

ANSWER ON A SEPARATE PIECE OF PAPER:

Cell Cycle

- 1) What is the longest stage in a cell's life? Interphase
- 2) During what stage of the cell cycle does the genetic information in a cell double? S phase
- 3) During what stage(s) of the cell cycle does a cell only have one copy of its genetic information? G1 of Interphase or after cytokinesis
- 4) When does protein synthesis occur in the cell? G1 phase of Interphase
- 5) When does nuclear division in the cell occur? Mitosis or Meiosis
- 6) When does the cytoplasm of the cell divide? Cytokinesis

DNA

- 7) What does DNA stand for? deoxyribonucleic acid
- 8) What is DNA's primary function? to carry genetic information
- 9) What is the function of proteins? to carry out the expression of our genes
- 10) What are the repeating subunits called that make up DNA? nucleotides
- 11) Name the 3 parts of a DNA nucleotide. Sugar + phosphate + nit. base
- 12) Sketch and label a DNA nucleotide. O - P - A
- 13) Name the 4 nitrogen bases on DNA. Adenine, Guanine, Cytosine, Thymine
- 14) Who is responsible for determining the structure of the DNA molecule & in what year was this done? Watson + Crick 1950's
- 15) The model of DNA is known as a double helix because it is composed of two DNA chains wrapped around each other.
- 16) What makes up the sides of a DNA molecule? sugar + phosphate
- 17) What makes up the "steps" of a DNA molecule? nitrogen bases
- 18) How can you identify each of the parts that make up a Nucleotide of DNA?
- 19) What type of bonds holds the DNA bases together? Are they strong or weak bonds? hydrogen bonds (weak)
- 20) What makes up the "backbone" of the DNA molecule? sugar + phosphate
- 21) On DNA, a purine base will always pair with a pyrimidine base.
- 22) Name the complementary base pairs on DNA. A=T & G=C
- 23) Why must DNA be able to make copies of itself? For cell Replication
- 24) Define DNA replication. the process in which the cell makes a duplicate of DNA
- 25) What is the first step that must occur in DNA replication?
- 26) What acts as the template in DNA replication? old DNA ^{← helicase unwinds DNA}
- 27) What is a replication fork? where helicase is ^{← DNA (parent DNA)}
- 28) What enzymes help separate the 2 strands of nucleotides on DNA? What bonds do they break? helicase breaks apart hydrogen bonds
- 29) What is the function of DNA polymerases? builds DNA
- 30) Nucleotides are joined to replicating strands of DNA by hydrogen bonds.
- 31) If the sequence of nucleotides on the original DNA strand was A - G - G - C - T - A, what would be the nucleotide sequence on the complementary strand of DNA?
- 32) Does replication of DNA begin at one end and proceed to the other? Explain.
- 33) When replication is complete, how do the 2 new DNA molecules compare to each other & the original DNA molecule? - Semiconservative

Yes it starts at the 3' end & New DNA gets added in the 5' → 3' dir.

TCCGAT

- 34) Is DNA replicated (copied) before or after cell division? *before*
 35) Sketch & label DNA replication.
 36) What is a mutation? *random change in DNA*
 37) Name several things that can cause DNA mutations.

Chemicals, exposure to UV

RNA

- 38) What sugar is found on RNA? *Ribose*
 39) What base is missing on RNA, & what other base replaces it? *Thymine → Uracil*
 40) Uracil will pair with what other on DNA? *A*
 41) Is RNA double or single stranded? *single*

Protein Synthesis

- 42) Name the 3 types of RNA. *mRNA, rRNA, tRNA*
 43) Which type of RNA copies DNA's instructions in the nucleus? *mRNA*
 44) What does tRNA transport? *Amino acids + anticodons*
 45) Define transcription. *making mRNA from DNA*
 46) In what part of a cell are proteins made? *Ribosomes in cytoplasm*
 47) What is RNA polymerase & tell its function. *makes mRNA (enzyme)*
 48) As RNA polymerase moves along the DNA template strand, what is being added? *RNA nucleotides*
 49) What bases pair with each other during transcription? *A-U, G-C*
 50) What are the products of transcription called? *mRNA*
 51) Which RNA molecules are involved in the synthesis (making) of a protein? *rRNA + tRNA*
 52) What happens to the newly made mRNA molecule following transcription in the nucleus? *leaves to go to ribosomes*
 53) What signals translation to stop? *stop codon*
 54) What makes up proteins, what are the subunits called? *amino acids*
 55) How many different kinds of amino acids make up proteins? *20*
 56) What is the genetic code & why is it important? *carries protein instructions*
 57) What is a codon & what does each codon code for? *can be passed on*
 58) How many codons exist? *64, ↑ 3 nucleotides on mRNA*
 59) USE A CODON CHART: Name the amino acid coded for by each of these codons:
 a. UUA → *use your chart*
 b. AUU → *use your chart*
 c. UGU → *use your chart*
 60) What codon starts protein synthesis? *Methionine*
 61) What codons stop protein synthesis? *" "*
 62) Proteins are synthesized (made) at what organelle in the cytosol? *Ribosome*
 63) Define translation & tell how it starts. *mRNA → protein*
 64) USE A CODON CHART: What would the translation of these mRNA transcripts produce?
 a. UAA CAA GGA GCA UCC
 b. UGA CCC GAU UUC AGC

