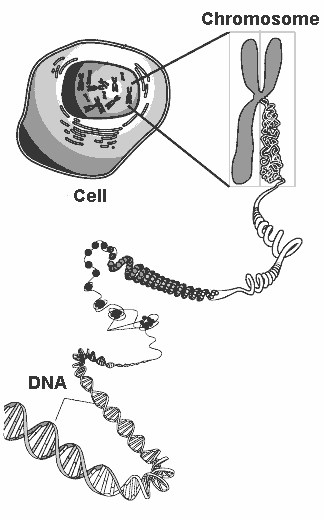


Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period:\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_



Gene

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= passing on of characteristics from parents to offspring

• How?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!

**I. DNA, Chromosomes, Chromatin, and Genes**

* + \_\_\_\_\_\_\_\_\_= blueprint of life (has the instructions for making an organism)
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= uncoiled DNA
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= coiled DNA
  + You have 46 chromosomes or 23 pairs in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of each body cell.

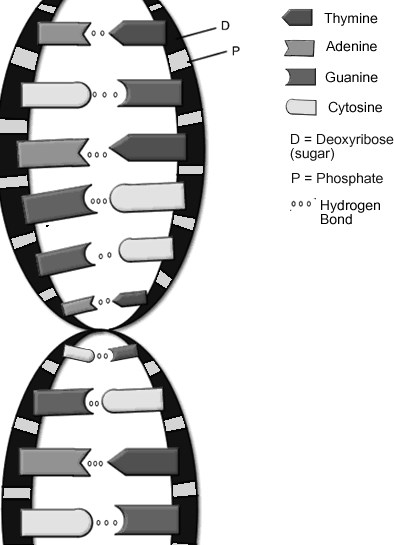
o 23 from mom and 23 from dad

• \_\_\_\_\_\_\_\_\_\_\_= a segment of DNA that codes for a protein, which in turn codes for a trait (skin tone, eye color, etc); a gene is a stretch of DNA.

o There is a gene for every protein your body has to make.

# DNA

* Deoxyribonucleic Acid
* Located in the \_\_\_\_\_\_\_\_\_\_\_\_\_of the cell

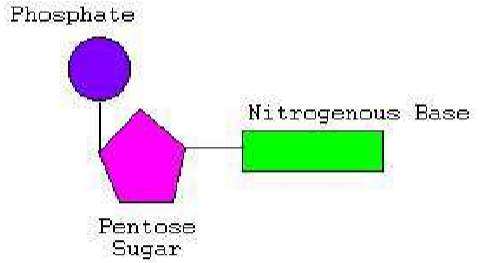


* Codes for your \_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- discovered DNA in 1928

1. **SHAPE & STRUCTURE:**

o Made from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* DNA nucleotide components:



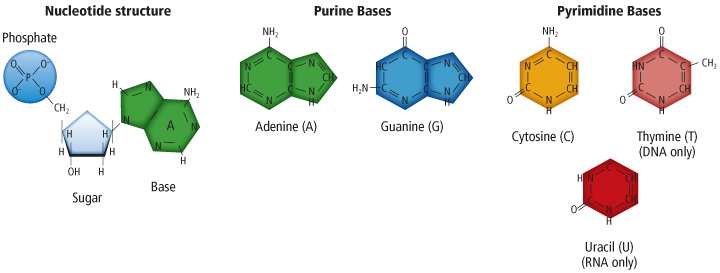
* + - 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (simple sugar)
      2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Shaped similar to a twisted ladder…aka\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!
    - The uprights of this ladder are composed of

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**and

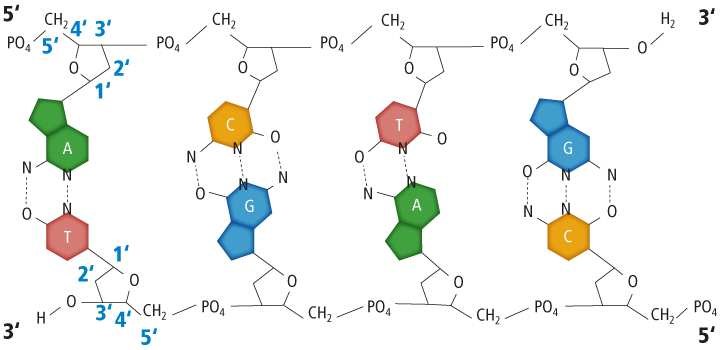
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

o The rungs are composed of 2 bases (a purine and pyrimidine) joined at the center by weak \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_bonds.

