Learning Targets

- 1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA) (A)
- 2. Identify the chemical components and overall structure of DNA (B)
- 3. Summarize the events of DNA replication (B)
- 4. Compare RNA and DNA (B)
- 5. Explain the process of transcription (B)
- 6. Identify the genetic code and explain how it is read (B)
- 7. Summarize the process of translation (B)
- 8. Describe the effects different mutations can have on genes (A)

Thursday _ _ 2/14/19

Agenda:

- DNA Notes #1
- Storyline
- Ticker Questions
- No test today – Test Tomorrow!

Warm Up:

- Give a high five to another student.

Learning Target(s) – What you should be able to do by the end of today:

1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA)
2. Identify the chemical components and overall structure of DNA

DNA Storyline List

James Watson
Polymer
Double Helix
Model
X-Ray Photographs
Rosalind Franklin
Maurice Wilkins
Mutation
DNA Polymerase
1962
Nobel Prize in Medicine
Nucleotides
Deoxyribose sugar
Adenine
Nitrogen-containing bases
Complimentary base pairs
Guanine
Thymine
Francis Crick
1953
Hydrogen Bond
Covalent Bond
Single and Double Strand
Cytosine
Phosphate molecules
Genetic information
Chromosome
Replication
Copying
Chargaff's Rule
DNA

DNA, RNA & Protein Synthesis

Chapters 12 & 13

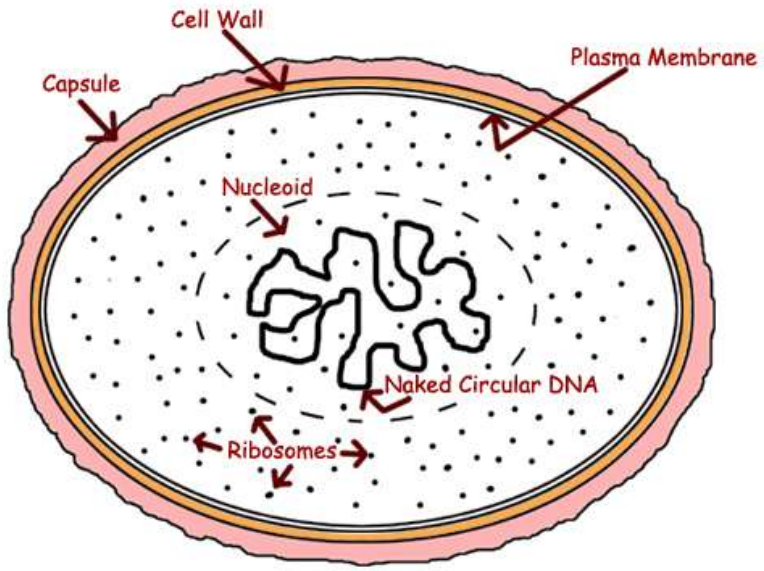
The Structure of DNA

A little History

Year	Scientist(s)	Discovery
1928	Frederick Griffith	Bacteria transfer genetic material from cell to cell.
1944	Oswald Avery, Colin Macleod & Maclyn McCarty	Griffith had discovered DNA!
1950	Erwin Chargaff	Of the four possible nucloetides: As = Ts & Gs = Cs.
1952	Alfred Hershey & Martha Chase	Genetic material in viruses is also DNA.
1952	Rosalind Franklin	Demonstrated that DNA is a helix.
1953	James Watson & Francis Crick	DNA is a double helix.
2000	Craig Venter & Francis Collins	Sequenced human DNA.

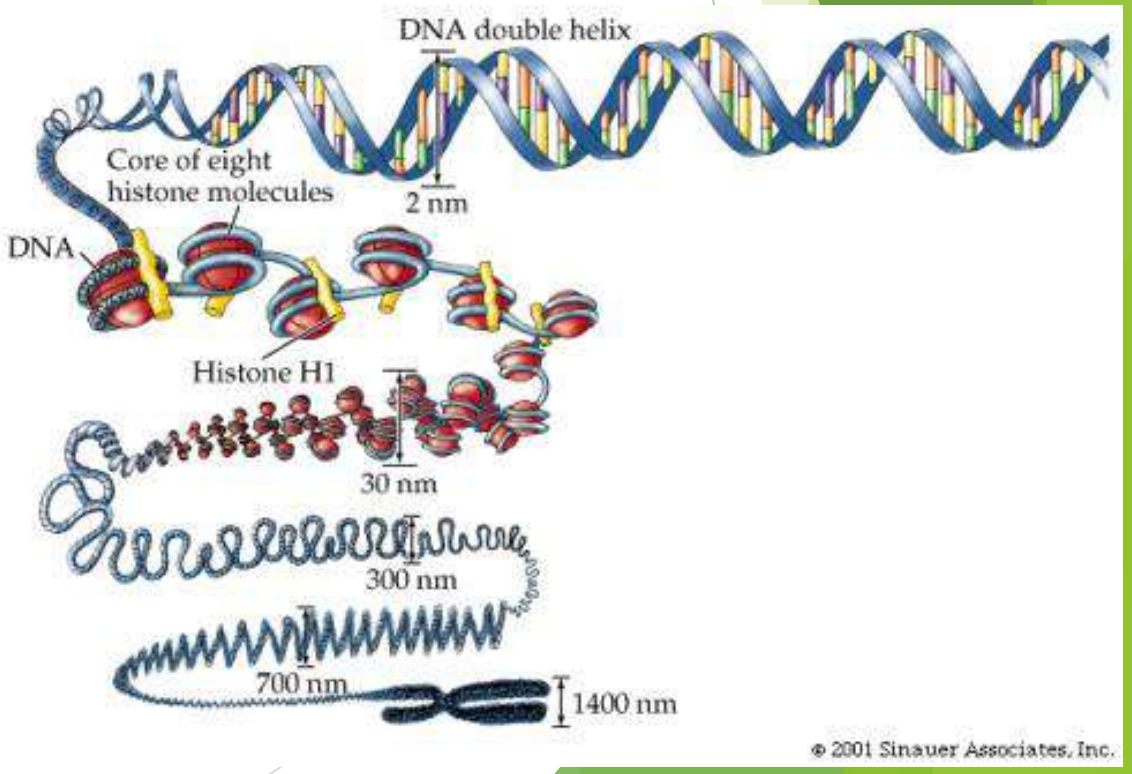
DNA

- DNA stands for Deoxyribose Nucleic Acid.
- In prokaryotes (no nucleus), DNA is circular.



Prokaryotic Cell

- In eukaryotes, DNA is on the chromosomes in the nucleus.