Name _____
DNA Activity

Date _____
Block _____

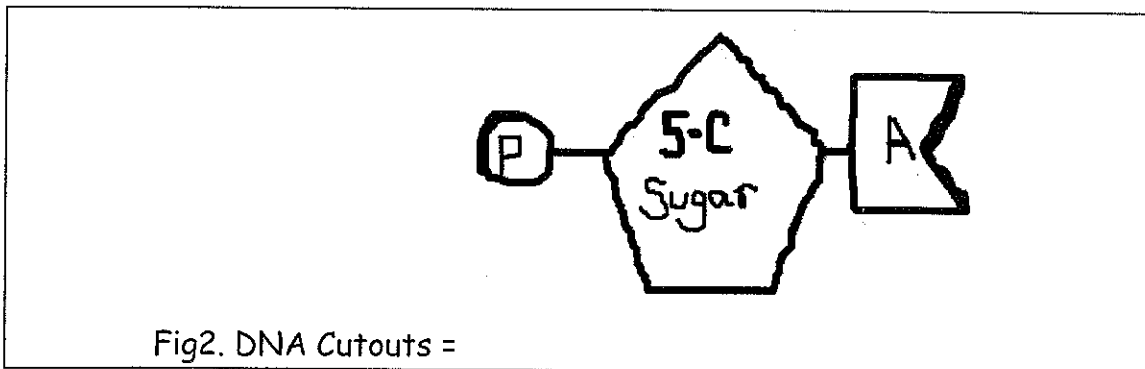
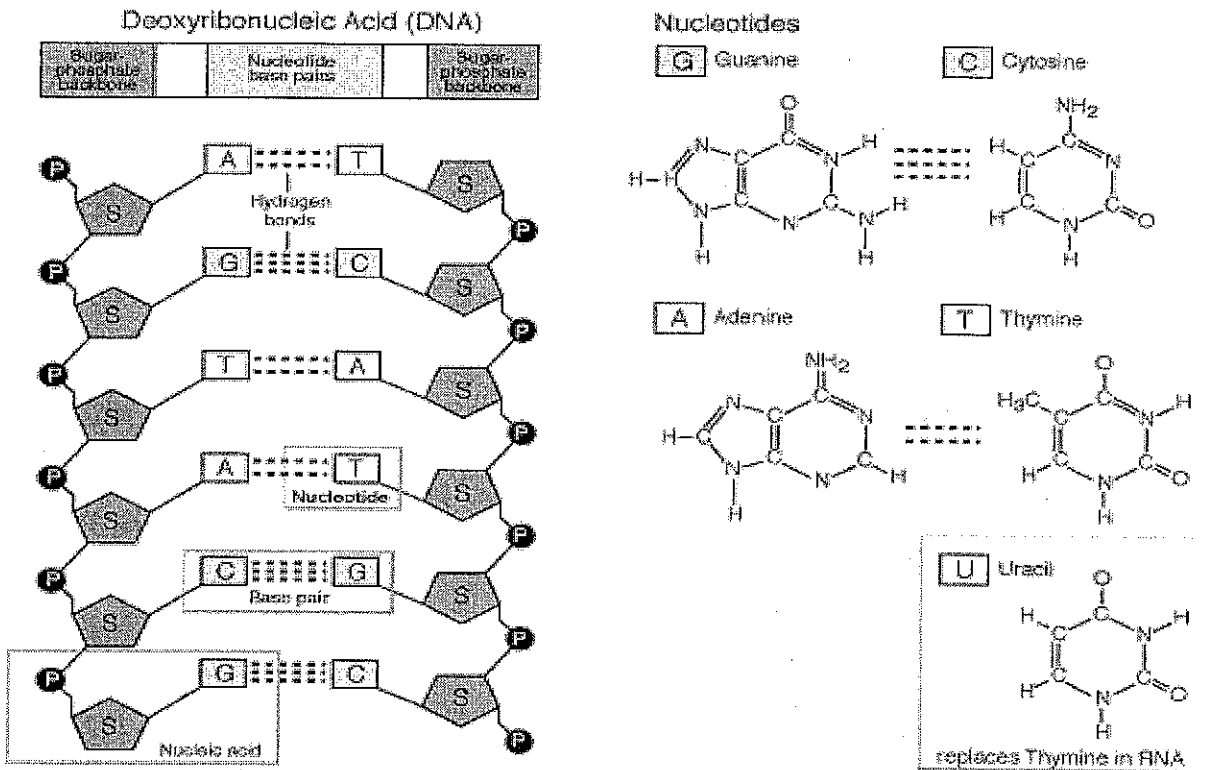
Introduction

