ information is stored in the _____ of the _____.
- DNA Base Paring Rules
    - ***A*** pairs with ____. o ***G*** pairs with ____.
- *Hydrogen bonds* between _____ _____ hold connect the _____ strands of _____.
    - Represented by _____ because they are _____ (like magnets) not true bonds.
    - Can be broken to allow the information _____ in DNA to be used to make _____.



DNA REPLICATION

What is DNA Replication?

- Why does the cell copy its DNA?
    - To produce _____ cells with _____ the same _____
- When does the cell copy its DNA? During _____
- ***DNA replication*** – the process of _____ a _____ of the cell's _____

How does DNA replicate (copy)?

1. DNA _____ and _____.
    - *DNA helicase* – breaks the _____ and _____ the strands
2. New _____ are added to _____ new strands of _____.
    - *DNA polymerase* – _____ the DNA strand and _____ the new strand by adding new _____

Semiconservative

- What does it mean to conserve?
- The _____ strand is used as a _____ to build the _____ strand
- After replication, each DNA molecule has ___ _____ strand and ___ _____ strand.

Let's Practice copying DNA

- Remember in DNA A ↔ ___ G ↔ ___
- ATG CGC TAC GTA CTA
- CGC GTA TAT ACG GCT AGC

TRANSCRIPTION AND TRANSLATION (DNA → RNA → PROTEIN)

What is RNA? _____

Why is RNA needed?

- DNA contains the _____ for the proteins, but DNA cannot _____
- Proteins are made on the _____ which are in the _____
- RNA carries the _____ message to the _____

How is RNA different from DNA?

Differences	**DNA**	**RNA**
How many strands of nucleotides?		
What is the sugar molecule?		
Nitrogen Bases?		