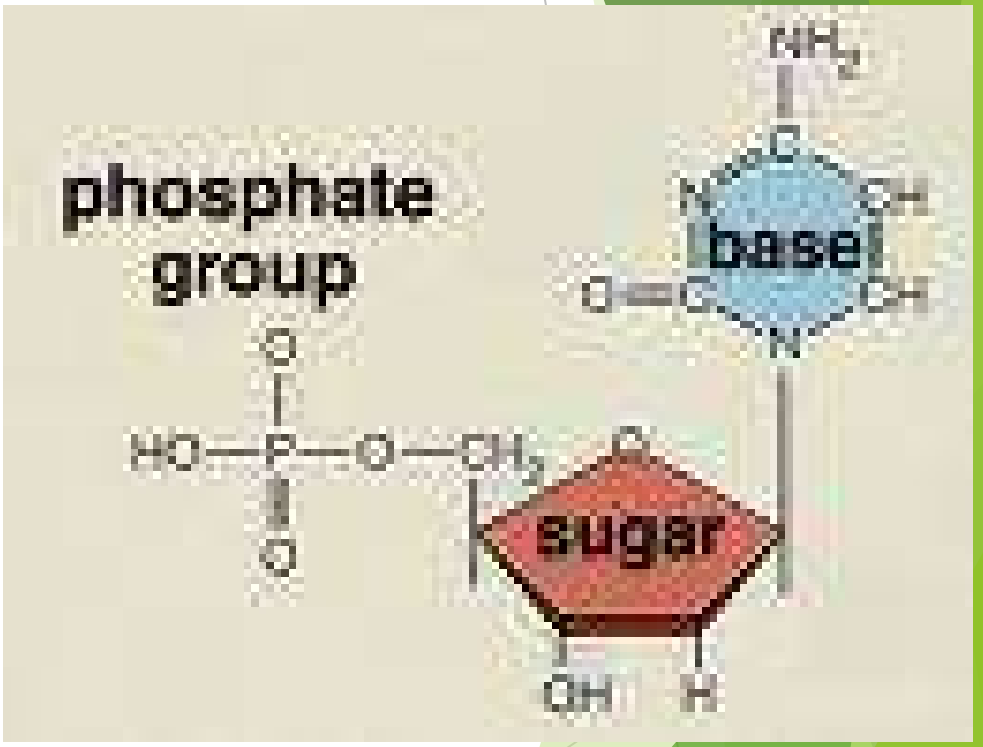
Structure of DNA

- Double-stranded helix
- Provides instructions for making proteins/codes for specific traits.
- Made of nucleotides.

Nucleotide Parts

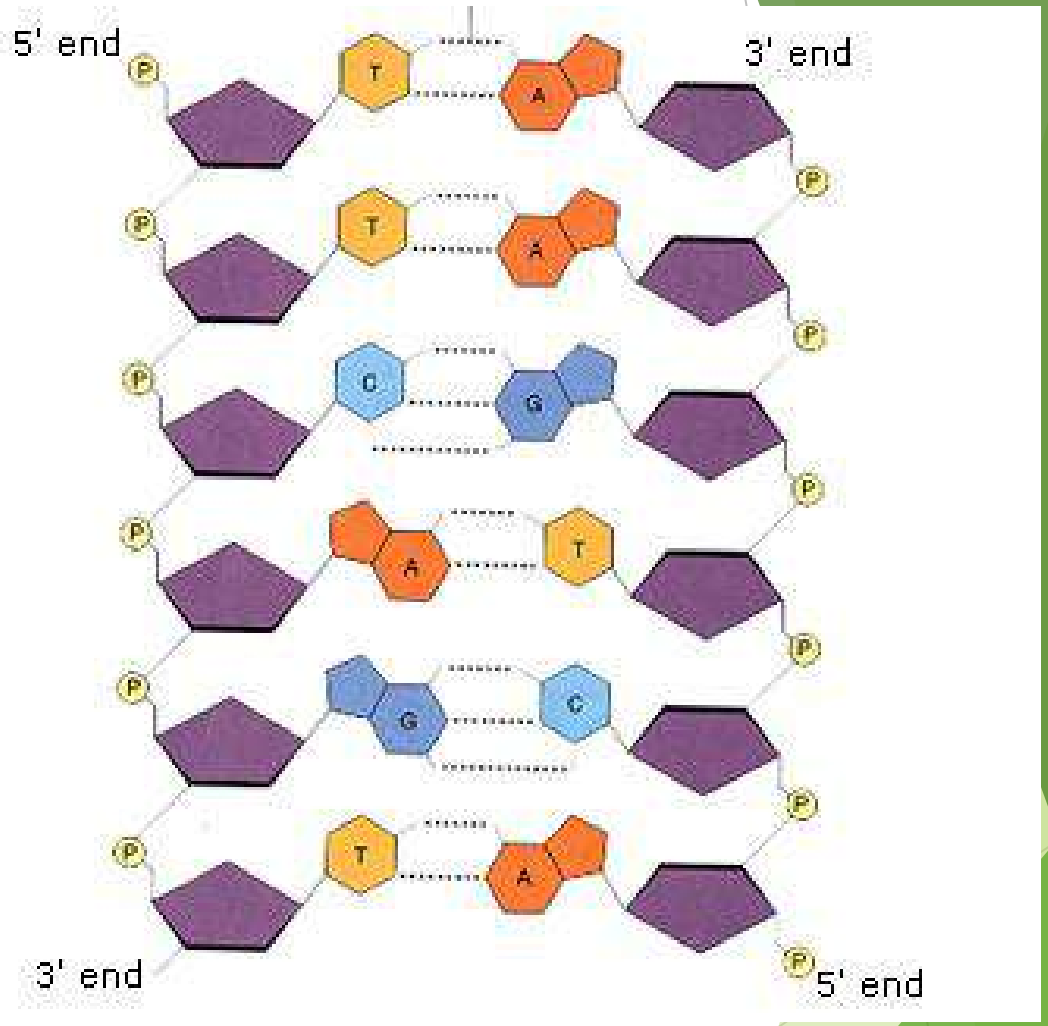
1) Sugar - deoxyribose
2) Phosphate group (has element phosphorous)
3) Nitrogenous base

- Sugar and phosphate make the sides.
- Bases make the rungs.



Nucleotide Types

1) Adenine (A)
2) Thymine (T)
3) Cytosine (C)
4) Guanine (G)



- A bonds with T
- G bonds with C

- **Chargaff's Rules**
  - Complementary Strands: one strand of DNA is built from bases of another strand.

We love DNA made of nucleotides, sugar phosphate and a base, bonded down one side.

Adenine and thymine make a lovely pair
Cytosine without guanine would feel very bare

Ticker Questions: Page 6 in packet

2nd period only

Friday _ _ 2/15/19

Agenda:

- Test
- TED Talk-Watson
- DNA Notes #2

Warm Up:

Study Guides!!

- Genetics Test
  - Can use notes (only 75% possible)
  - Cannot correct if you did not do the review
  - Review is turned in for 10 pts

Learning Target(s) – What you should be able to do by the end of today:

1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA)
2. Identify the chemical components and overall structure of DNA

DNA Replication

DNA Replication

- Why does DNA need to replicate? To make a new strand of DNA.

When does it happen?

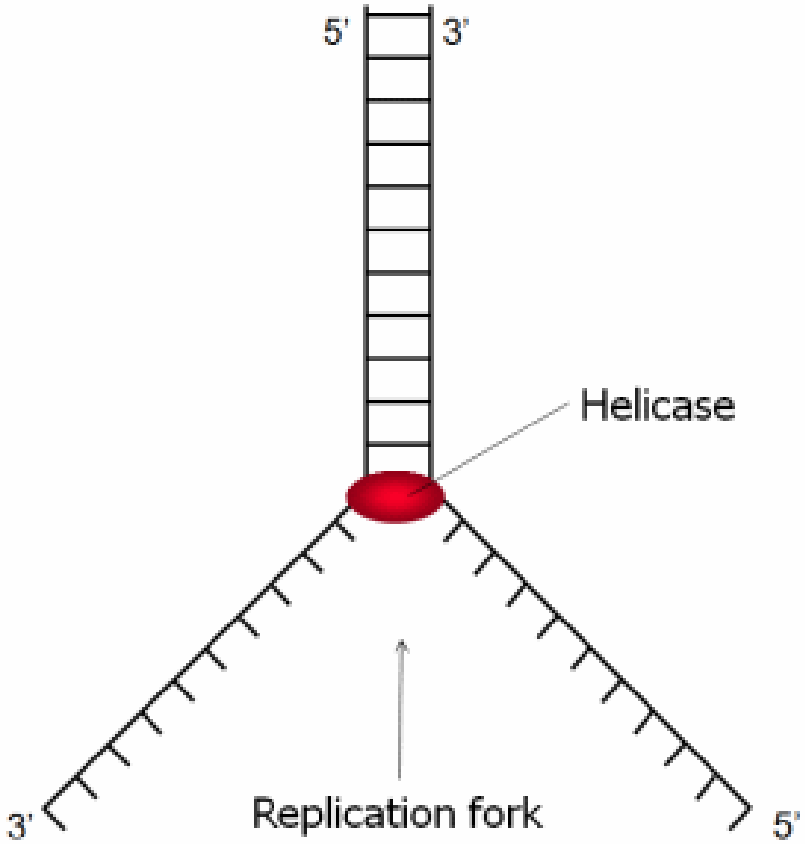
- Before cell division (mitosis or meiosis)

Where does it happen?