DNA is built from building blocks called Nucleotides. Each of these building blocks has 3 parts:

- (1) phosphate
- (2) 5 Carbon Sugar
- (3) Nitrogen Bases (A, T, G, C)

(There are 4 kinds of bases each symbolized by a letter: A, T, G, C)

Fig1.



A. Make The Chain

1. Color in the various parts of the DNA cutouts. Color the phosphates - green; the 5-carbon sugars - blue; and the nitrogenous bases each a different color: adenine - red; thymine - orange; guanine - yellow; cytosine - purple.

2. Cut out the DNA pieces and use the DNA cutouts to make a strand (chain) of 9 nucleotides in this order:

adenine, adenine, guanine, cytosine, cytosine, adenine, thymine, thymine, guanine

3. Place the nucleotides in the middle of a piece of blank paper. The end of the DNA backbone that begins with a deoxyribose is the 5' end of that DNA strand. Draw a line that connects the phosphate to the deoxyribose sugar of the next nucleotide, as shown in Fig1.

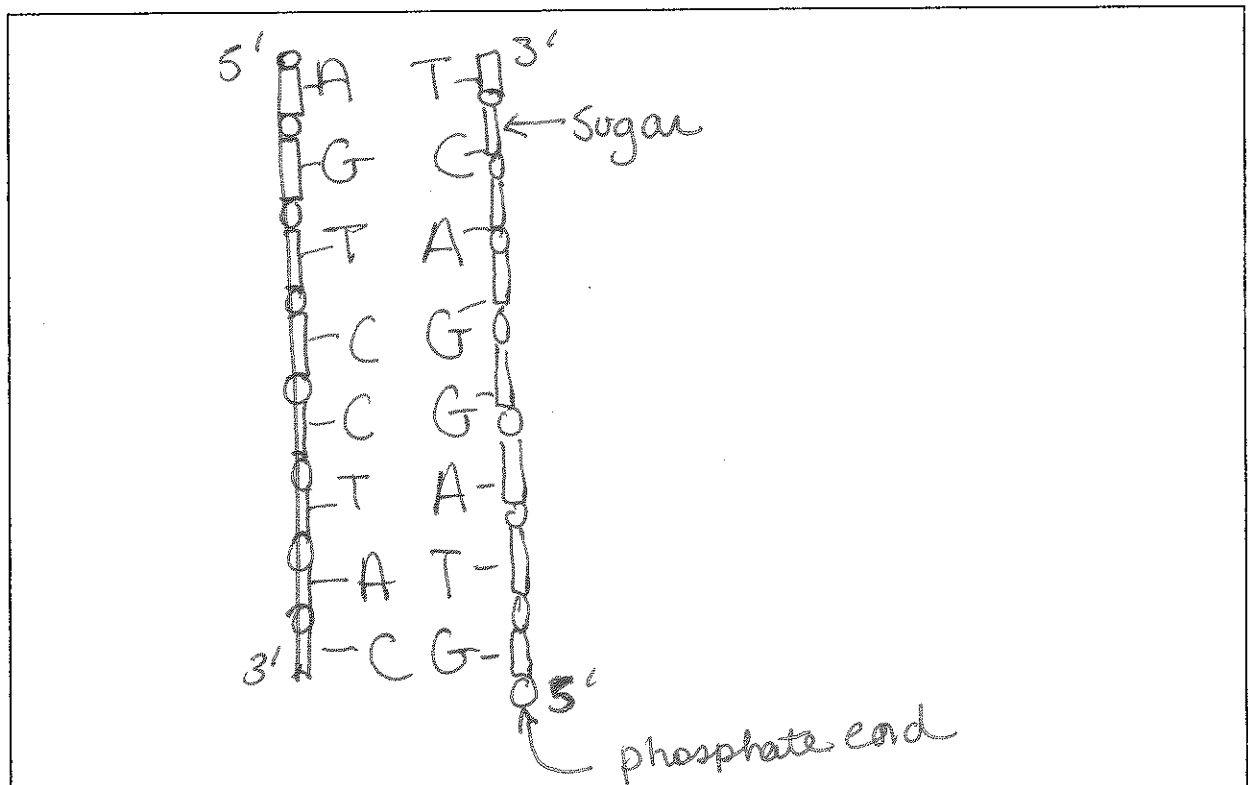
B. Make the Complementary Strand to make this a double stranded DNA

1. DNA is composed of not 1 but 2 strands side-by-side. Each nitrogen base on one strand of the DNA bonds to a nitrogen base on the other strand.

