Session 2: The Stuff of Genetics (Genes and Chromosomes Part I)

1. Write the two definitions of a gene.

(1.) A unit of transcription (DNA → RNA)
(2.) A stretch of DNA that contains the information to produce a RNA molecule, which may or may not produce a polypeptide, which may or may be a protein by itself

2. Genes may be transcribed to produce RNA and then may be translated to produce polypeptide. These are the two products of gene expression.

3. What are the 3 types of RNA that he provided in class. What does each one do?

* mRNA - "messenger RNA" - transcribed from DNA, contains the information for translation
* tRNA "tranfer RNA" brings amino acids during translation
* Regulatory RNA - regulates gene expression

4. Proteins are made from chains of amino acids that are folded into a 3-D shape. They are the main building blocks of life and serve many functions

5. Complete the table of the many functions of proteins.

Name of Protein	Function	Examples
Enzymes	Catalyze chemical	DNA Polymerase Helicase Protease
Immunoglobulins	Bind to foreign entities to mount an immune response	Antibodies

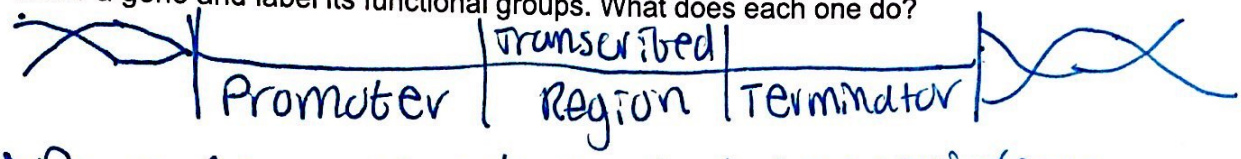
Usually ends in -ase

* Do not need to know specific examples *

Hormones	Chemical signals	Testosterone, Insulin, Growth hormones
Receptor Proteins	Recieve signals	Detect Hormones
Membrane / Gateway Channels	Move specific molecules across membranes	Potassium-ion Channel
Carrier Proteins	Transports specific molecules	Hemoglobin carriers CO_2 + O_2
Structural Proteins	Provides Structural support	Keratin, Tubulin
DNA / RNA Binding Proteins	Recognizes specific sequences, causes action	Binding
Ribosomal Proteins	Forms the structure of a ribosome	Ribosomal Proteins

Contractile Proteins	Proteins that form muscles	Actin & myosin

6. Draw a gene and label its functional groups. What does each one do?



* Promoter - signals to start transcription
* Transcribed Region - sequence that is transcribed into mRNA
* Terminator - signals the end of transcription

7. Define intron and exon.

- Intron - Interfering DNA - "no purpose"
- Exon - Expressed DNA in a gene "good stuff"

8. True or ~~False~~ Introns are spliced out of ~~prokaryotic~~ Eukaryotic DNA before it is translated.

9. What are chromosomes?

Packaged DNA 

Genome - all of the DNA in a cell

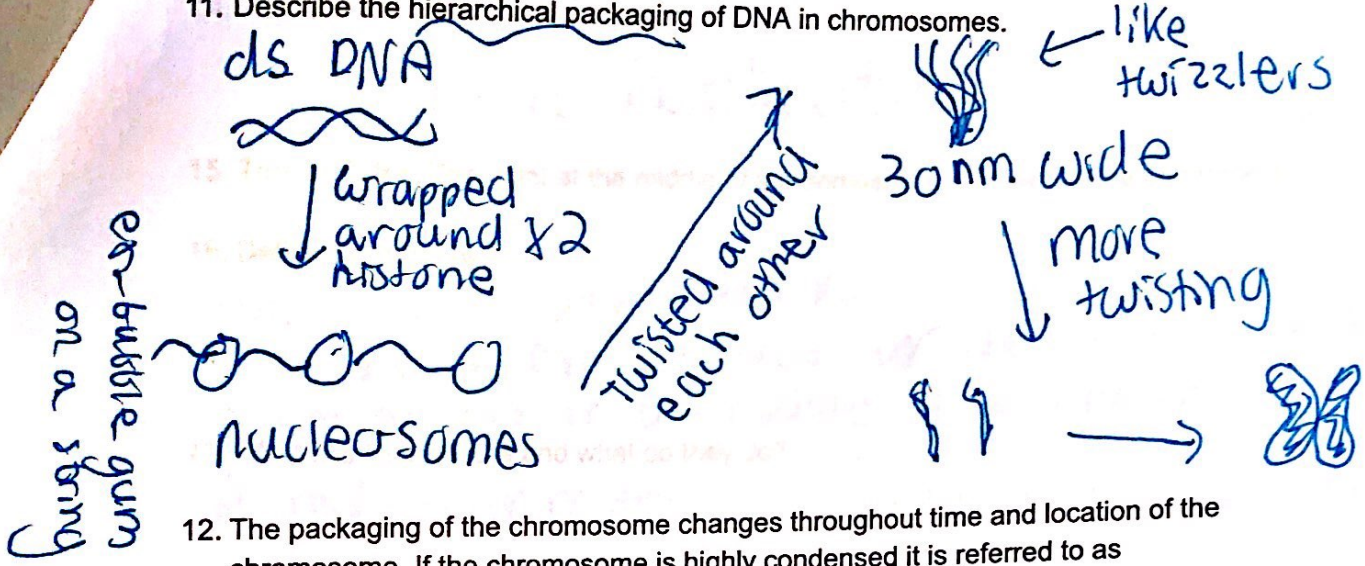
10. Define chromatin.