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= adenine (A) and guanine (G)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= thymine (T) and cytosine (C)



* + Direction of the two DNA strands:
    - \_\_\_\_\_\_\_\_= orientation of the sugar has carbon on the left
    - \_\_\_\_\_\_\_\_= orientation of the sugar has carbon on the right
    - Ex: (look at pic. below) the \_\_\_\_\_\_\_\_\_\_stand is oriented 5’-3’ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_strand is opposite 3’-5’



1. **BASE PAIRING:** 
   * + 1962: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_discovered that A always bonds with T and C bonds with G
     + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_are complementary. They both require \_\_\_\_\_\_\_ hydrogen bonds.
     + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_are complementary. They both require \_\_\_\_\_\_\_ hydrogen bonds.
     + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of bases determines the genetic information and is unique to each organism
     + If the organisms are closely related the more \_\_\_\_\_\_\_\_\_the DNA nucleotide sequence would be
     + The rungs of the ladder can occur in any order (as long as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is followed)

**If the order of base pairs in a DNA molecule is changed, what might occur?**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

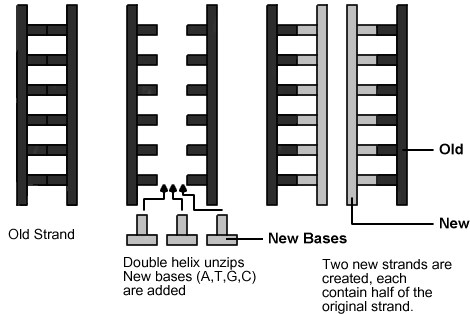
* + - DNA is made of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**strand of nucleotides.
    - The DNA from each side is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to the other side.
    - If you know the sequence of one side you can determine the sequence of the other side.
    - Ex: What is the complementary strand to this DNA molecule?

**A A T C G T A C C G A T**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **2 FUNCTIONS OF DNA:** 
   * 1. To direct and control \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
     2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= reproducing an exact copy of DNA so that the information can be passed on during cellular division

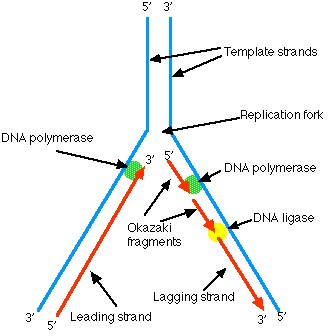
1. **DNA REPLICATION:** 
   * + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is the process where DNA makes a copy of itself



* + - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_= parental strands of DNA separate, serve as a template, and produce DNA molecules that have one strand of parental DNA and one strand of new DNA.
      * Helps\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_the number of copying errors
      * 3 stages: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, base pairing, and joining

o **Why does DNA need to replicate?**

* Cells divide for an organism to grow or reproduce; every new cell needs a copy of the DNA or instructions to know how to be a cell.
* DNA replicates right before a cell divides (\_\_\_\_\_\_\_\_\_\_\_\_\_\_).



1. **REPLICATION STEPS:** 
   1. **Unwinding**: DNA helicase (an \_\_\_\_\_\_\_\_\_\_\_) unwinds and unzips the double helix and begins to break the H bonds between the nitrogen bases.
   2. **Base pairing:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(an enzyme) runs along the parent chain of DNA in the 3’5’ direction and bonds free floating nucleotides to the parent (original) chain-- based on base pairing rules.

* The newly assembled strand is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of nucleotides and reforms the double helix.
* Each new strand is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of parent strand.
  1. Because DNA synthesis can only occur 5' to 3', a second type of

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ binds to the other template strand as the double helix opens.

* + - * DNA polymerase synthesizes discontinuous segments of nucleotides (called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).
  1. **Joining:** Another enzyme, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ then bonds these Okazaki fragments together into the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  2. Therefore, the result is the formation of \_\_\_\_\_\_ DNA molecules, each of which is identical to the original DNA molecule.

1. **What makes up our characteristics?** 
   * If you have brown hair, what makes it brown, as opposed to blonde, or red?
     + A pigment called\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a\_\_\_\_\_\_\_\_\_\_\_\_\_, is what you see as “brown” in the hair.
   * What makes you tall or short?
     + The lengths of your bones are made up of a framework of\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   * So, if heredity material controls your traits, and your traits are made of proteins, then shouldn’t heredity material control the making of proteins?
     + This is exactly what \_\_\_\_\_\_\_\_\_ does!!

* + - The order of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (A, T, C, G) determines the type of \_\_\_\_\_\_\_\_\_\_\_\_\_that is assembled.