The hydrogen bonds between the Nitrogen Bases hold the 2 strands together.

2. Construct the complementary strand by correctly pairing up nitrogen bases to your original 9-nucleotide strand.

Draw a picture of what this looks like in the space provided:



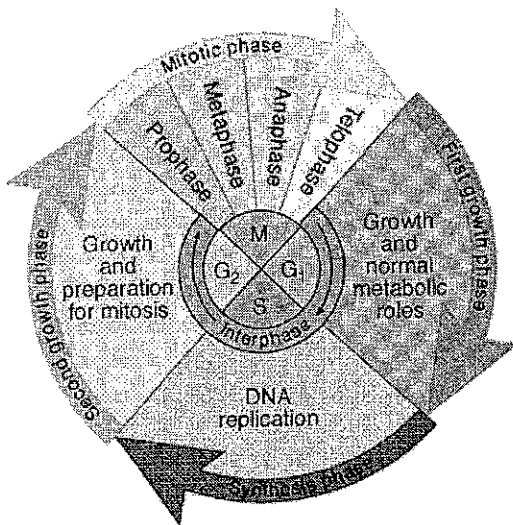
Questions: DNA Structure and Function

1. Write out the full name for DNA. deoxyribonucleic acid
2. What is a gene?
a gene is segment of DNA that codes for a particular protein, which carries out a particular trait
3. Where in the cell are chromosomes located?
nucleus
4. DNA can be found in what two organelles?
nucleus + mitochondria
5. What two scientists established the structure of DNA? Watson + Crick
6. What is the shape of DNA? double helix
7. What are the sides of the DNA ladder made of? sugar + phosphate
8. What are the "rungs" of the DNA ladder made of? nitrogen bases
9. What sugar is found in DNA? deoxyribose In RNA? Ribose
10. How do the bases bond together? Hydrogen bonds
11. DNA is made of repeating units called: Nucleotides
12. In DNA, Adenine pairs with thymine and Cytosine pairs with Guanine.

Cell Cycle and DNA Replication

Cell Cycle:

Interphase: generally lasts at least 12 to 24 hours in mammalian tissue. During this period, the cell is constantly synthesizing RNA, producing protein and growing in size. By studying molecular events in cells, scientists have determined that interphase can be divided into 4 steps: Gap 0 (G₀), Gap 1 (G₁), S (synthesis) phase, Gap 2 (G₂).



Gap 0 (G₀): There are times when a cell will leave the cycle and quit dividing. This may be a temporary resting period or more permanent. An example of the latter is a cell that has reached an end stage of development and will no longer divide (e.g. neuron).

Gap 1 (G₁): Cells increase in size in Gap 1, produce RNA and synthesize protein. An important cell cycle control mechanism activated during this period (G₁ Checkpoint) ensures that everything is ready for DNA synthesis. (Click on the Checkpoints animation, above.)

S Phase: To produce two similar daughter cells, the complete DNA instructions in the cell must be duplicated. DNA replication occurs during this S (synthesis) phase.

Gap 2 (G₂): During the gap between DNA synthesis and mitosis, the cell will continue to grow and produce new proteins. At the end of this gap is another control checkpoint (G₂ Checkpoint) to determine if the cell can now proceed to enter M (mitosis) and divide.

Mitosis or M Phase: Cell growth and protein production stop at this stage in the cell cycle. All of the cell's energy is focused on the complex and orderly division into two similar daughter cells. Mitosis is much shorter than interphase, lasting perhaps only one to two hours.

Cells are the simplest units of life capable of independent existence and reproduction. Cells have the ability to make nearly identical copies of themselves by the process of cell division, a process which is essential for the continuation of life. There are a variety of reasons that might cause a cell to divide:

- Multicellular organisms grow in size and complexity by making more cells.
- Old and damaged cells are continuously replaced by the division of cells.
- Single-celled organisms such as bacteria divide to make new, independent organisms.