- In the nucleus

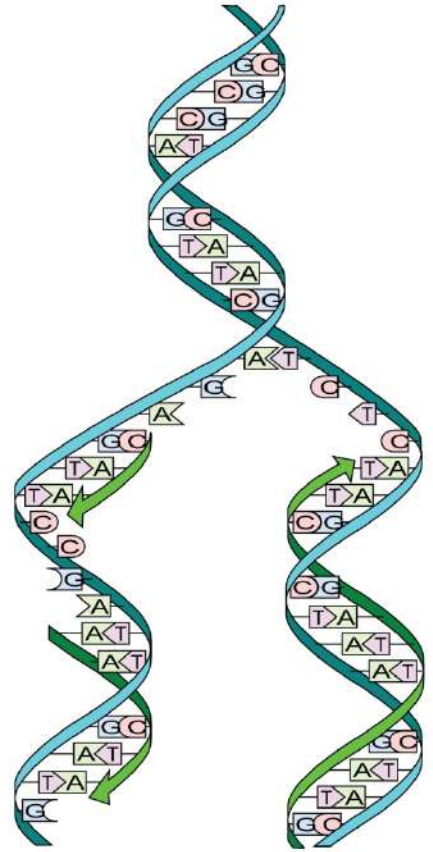
DNA Replication: Step 1

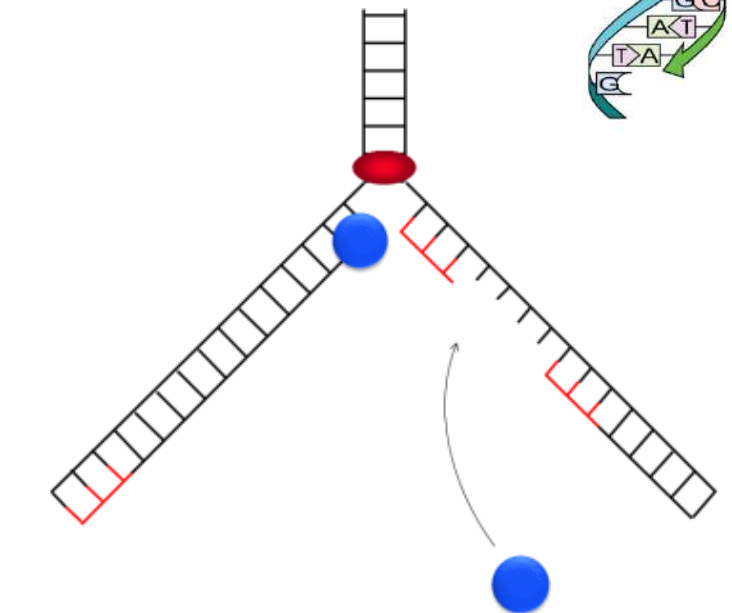
- Enzyme (Helicase) unwinds DNA



DNA Replication: Step 2

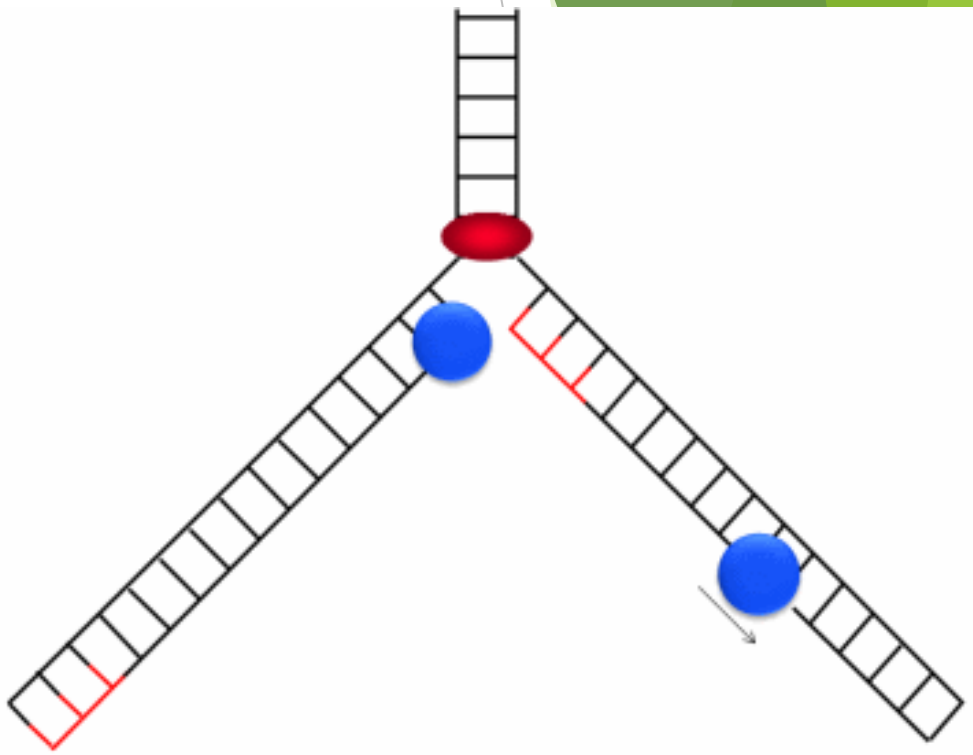
- Enzyme (DNA Polymerase) attaches free nucleotides to the original strands to form a new double helix strand.





DNA Replication: Step 3

- Replication occurs in many spots along the DNA molecule until all parts are copied.
- Two identical strands are made.
- Now cell division can occur!
- Zipper demo ☺
- Replication Video



- Humans have 3 billion pairs of nucleotides.
- DNA replication speeds up when you add heat and/or more enzymes. And enzymes are…?

Tuesday _ _ 2/19/19

Agenda:

- Notes #3: DNA and RNA
- DNA Extraction LAB
- Primary Article
- GRADES: Check them, some of you are missing labs. I have no names as well.

Warm Up:

- New Warm Up Sheet
- Where can we find your genes?

Learning Target(s) – What you should be able to do by the end of today:

1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA)
2. Identify the chemical components and overall structure of DNA

DNA Extraction Lab (DUE tomorrow)

1. Fill testube 1/3 full of banana mush. (3 pipettes!!!)
2. Add 3 pipettes of soap buffer to banana mush. (250 mL water, 1.5 g salt, 10% soap)
3. Stir soap and banana mix for 5 minutes.
4. Add 3 pipettes of cold alcohol to the test tube at
5. 45 degrees and observe for 5 minutes. Precipitate=DNA.
6. Clean beaker and test tube and return to original area.