* + - If the order of bases is accidentally changed, then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_occur which can change the proteins that need to be made!

1. **THE LINK BETWEEN DNA & PROTEINS:** 
   * In the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of each cell, there are tiny organelles where proteins are assembled. What are they called?

o \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + If a hair cell needs to make melanin. How do the instructions to synthesize this protein get from the DNA to the ribosome?

o Something must carry these instructions from the nucleus to the ribosomes in the cytoplasm. This “messenger” molecule is\_\_\_\_\_\_\_\_\_\_\_!!

**A. RNA (Ribonucleic acid):**

* + Comparing the STRUCTURE of DNA to RNA:

|  |  |  |
| --- | --- | --- |
| **STRUCTURE:** | **DNA** | **RNA** |
|  | |  |
| Strands of nucleotides |  |  |
| Sugars |  |  |
| Nitrogen Bases |  |  |

* + 3 kinds of RNA:

* + 1. \_\_\_\_\_\_\_\_\_\_– messenger RNA (see picture below)
       - * Structure: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
         * Function: Carries the \_\_\_\_\_\_\_\_\_\_message from the nucleus to the ribosomes

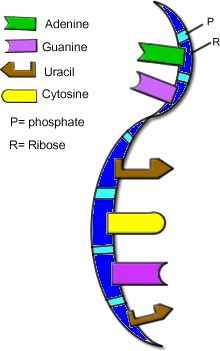
o \_\_\_\_\_\_\_\_\_\_\_= set of three nitrogen bases representing an amino acid

* + 1. \_\_\_\_\_\_\_\_\_\_– transfer RNA (see picture below)
       - * Structure: has an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_that is a complement to the

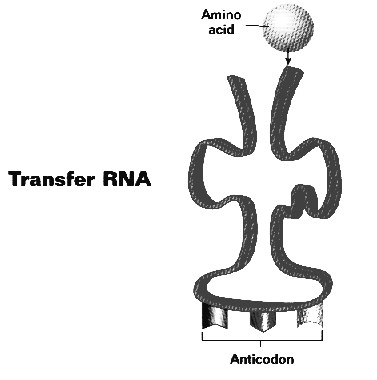
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_at one end and an \_\_\_\_\_\_\_\_\_\_\_\_\_at the other end

* + - * + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ shaped
        + Function: Carries the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to the ribosomes for protein production.

* + 1. \_\_\_\_\_\_\_\_\_– ribosomal RNA
       - * Structure: A part of ribosome
         * Function: Creates the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_between the amino acids during protein production.



**mRNA**



1. **PROTEIN SYNTHESIS Overview:** 
   * The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_created is determined by the base arrangement in DNA (code sentence)
   * \_\_\_\_\_\_\_\_transfers this information to\_\_\_\_\_\_\_\_\_\_, which carries the code to the ribosome where tRNA decodes it**. \_\_\_\_\_\_\_\_** anticodons pair with mRNA’s codons. Then \_\_\_\_\_\_\_\_\_forms peptide bonds between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to form a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

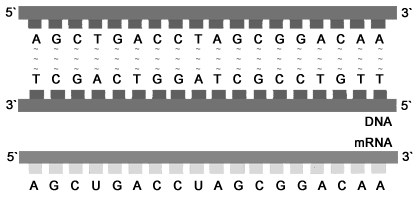
* + The process of protein synthesis is broken down into two sub-processes: transcription and translation.
    - 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= is the process through which \_\_\_\_\_\_\_\_\_transfers the code to \_\_\_\_\_\_\_\_\_

Takes place in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + - 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= is the process through which \_\_\_\_\_\_\_\_\_is decoded and forms a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Takes place at a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (enzyme) attaches at a specific location on DNA



**A.**

**TRANSCRIPTION- From DNA to mRNA:**

The enzyme then causes the DNA strands to separate from one another and allow one of the DNA strands to be

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

mRNA nucleotides are floating around in the

nucleus find their complement on the DNA stand and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_together. This

is possible due to the base-pairing rules.

Once the DNA segment has been copied by the mRNA bases, the mRNA strand separates from the DNA

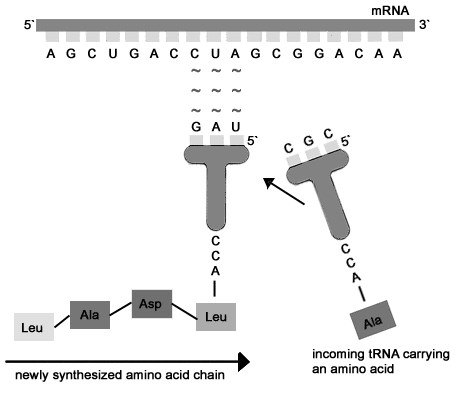
The mRNA (messenger RNA) leaves \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_through a nuclear pore & enters the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ goes to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_for protein synthesis

DNA zips up again to create the original double helix.