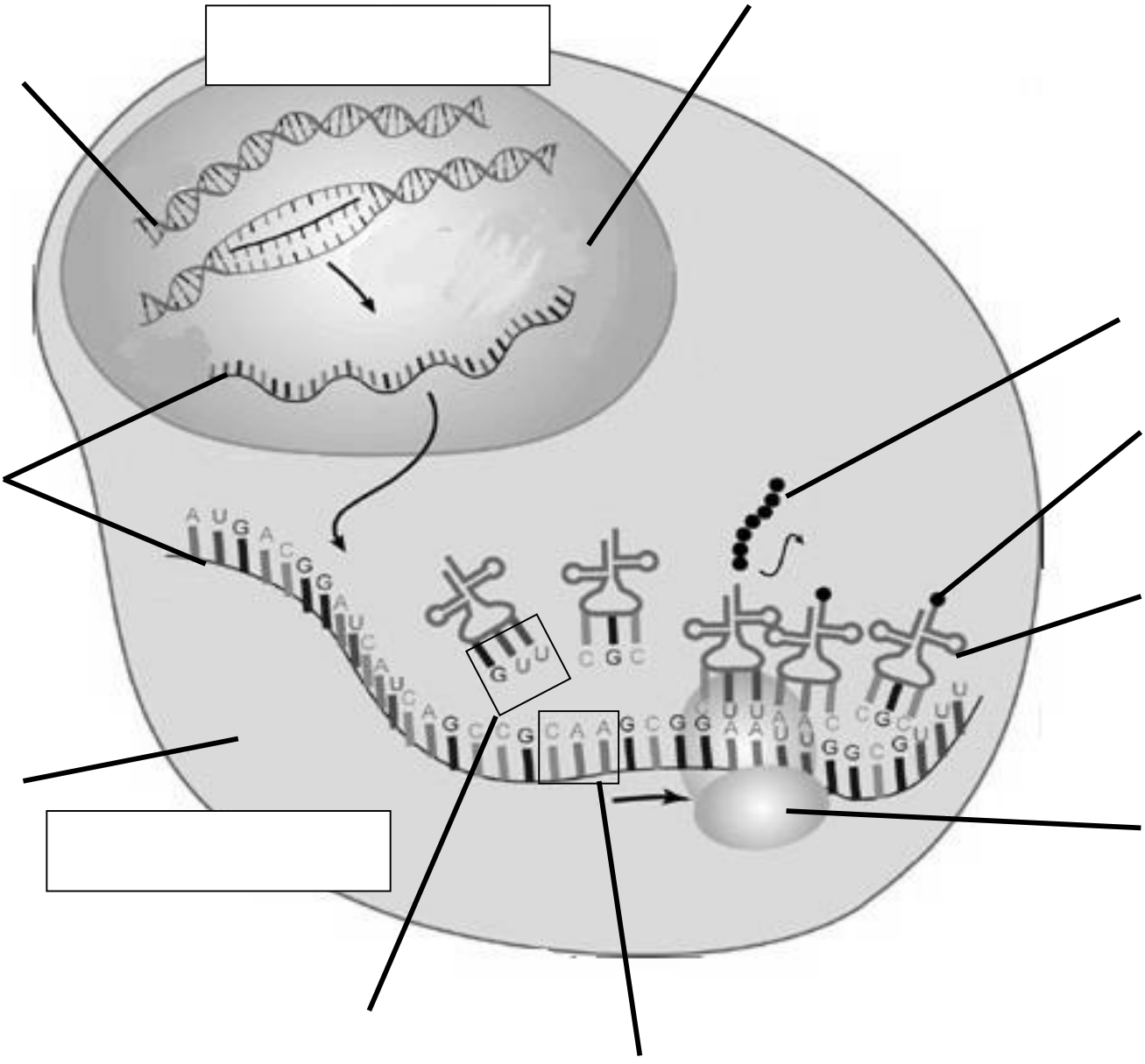
Three Types of RNA

TYPE OF RNA	**FUNCTION**	**INVOLVED IN: (PROCESSES)**
_____ (Messenger RNA)	Carries the _____ information from _____ in the _____ to the _____in the _____	
_____ (Transfer RNA)	Reads the _____ and _____ the code into _____	
_____ (Ribosomal RNA)	Makes up part of the _____	

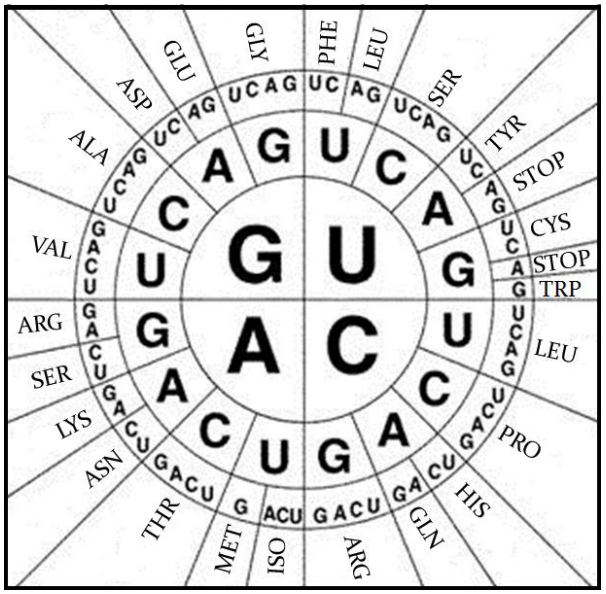
How does a GENE become a PROTEIN? *PROTEIN SYNTHESIS:* _____ _____

- ***Gene*** – a _____ of _____ that codes for a particular _____, which in turn codes for a _____.

- ***TRANSCRIPTION*** – making _____ from the _____ in _____
  - Takes place in the _____
  - The enzyme, _____, copies the DNA into _____
  - mRNA leaves the nucleus through _____.



- ***TRANSLATION*** – using the _____ in _____ to build a _____
  - Takes place in the _____
  - Does not require _____
  - mRNA carries the message to the _____ were the _____.
  - The mRNA is read _____ at a time
    - ***Codon*** – a _____ nucleotide sequence found on the _____ that corresponds to a particular amino acid
  - The _____ on the tRNA matches to the _____ on the mRNA
    - ***Anticodon*** – the _____ of the codon
  - The tRNA with the correct _____ attaches its _____ to the growing _____ to build the _____.



Let's Practice #1

DNA → **TAC GCT ATC GAG ATC**

mRNA →

AA →
(Protein)

MUTATIONS

WHAT ARE THE EFFECTS OF MUTATIONS?

- Mutations may _____, _____, or have ____ _____.
- Depends on _____ the mutation occurs
- Depends on _____ DNA is affected

WHAT IS A MUTATION?

- ***Mutation*** – a change in the _____ or _____ of the genetic material in an organism

WHAT CAUSES MUTATIONS?