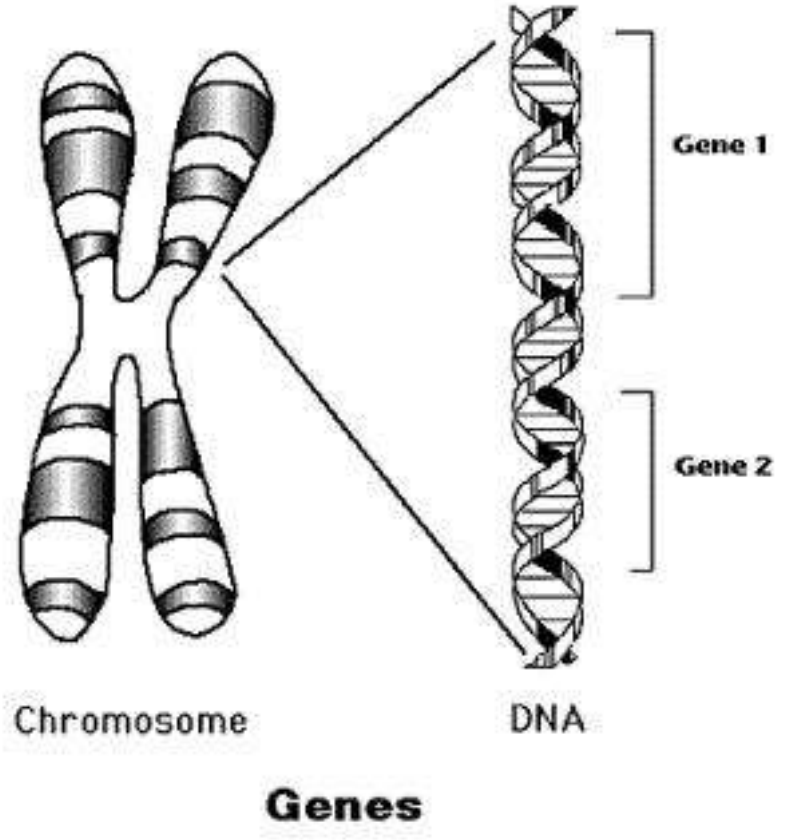
DNA LAB CLEAN UP

- Rinse testubes, put back in rack
- Rinse beaker
- Rinse pipettes and skewers (wooden sticks) and put back in beaker
- Get bottom of paper signed by me to be excused back to your seat. ☺

RNA

Genes

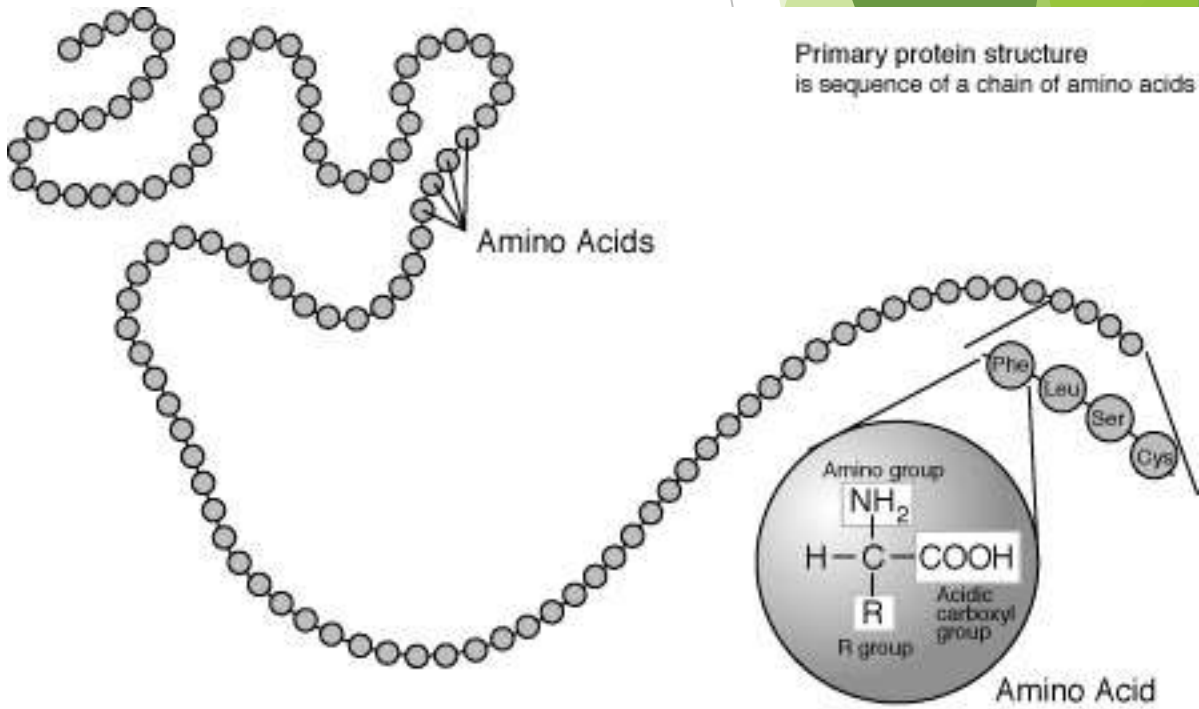
- Section of DNA with the instructions to make 1 protein.
- Found in the nucleus of the cell.



Proteins

Click here for animation -> XX

- Many amino acids linked together.
- Proteins are made in the cytoplasm by ribosomes but the instructions for doing this (the DNA) can't leave the nucleus.



How can this work???

RNA

- A single-stranded copy of DNA.

DNA vs. RNA

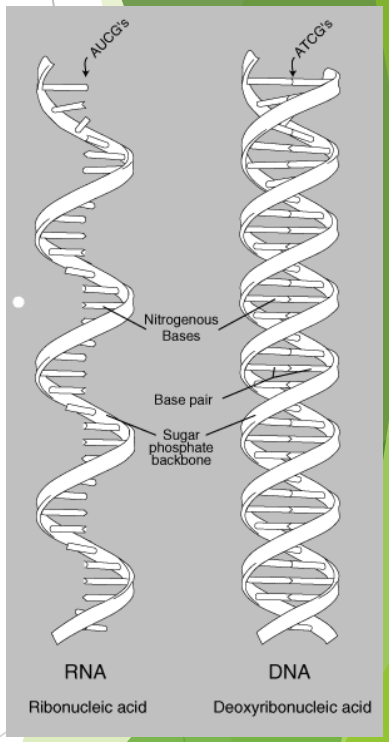
RNA

- Chain of nucleotides.
- Sugar is ribose. (O2 added)
- Single-stranded.
- Bases are A,U,G,C.

  (U = uracil, molecule lost).

DNA

- Chain of nucleotides.
- Sugar is deoxyribose.
- Double-stranded.
- Bases are A,T,G,C.



To go from DNA to a Protein, there are two steps:

1) **Transcription**- The process of copying a sequence of DNA to produce a complementary strand of RNA.

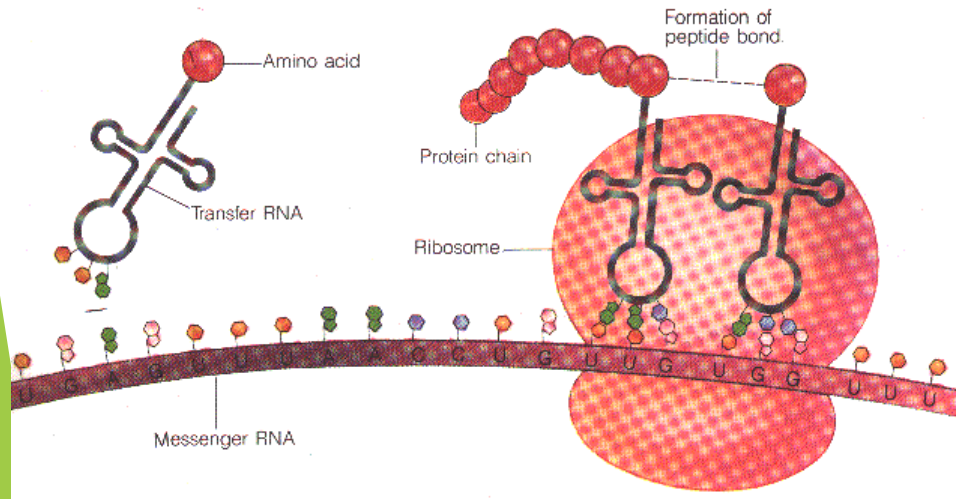
2) **Translation**- protein is made from mRNA using a ribosome.