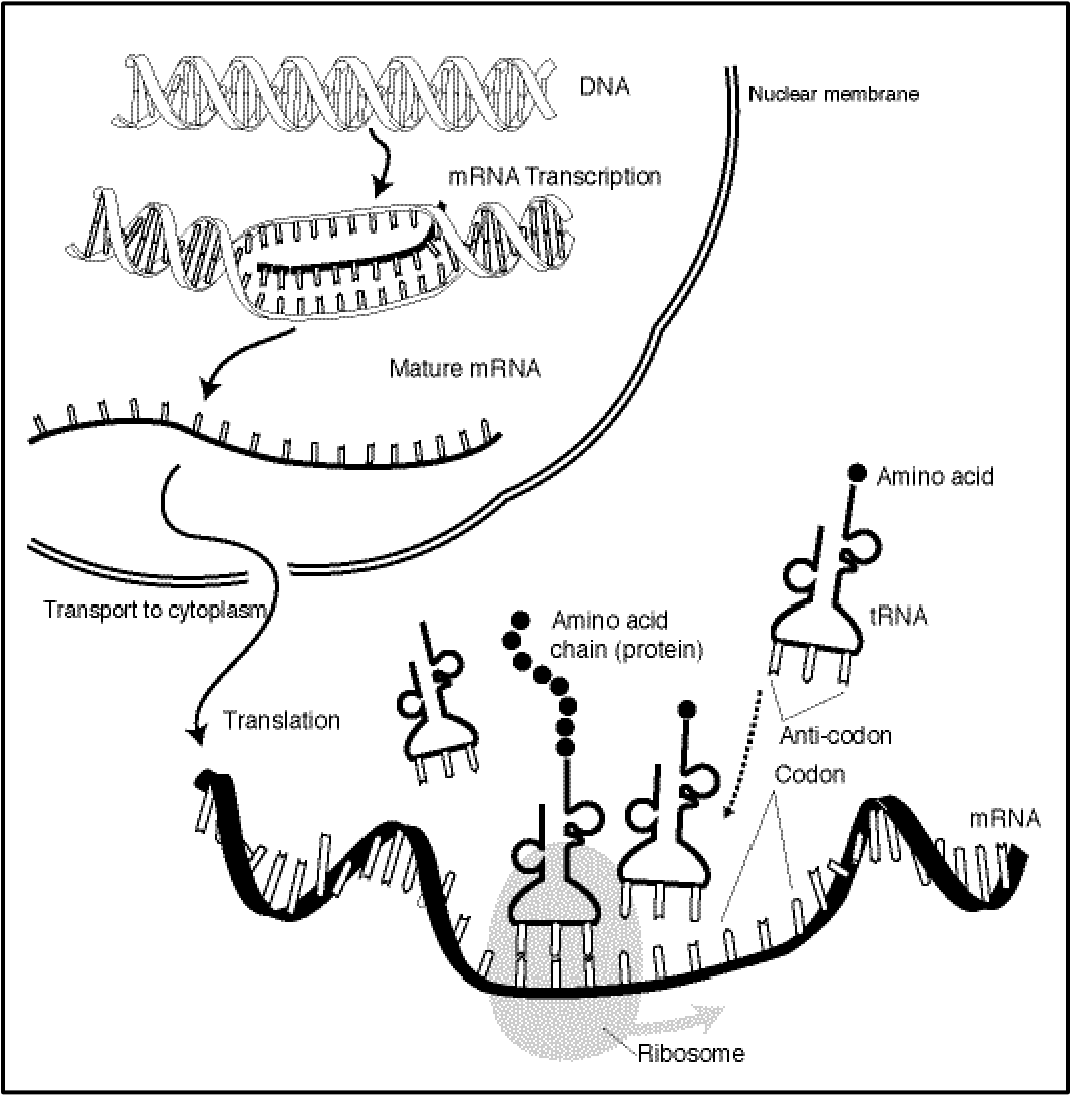
**WHY is TRANSCRIPTION Important?**

* + It is needed to get the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_out of the **\_\_\_\_\_\_\_\_\_\_\_\_\_**so the ribosomes know what \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to make!
  + Without transcription, the ribosome would have no idea what proteins the body needed and would not make any.