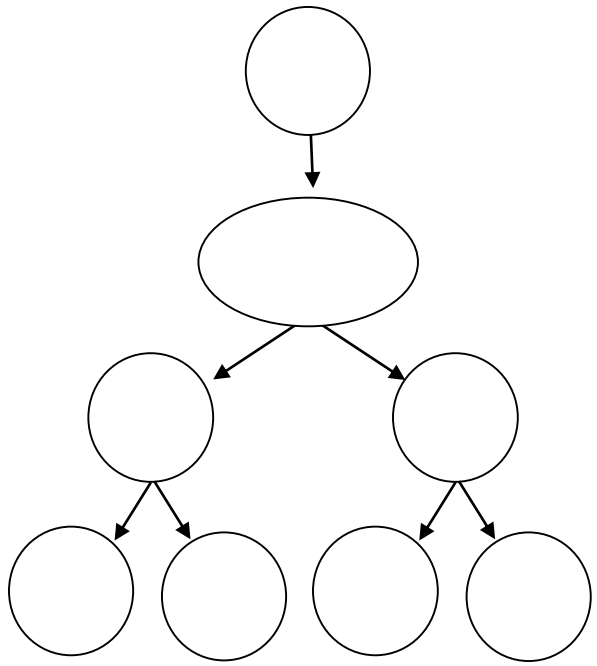
- _____ during DNA _____
- Mutagens – cause _____ to _____ shape so that the DNA_____ incorrectly
  - Examples:

ARE MUTATIONS INHERITED FROM PARENTS?

- Mutations are only _____ if the mutation occurs in the _____.

TYPE OF MUTATIONS	Definition	Example of Mutation in the DNA ATG CCA TCG	Result of the Mutation in the protein MET – PRO – SER
Silent	• Causes _____ change to the _____ because it codes for the _____ amino acid	ATG CC __ TCG	Met – – Ser
Missense	• Causes a codon to code for a _____ amino acid	ATG C __ A TCG	Met – – Ser
Nonsense	• Causes a codon to change to a _____ codon • Protein synthesis stops _____ and the protein may not _____	ATG CCA T__G	Met – Pro –
Insertion	• One or more _____ are _____ to the DNA which changes the entire _____ sequence from that point on	ATG __CC ATC G	Met –
Deletion	• One or more _____ are _____ from the DNA which changes the entire _____ sequence from that point on	ATG CAT CG*A*	Met –

CHROMOSOMAL MUTATION

Nondisjunction	• Occurs when _____ chromosomes fail to _____ during _____ • One _____ ends up with an _____ chromosome and one is _____ a chromosome	

DNA TECHNOLOGY NOTES (CH. 15) – SB2F

DNA Technology = _____

- Benefits of DNA Technology → _____, _____, & _____

Is this new? _____

- For thousands of years, _____ have been _____ plants and animals to produce _____ with certain _____
  - What is the called?

Genetic Engineering – transfers _____ from one _____ to _____

- *Recombinant DNA* – an organism's DNA that has another _____ DNA/genes _____to it
- *Transgenic organisms* – organisms with _____ DNA

Recombinant DNA and Medicine

- Human DNA is transferred to a simpler organism like _____ or _____ so that they make the _____ for us (Example: _____)
  - Why bacteria and yeast? They reproduce _____ and _____

DNA Fingerprinting – comparing _____ produced by _____ molecules to determine _____ among _____

- How do we get a DNA fingerprint? _____

Uses of DNA Fingerprinting

- Identifying a child's _____ → the closer the _____ match, the closer the _____
- Forensics – the branch of law enforcement that uses _____ _____ and _____ to solve _____
  - Technicians may collect _____, skin, hair, _____, sperm, etc. that will contain DNA

The Human Genome Project (_____ to _____)

- An international cooperative effort to _____ the entire human _____ and find all the _____ in human DNA.
- Surprising Findings from HGP
  - Humans have only _____ genes (expected over _____)
  - Most human DNA does not code for _____ – only about _____.
  - Many _____ genes are _____ to those of other _____.
  - All humans are _____ close. _____ of your DNA is _____ to everyone else's!!
- What can we do with this information?
  - _____ and _____ diseases
  - Treat _____
  - Gene therapy – replacing _____ genes using genetically engineered _____.

Stem Cell Research

- ***Stem cell*** – a cell that can continuously _____ and _____ into various _____ of the body
- May be used to _____, _____, or _____ diseases.

Cloning

- ***Clone*** – an organism (or cell) that is _____ _____ to a _____ organism
- Clones are produced naturally by _____ reproduction.

How far is too far? Concerns about _____ and _____ _____