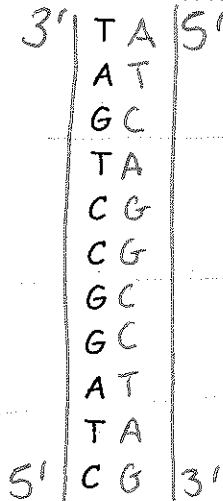
In order for the cell to produce an exact copy the parent cell must ensure that each new daughter cell receives a complete copy of its hereditary information (DNA).

DNA Replication Activity

C. DNA Replication

Using the nucleotide "cards" construct a model of DNA with a backbone strand that has the following code: T, A, G, T, C, C, G, G, A, T, C

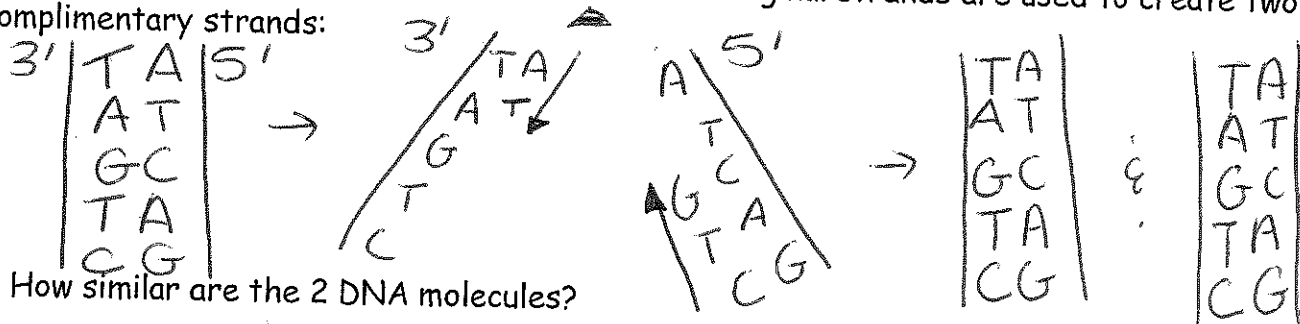
Draw a picture of the double stranded DNA in the space provided:



What you have above are the two "original strands" of DNA!

1. Before a cell divides, the DNA must be replicated (copied). This happens during S phase of Interphase of the Cell Cycle.
2. DNA is able to unzip into it's 2 complementary strands by separating down the middle, breaking the bonds between A and T and between C and G. Now there are 2 separate strands.
3. New nucleotides (with bases) enter between the 2 strands and bind to the separated original strands using "complementary base pairing" (ie. A-T, C-G).
4. Unzip the two original DNA strands. What enzyme is responsible for unzipping the DNA?
***HELICASE**
5. Now add new nucleotides to each original strand (making sure to add in the 5' → 3' direction).

Create a diagram that demonstrates how the two original strands are used to create two new complimentary strands:



5. How similar are the 2 DNA molecules?

they each have an old and a new part of DNA (semi conservative)

Questions on DNA Replication

1. The duplication (replication) of DNA begins with the unwinding of the double helix.
2. The enzyme helicase is responsible for "unzipping" the DNA helix.
3. DNA replication is said to be Semi conservative because each strand acts as a template to construct the other half of the molecule.
4. The enzyme DNA polymerase joins the nucleotide building blocks together.
5. The direction of the base pairing starts is always from the 5' to the 3' end of the DNA molecule.

D. The Genetic Code

1. The genetic code is like words 3-letters long (ie. CAT, DOG, BOX). In DNA, the letters are nucleotides. So a code in DNA might read: ACC, TCG, CGA. Each 3-nucleotide code word is called a "codon".

2. How many codons does the 1st original strand of your DNA molecule have? 3
3. List the codons of your 1st original strand: AAG, CCA, TTG.
4. ~~Use your text (pg. 117) to answer these:~~

- a) A codon actually codes for one particular (two word name) Amino Acid.
- b) Many amino acids join together to produce a polypeptide (which make up most of the structure of cells and tissues and act as enzymes and hormones).
- c) What is a gene? segment of dna that codes for protein → trait
- d) A genetic mutation may occur if a mistake occurs in: the DNA replication process

Vocabulary:

Anabolic-
 Binary fission-
 Catabolic-
 Cellular Respiration-
 Chromosome-
 DNA Polymerase -
 DNA Replication-
 Enzyme-

G1 Phase-
 G2 Phase-
 Helicase-
 Interphase-
 Ligase-
 Mitosis-
 Origin of replication-
 Photosynthesis-

Prokaryotic cells-
 S Phase-
 Somatic cell-