* + You could \_\_\_\_\_\_\_\_replace the hair that we lose every day; could NOT grow long fingernails; be able to fight off diseases; cells would fall apart because the proteins were not being\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!!



**B. TRANSLATION (Protein Synthesis)-From RNA to Protein:**

1. First codon of mRNA attaches to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. \_\_\_\_\_\_ (transfer RNA)- each carries a specific amino acid; the tRNA anti-codon will pair up with its complementary mRNA codon.
3. When the 1st and 2nd amino acid is in place, the rRNA joins them by forming a\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. As the process continues, the amino acid chain is formed until a stop codon comes along.
4. The tRNA is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to find another of the same amino acid so the process can occur again and again.
5. The protein chains are then transported to other areas of the body that need them.

* **WHY is TRANSLATION Important?**

* Makes all the \_\_\_\_\_\_\_\_\_\_\_\_\_\_that the body needs

* Without translation, proteins wound not be made and we could not replace the

proteins that are depleted or damaged

**Codons and amino acids**

You will need to look up the mRNA codon and amino acid that corresponds to it using a table or a wheel (see below)

**Special Codons**

There are 2 special codons on the mRNA.

1. Start or initiation codon = ­­­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_
   * Tells where a protein will begin
2. Stop or termination codon – \_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Tells where a protein ends

**C. SUMMARY of PROTEIN SYNTHESIS:**

Below you will find the base sequence of a single strand of DNA. Please fill in the complimentary bases of mRNA, tRNA, and the correct amino acid sequence.

**\* NOTE: mRNA and tRNA never have \_\_\_\_\_\_ in the sequence! Always use the \_\_\_\_\_\_\_\_strand to code for the\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**DNA** T A C **T T G** C A T **G G A** A T G **G T A** A C G **G T A** A C T