Fill in picture together ☺

Types of RNA

Messenger RNA (mRNA)

- Copies DNA in the nucleus and moves it to a ribosome.



Transfer RNA (tRNA)

- Brings amino acid to the ribosome for protein assembly.

Ribosomal RNA (rRNA)

- Inside the ribosome. Helps with translation to create a protein.

Transcription: mRNA copies DNA

Step 1: enzyme (RNA Polymerase) unwinds DNA in the nucleus.

Step 2: mRNA bases make a copy of DNA.

Transcription (Part 2)

Step 4: cap and tail are added.

Step 5: mRNA leaves the nucleus for the cytoplasm.

Link

Wednesday _ _ 2/20/19

Agenda:

- SUB
- Drawing
- 3rd period: replication book notes
- DNA online: Build a Model
- Letter from Crick/Response

Warm Up:

- What needed to happen to the cell membrane in banana cells in order to extract DNA? (first period do not answer yet)
- The structure of DNA: speaking about the bases it is made of – what did Chargaff say? Think about the movie.

Learning Target(s) – What you should be able to do by the end of today:

1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA)
2. Identify the chemical components and overall structure of DNA

Crick's Letter to his Son

19 Portugal Place Cambridge 19 March '53

My Dear Michael,

Jim Watson and I have probably made a most important discovery. We have built a model for the structure of de-oxi-ribose-nucleic-acid (read it carefully) called D.N.A. for short. You may remember that the genes of the chromosomes — which carry the hereditary factors — are made up of protein and D.N.A.

Our structure is very beautiful. D.N.A. can be thought of roughly as a very long chain with flat bits sticking out. The flat bits are called the "bases". The formula is rather like this.

|

sugar —— base

|

phosphorus

|

sugar —— base

|

phosphorus

and so on

- Now we have two of these chains winding round each other — each one is a helix — and the chain, made up sugar and phosphorus, is on the outside, and the bases are all on the inside. I can't draw it very well, but it looks like this.

  [diagram of the double helix]

- The model looks much nicer than this.
  Now the exciting thing is that while there are 4 different bases, we find we can only put certain pairs of them together. The bases have names. They are Adenine, Guanine, Thymine & Cytosine. I will call them A, G, T and C. Now we find that the pairs we can make — which have one base from one chain joined to one base from another — are only

  A with T

- and G with C.

- Now on one chain, as far as we can see, one can have the bases in any order, but if their order is fixed, then the order on the other chain is also fixed. For example, suppose the first chain goes ↓ then the second must go

- A - - - - - - - - - - - - - - - - - T
- T - - - - - - - - - - - - - - - - - A
- C - - - - - - - - - - - - - - - - - G
- A - - - - - - - - - - - - - - - - - T
- G - - - - - - - - - - - - - - - - - C
- T - - - - - - - - - - - - - - - - - A
- T - - - - - - - - - - - - - - - - - A
-

It is like a code. If you are given one set of letters you can write down the orders.
Now we believe that the D.N.A. is a code. That is, the order of the bases (the letters) makes one gene different from another gene (just as one page of print is different from another). You can now see how Nature makes copies of the genes. Because if the two chains unwind into two separate chains, and if each chain then makes another chain come together on it, then because A always goes with T, and G with C, we shall get two copies where we had one before. For example

A — T

T — A

C — G

A — T

G — C

T — A

T — A

chains

↙ separate ↘

A T

T A

C G

A T

G C

T A

T A

↓

new chains form

A — T	T — A
T — A	A — T
C — G	G — C
A — T	T — A
G — C	C — G
T — A	A — T
T — A	A — T

In others words we think we have found the basic copying mechanism by which life comes from life. The beauty of our model is that the shape of it is such that only these pairs can go together, though they could pair up in other ways if they were floating about freely. You can understand that we are very excited. We have to have a letter off to Nature in a day or so.

Read this carefully so that you understand it. When you come home we will show you the model.

Lots of love,

Daddy

- **Reading Crick's Letter to His Son**
- Imagine you are a high school student in 1953. You had never heard of DNA, but you had heard of hereditary and genetic material. If news came to your science classroom that the "genetic material" inside of the cells that you were studying had been identified and that there had been a proposed configuration for the structure, how would that affect your studies? Would you have been excited? What are some other discoveries that could not have been done without understanding the structure of DNA? Write a two-paragraph response.

Friday _ _ 2/22/19

Agenda:

- Notes #4
- Video?
- Cell Model – laminate parts
- DNA Dry Lab
- Practice quiz Monday

Warm Up:

- Draw a quick model of DNA.

Learning Target(s) – What you should be able to do by the end of today:

1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA)
2. Identify the chemical components and overall structure of DNA

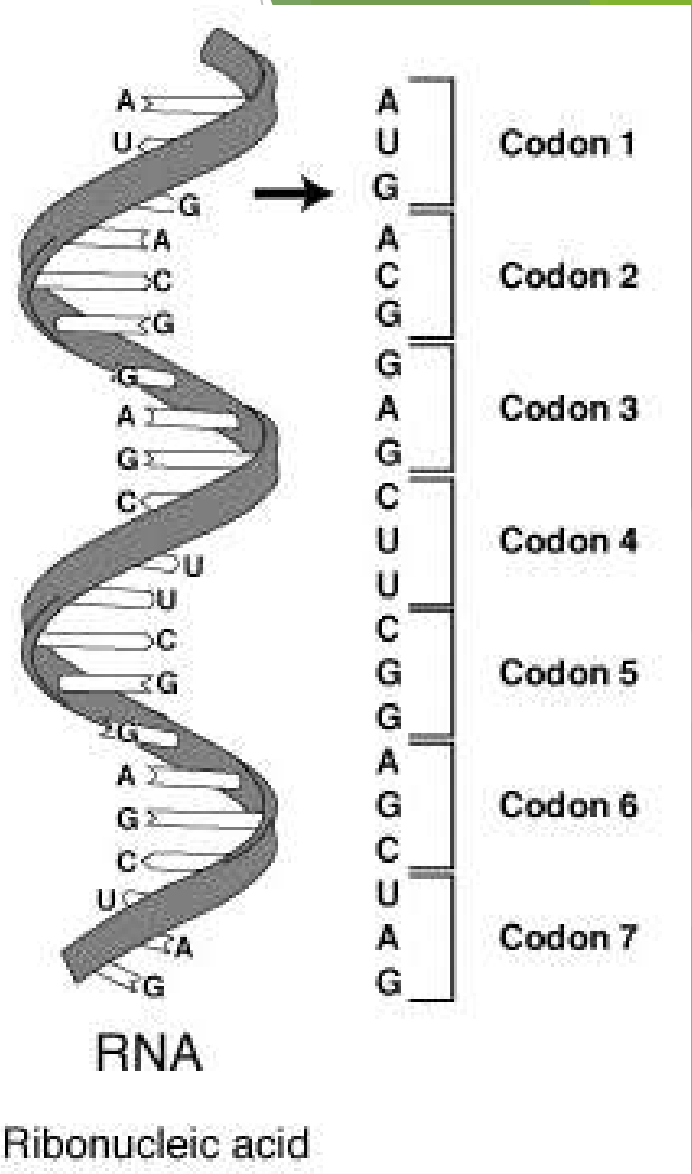
Ribosomes & Protein Synthesis

Codons

- Instructions or a section of three mRNA bases in a row that code for one amino acid.
- Each codon corresponds to an Amino Acid.