DNA packaged with proteins, chromatin makes up the chromosomes

ex. Bubble gum on a string → 

a process

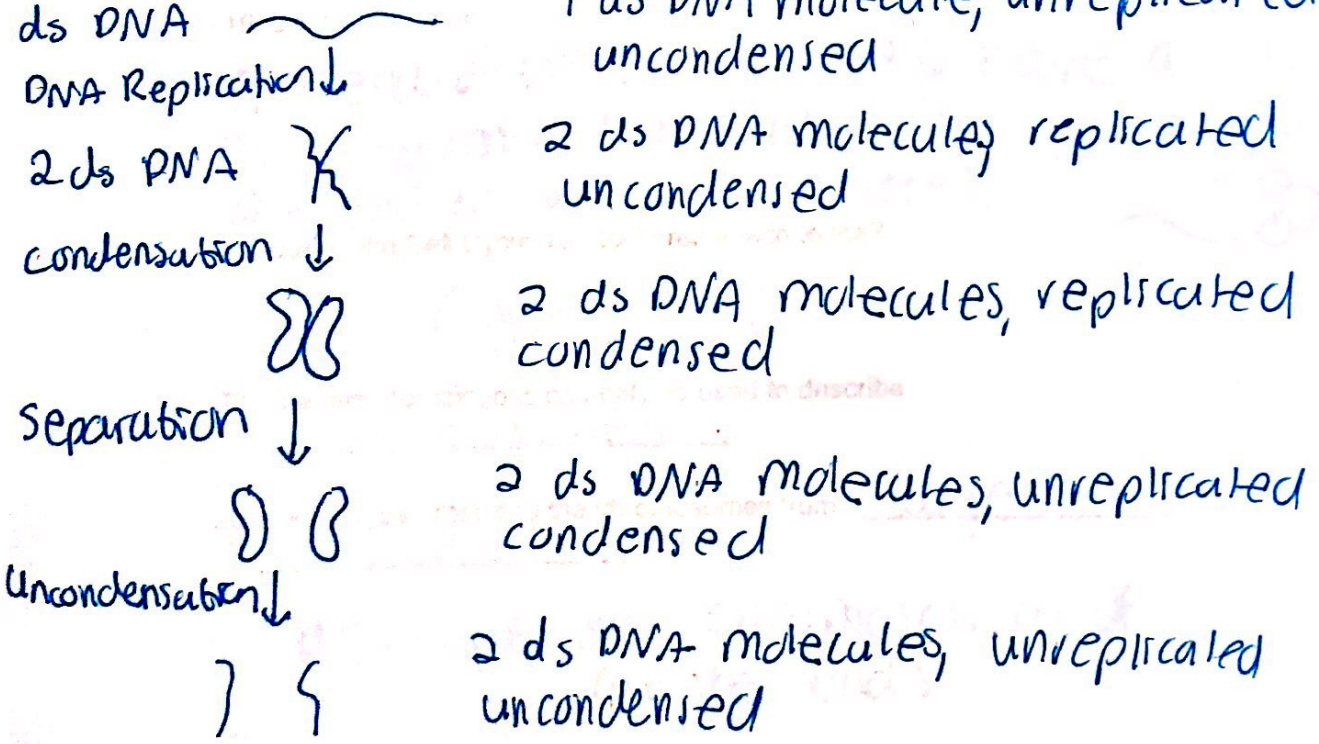
11. Describe the hierarchical packaging of DNA in chromosomes.



12. The packaging of the chromosome changes throughout time and location of the chromosome. If the chromosome is highly condensed it is referred to as heterochromatin and if it is loosely packaged it is known as euchromatin. Where might you see these two forms?

* Heterochromatin ~ Mitosis/meiosis
* Euchromatin ~ Interphase/DNA Replicaton

13. Draw the process of a double-stranded DNA molecule being replicated, condensed, sister chromatids separating, and DNA uncondensed. In each imaged identify how many strands of DNA there are, whether they are replicated/unreplicated, and if they are condensed/uncondensed.



14. How are sister chromatids formed?

DNA Replication

15. True or False: The point at the middle of a chromosome is known as the centromere. (where they bind)

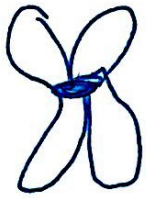
16. Define centromere.

The location where the kinetochores attach. There is a unique DNA sequence for the centromere that is not always in the middle of a chromosome.

17. What is a kinetochore and what do they do?

A molecular motor that drags a sister chromatid along a spindle fiber during mitosis, drives anaphase.

18. Draw and label a metacentric, submetacentric, acrocentric, and telocentric centromeres.



Metacentric = middle

Submetacentric = close to middle

Acrocentric = close to the end

Telocentric = at end

19. Define telomeres.

The ends of the chromosomes, have a specific DNA sequence that causes the proteins at the end to fold back on itself

20. During the Cell Cycle, kinetochores attach to the?

Centromere

21. The term homologous can only be used to describe chromosomes.

22. A karyotype organizes the chromosomes from largest to smallest.

Except sex chromosomes (at the end)