**code**

**mRNA** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

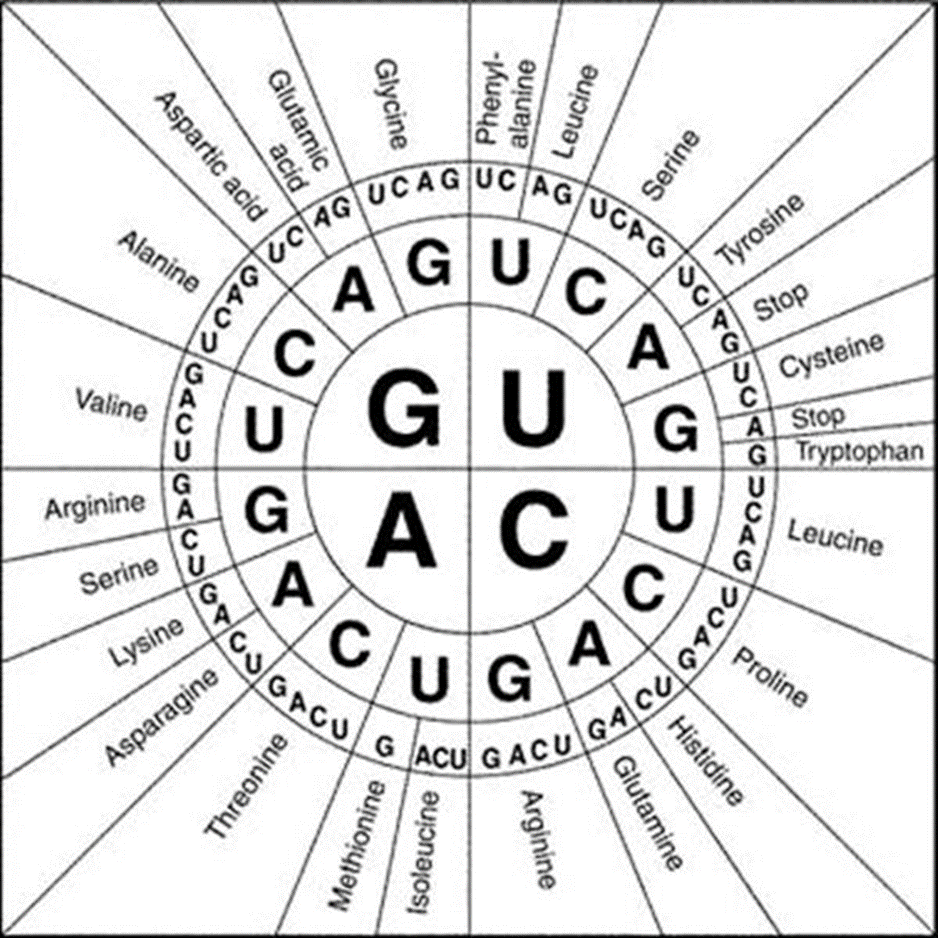
**code**

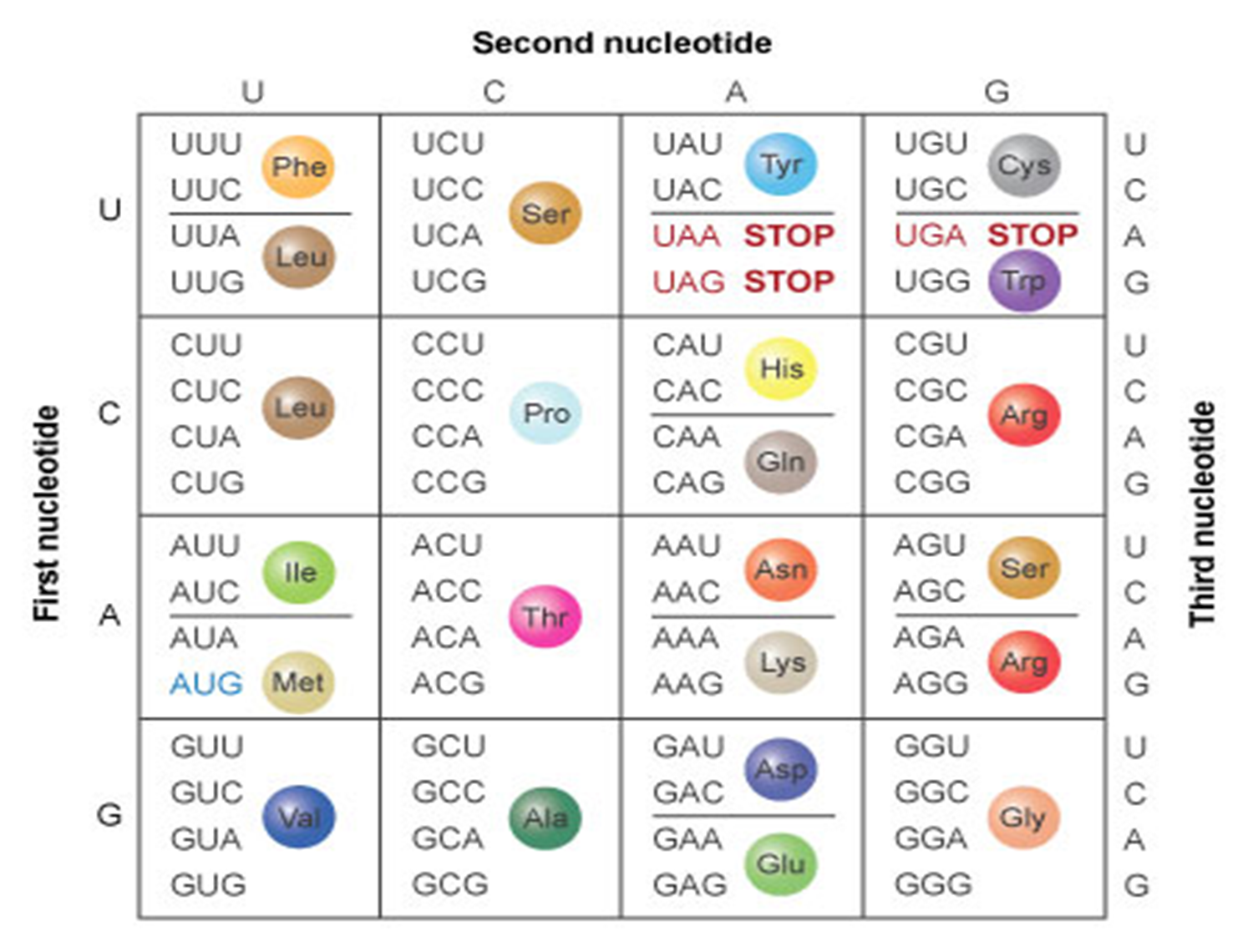
**tRNA** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**anticodon**