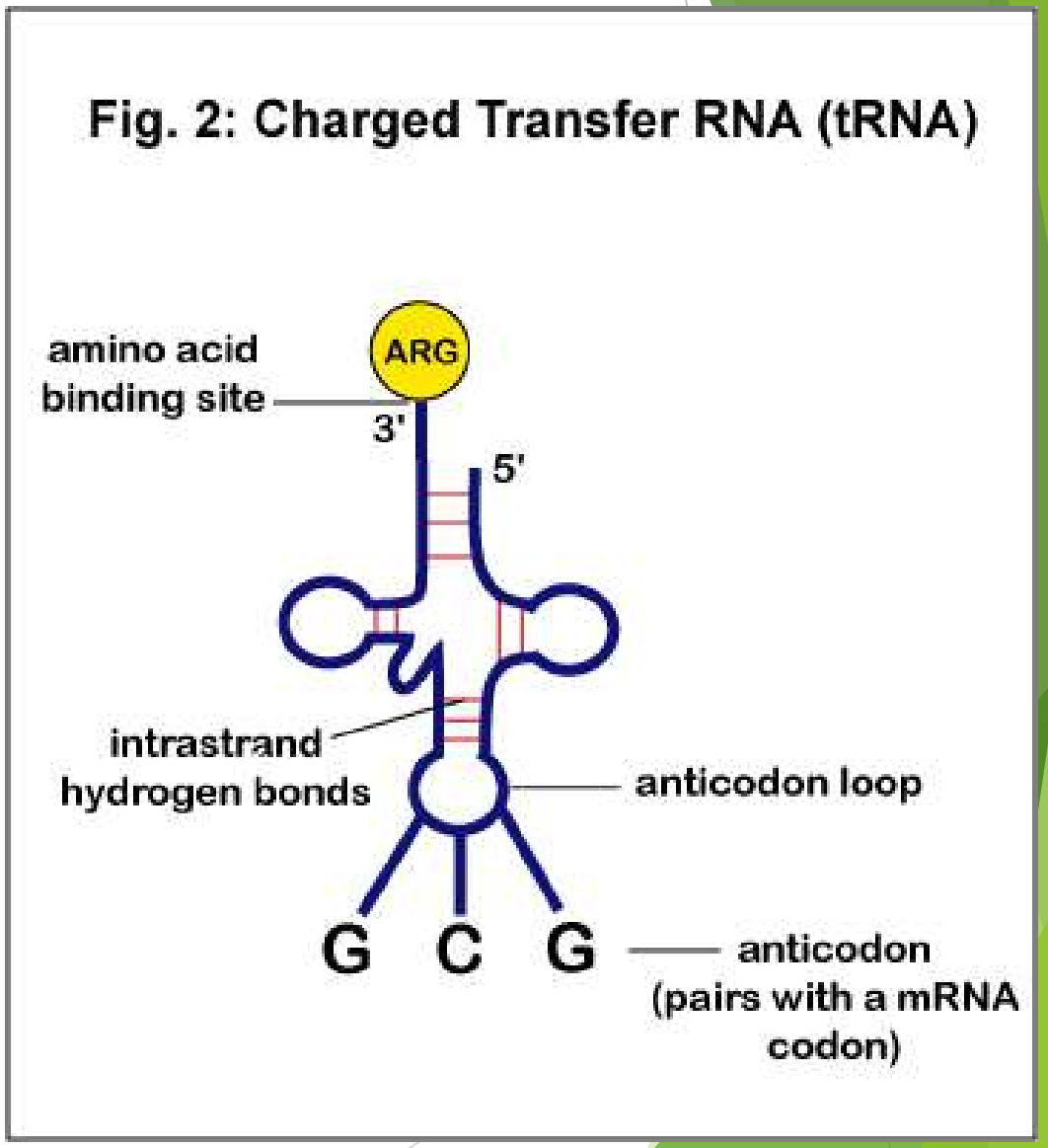
Second base of codon

First base of codon	U	C	A	G	Third base of codon
U	UUU Phenylalanine phe UUC UUA Leucine leu UUG	UCU Serine ser UCC UCA UCG	UAU Tyrosine tyr UAC UAA STOP codon UAG	UGU Cysteine cys UGC UGA STOP codon UGG Tryptonphan trp	U C A G
C	CUU Leucine leu CUC CUA CUG	CCU Proline pro CCC CCA CCG	CAU Histidine his CAC CAA Glutamine gin CAG	CGU Arginine arg CGC CGA CGG	U C A G
A	AUU Isoleucine ile AUC AUA AUG Methionine met (start codon)	ACU Threonine thr ACC ACA ACG	AAU Asparagine asn AAC AAA Lysine lys AAG	AGU Serine ser AGC AGA Arginine arg AGG	U C A G
G	GUU Valine val GUC GUA GUG	GCU Alanine ala GCC GCA GCG	GAU Aspartic acid asp GAC GAA Glutamic acid glu GAG	GGU Glycine gly GGC GGA GGG	U C A G



Anticodons

- The corresponding tRNA molecule that carries the amino acid to the ribosomes.
- Something something something…protein



Translation: mRNA binds with a ribosome and amino acids to create a protein.

Animation<- -> XX

1.) Ribosome finds the start codon, AUG, on mRNA.

2.) The corresponding anti-codon on the tRNA connects and binds to mRNA.

3.) The ribosome reads the next codon & its corresponding anticodon binds.

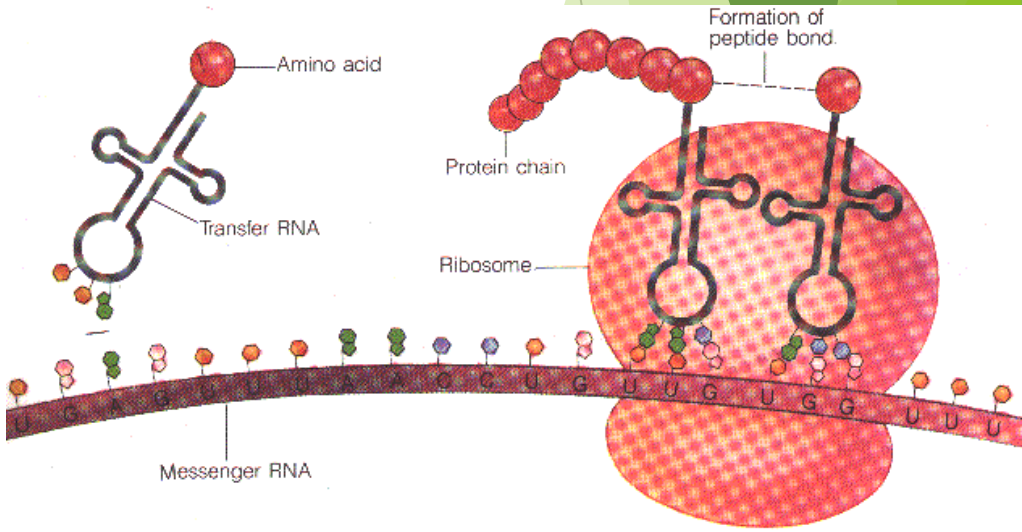
4.) The ribosome bonds the two amino acids on the tRNA together. The tRNA lets go.

5.) This continues until a stop

codon, UAA, is reached. Then the last tRNA & ribosome fall off.

6.) The amino acid chain folds

into its proper structure/protein.