**Amino \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Acids**

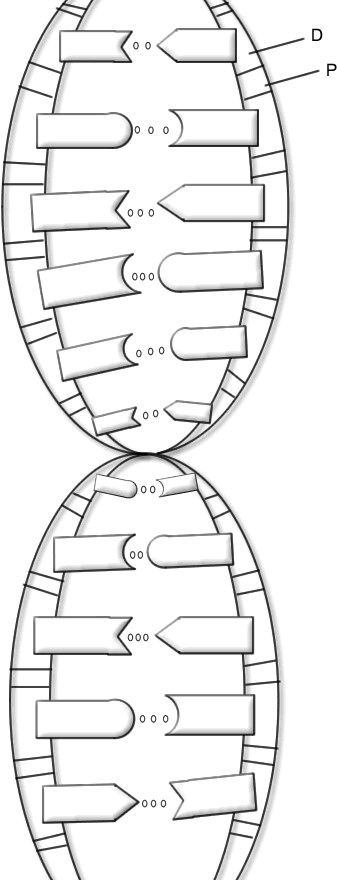
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# DNA & DNA Replication Worksheet

1. What does DNA stand for?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Where in a cell is DNA found?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What is the difference between chromatin and chromosomes?

1. How many PAIRS of chromosomes does a human have in their skin cells?\_\_\_\_\_\_\_\_
2. A segment of DNA that codes for a protein is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. What are the three parts of a DNA molecule? **Label** the three parts of a DNA molecule in the picture provided.
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What 4 bases make up DNA molecules?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Scientifically, describe the shape of a DNA molecule.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What type of bond holds together the nitrogen bases?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. **Label** the hydrogen bond in the picture
   2. How many hydrogen bonds are found between A-T?\_\_\_\_\_ C-G?\_\_\_\_\_
4. Who discovered DNA in 1928? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. What scientists are credited with the “base-pairing” rules?
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. What are the base pairing rules?

1. Write the complementary strand to this DNA molecule on the line.

**G A T C C A T G A G T T A C**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is the importance of the order of base pairs in a DNA molecule? (Hint: what might happen if the order of the base pairs were changed?)

1. When does DNA replicate? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What type of replication is DNA replication? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a. Why?

1. During DNA replication, what causes the hydrogen bonds to break?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. What happens after the hydrogen bonds are broken?

1. After free floating nucleotides are bonded to their complement, what name is given to the newly assembled strand? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. DNA synthesis can only occur (3’-5’ or 5’-3’) so a second type of DNA polymerase binds to the other template strand as the double helix opens.

1. DNA ligase bonds \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_fragments together forming the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ strand.

1. What are the 2 types of pyrimidines?
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What are the 2 types of purines?
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Protein Synthesis Review Worksheet

1. How are DNA and mRNA alike?

1. How are DNA and mRNA different? Fill in the table below.

|  |  |  |
| --- | --- | --- |
| **DNA** |  | **mRNA** |
|  | **Shape** |  |
|  | **Nitrogen bases** |  |
|  | **Sugars** |  |
|  | **Location** |  |

**Transcription: DNA to mRNA:**

1. How many strands of mRNA are transcribed from the two “unzipped” strands of DNA? \_\_\_\_\_\_\_\_\_\_

1. If the following were part of a DNA chain, what mRNA bases would pair with it to transcribe the DNA code onto mRNA? G-G-A-T-C-G-C-C-T-T-A-G-A-A-T-C

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If DNA is described as a double helix, how should mRNA be described? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How are the accuracy of DNA and mRNA codes assured? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