The central dogma of molecular biology=

DNA--> RNA--> Protein
(called protein synthesis)

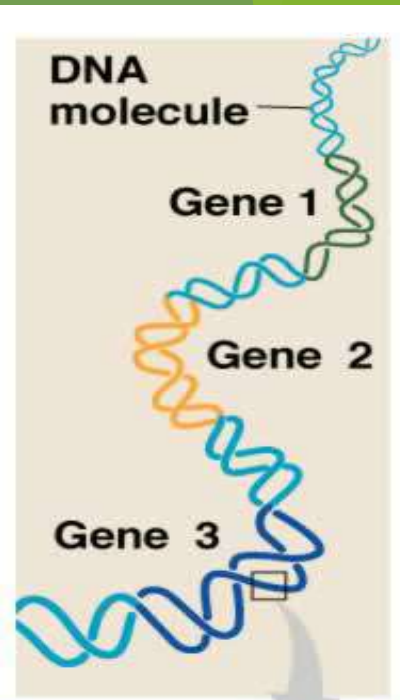
PRACTICE

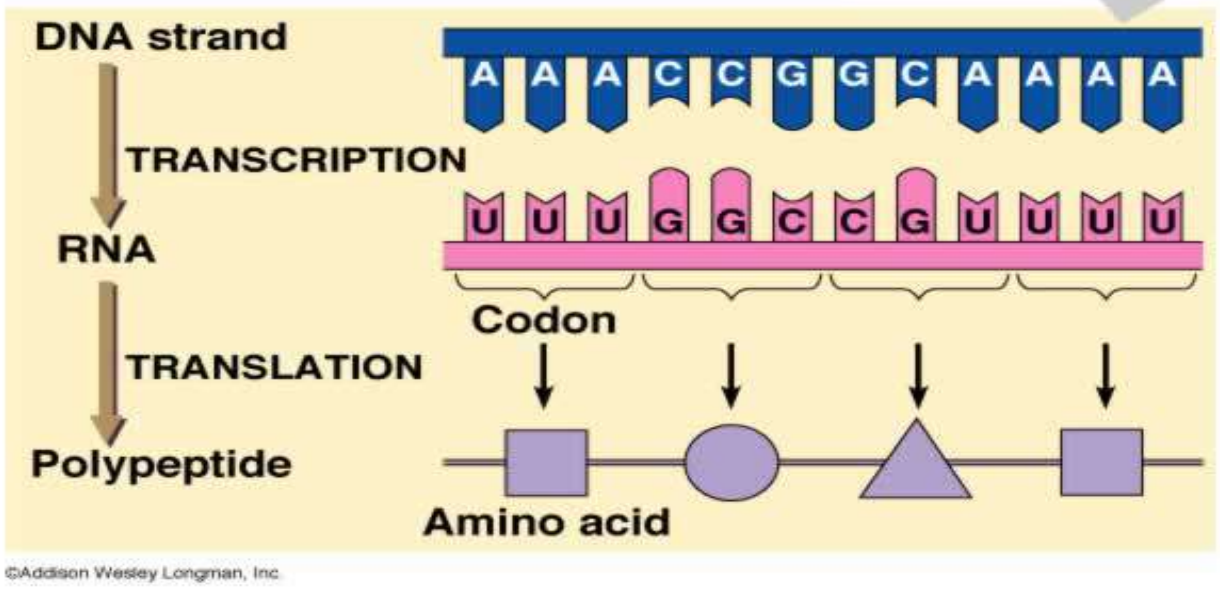
DNA: TTA CGC AGC

mRNA: AAU GCG UCG

tRNA: UUA CGC AGC

Amino Acid Amino Acid Amino Acid





Monday _ _ 2/25/19

Agenda:

- SUB
- 3rd period: forecasting
- DNA Practice Quiz
- Protein Synthesis Online Lab (HW for 3rd)

Warm Up:

- NEW warm up sheet – turn in the old one.
- What proteins are involved with DNA Replication?

Learning Target(s) – What you should be able to do by the end of today:

1. Compare RNA and DNA (B)
2. Explain the process of transcription (B)
3. Identify the genetic code and explain how it is read (B)
4. Summarize the process of translation (B)

Tuesday _ _ 2/26/19

Agenda:

- Complete online lab
- Protein Synthesis Sentences
- Begin: Secret of Photo 51 (50 mins)

Warm Up:

- Please create an mRNA molecule from the following DNA molecule. Here; only exchange for Uracil.
- ATATCCGACGAC

Learning Target(s) – What you should be able to do by the end of today:

1. Compare RNA and DNA (B)
2. Explain the process of transcription (B)
3. Identify the genetic code and explain how it is read (B)
4. Summarize the process of translation (B)

Protein Synthesis Sentences

- Visit the “nucleus” to get your DNA strand.
- Create RNA strand and leave the nucleus.
- Go the ribosome and translate your RNA strand into the corresponding amino acids and the final protein.

Wednesday _ _ 2/27/19

Agenda:

- Notes #5: Mutations
- Rice Krispy Lab
- Complete Photo 51

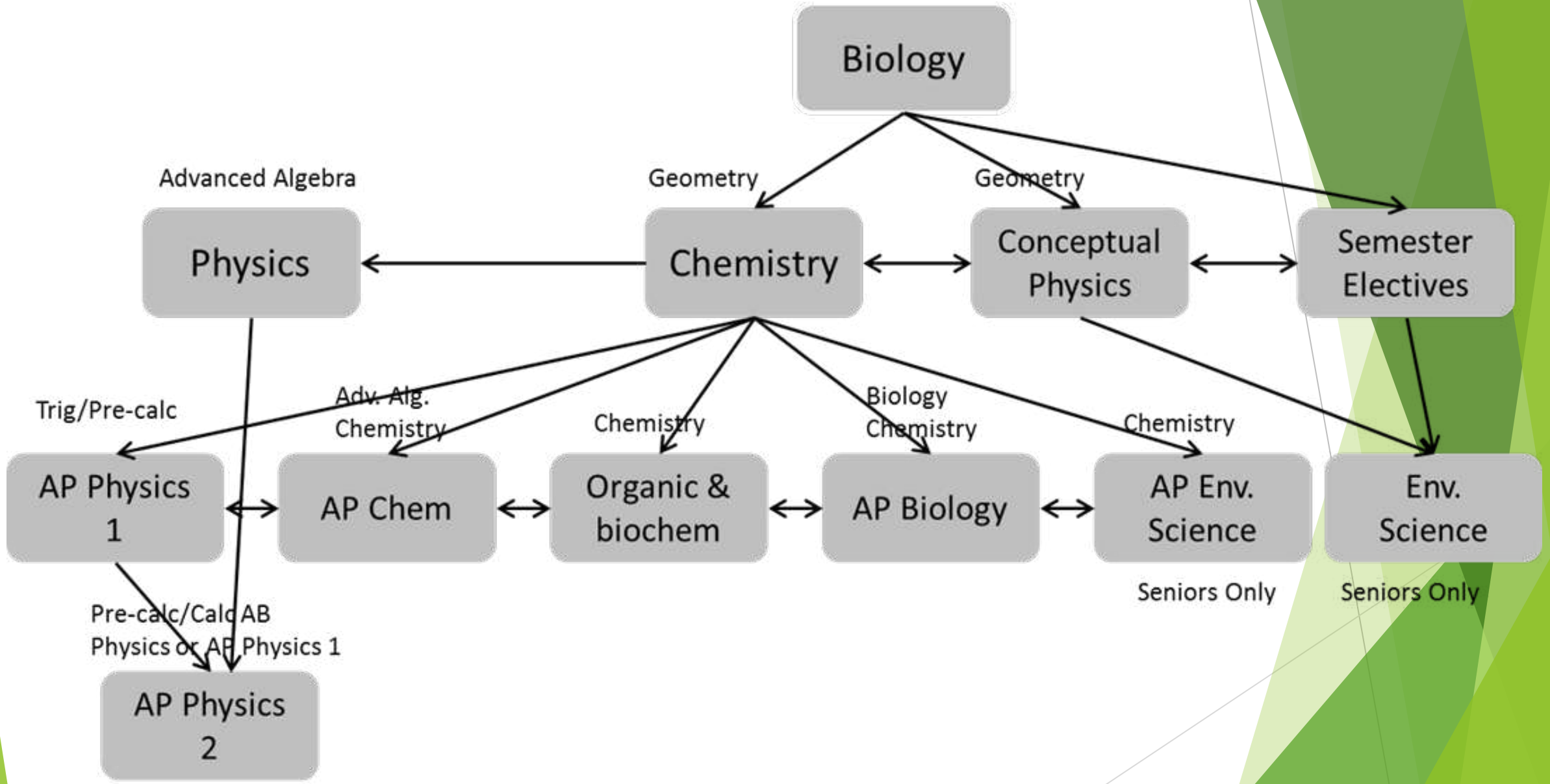
Warm Up:

- DNA to RNA to ?
- Forecasting

Learning Target(s) – What you should be able to do by the end of today:

1. Compare RNA and DNA (B)
2. Explain the process of transcription (B)
3. Identify the genetic code and explain how it is read (B)
4. Summarize the process of translation (B)

Environmental Science CTE Pathway: Earn College Credit!!


Biology
Advanced Algebra
Geometry
Geometry
Physics
Chemistry
Conceptual Physics
Semester Electives
Trig/Pre-calc
Adv. Alg. Chemistry
Chemistry
Biology Chemistry
Chemistry
AP Physics 1
AP Chem
Organic & biochem
AP Biology
AP Env. Science
Env. Science
Seniors Only
Seniors Only
Pre-calc/Calc AB Physics or AP Physics 1
AP Physics 2

* Math & Science Prerequisites

- AP Biology: Biology + Chemistry
- Conceptual Physics: Geometry
- Chemistry: concurrent Adv. Alg or higher
- AP Chemistry: Chem + Advanced Algebra (not Adv Alg A)
- Physics: Advanced Algebra (not Adv Alg A)
- AP Physics 1: Trig (**Concurrently Pre-calc or higher)**
- AP Physics 2: AP Physics 1 or Physics (with teacher approval)
- Organic/Biochem: Chemistry
- AP Envi Sci: Chemistry
- Envi Sci:

Semester Electives (No Math)

- Ecology Field Studies
- Marine Biology (preferred taken biology)
- Geology
- Geology Pacific Northwest
- Anatomy & Physiology I & II (biology prerequisite)
- Permaculture

Mutations

What are **mutations?**

- Changes in the DNA sequence that change which protein is created.

- Two Types:

1.) Chromosomal Mutations (we learned about this with genetic disorders)

2.) Gene Mutations

Point Mutations

- Occur at a single nucleotide (A,T,C,G) in the DNA.
- Usually one nucleotide is substituted for another, changing an amino acid.

Ex: Sickle Cell Anemia

ORIGNAL SEQUENCE

· UGUAC AUG UAU ACG UCU CAA UGA UCCA
Met Tyr Ser Thr Gln STOP

POINT MUTATIONS

· UGUAC AUG UAU ACG UCU CAG UGA UCCA
Met Tyr Ser Thr Gln STOP

· UGUAC AUG UAU ACG CCU CAA UGA UCCA
Met Tyr Ser Pro Gln STOP

· UGUAC AUG UAA ACG UCU CAA UGA UCCA
Met STOP

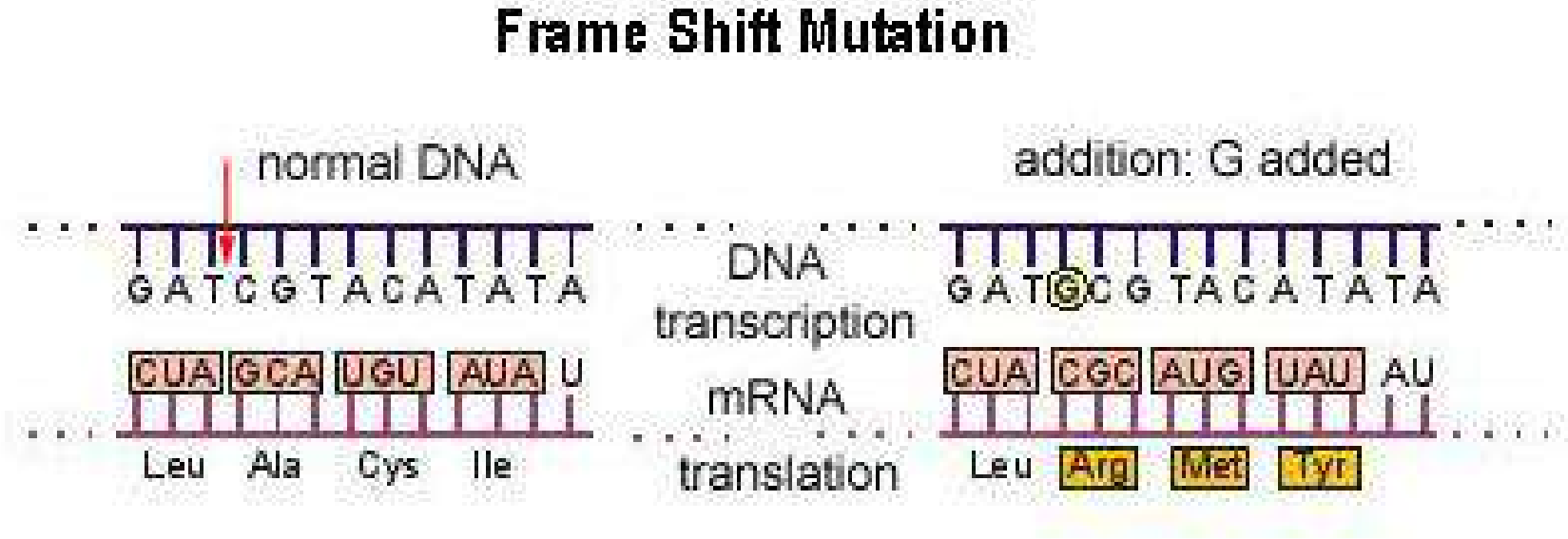
Frameshift Mutations

- Type of point mutation where an extra nucleotide is added or deleted, shifting the reading of codons, resulting in changes to ALL of the amino acids.

Ex: Huntingdon's Disease

What is Mutation?
The Outcome of Mutations->

Link



Mutagen

- An agent that causes a change in DNA.

Ex: smoke, high energy radiation (X rays, UV light, nuclear radiation), chemicals (dioxins, asbestos, benzene, cyanide, formaldehyde), and high temperatures.

Note: In some cases, a gene mutation may have positive effects leading to evolution.

Rice Krispie Lab

- Groups (Purple, Blue, Yellow) Roles (rRNA, mRNA, tRNA)
- Transcribe from RIGHT side of DNA molecule to mRNA (complement strand)
- mRNA codes for Amino Acids (use last sheet chart)
- tRNA codes for recipe instructions (cards)
- CLEAN UP: all utensils/bowls/pans washed and put on side counter.
- Wipe down tables/microwaves
- Two volunteers to return microwaves…get to leave early ☺

Friday (all) _ _ 3/01/19

Agenda:

- SUB
- Classwork Packet Check
- REview

Warm Up:

Learning Target(s) – What you should be able to do by the end of today:

1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA)
2. Identify the chemical components and overall structure of DNA

Monday _ _ 3/04/19

Agenda:

- Protein Synthesis Poster Review

Warm Up:

Learning Target(s) – What you should be able to do by the end of today:

1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA)
2. Identify the chemical components and overall structure of DNA

Tuesday _ _ 3/05/19

Agenda:

- TEST
- GATTACA/GMO MOVIE

Warm Up:

Learning Target(s) – What you should be able to do by the end of today:

1. Identify the role of DNA in heredity (including experimental evidence leading to discovery/structure of DNA)
2. Identify the chemical components and overall structure of DNA

Genetic Engineering!!!!!!!!!!!!! :D:D:D:D:D:D:D:D:D GET EXCITED :D