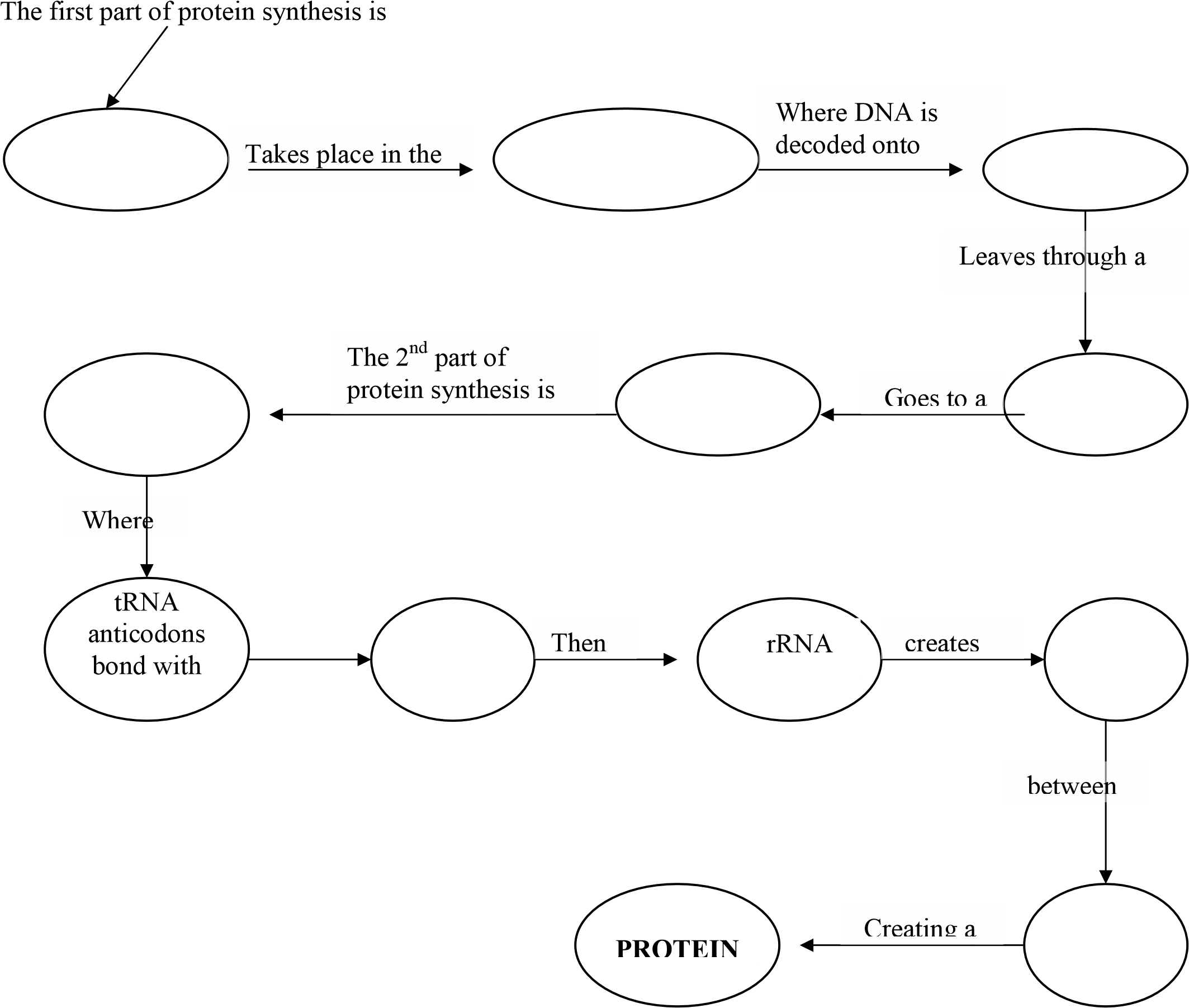
**Translation: mRNA to PROTEIN:**

1. Name and describe the three types of RNA’s involved in protein synthesis?

1. What is located at EACH end of a tRNA molecule? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Where must an mRNA attach before protein production can begin?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. How many bases are needed to specify an mRNA codon?\_\_\_\_\_\_\_\_\_\_
4. If a strand of mRNA contain the sequence, U-A-G-C-U-A-U-C-A-A-A-U, what tRNA anticodons would be needed to translate the sequence?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. How does mRNA get out of the nucleus? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. What is the difference between an amino acid and a protein?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. What type of bond is formed between amino acids?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

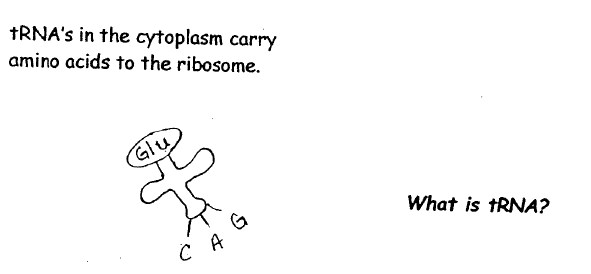
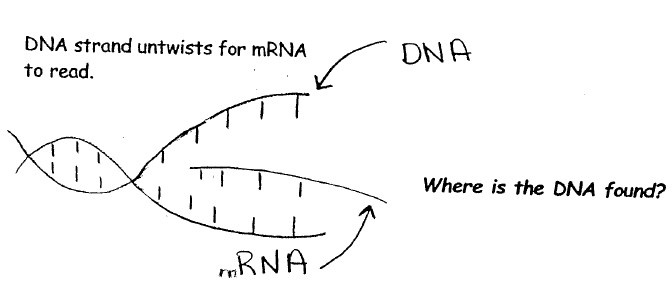
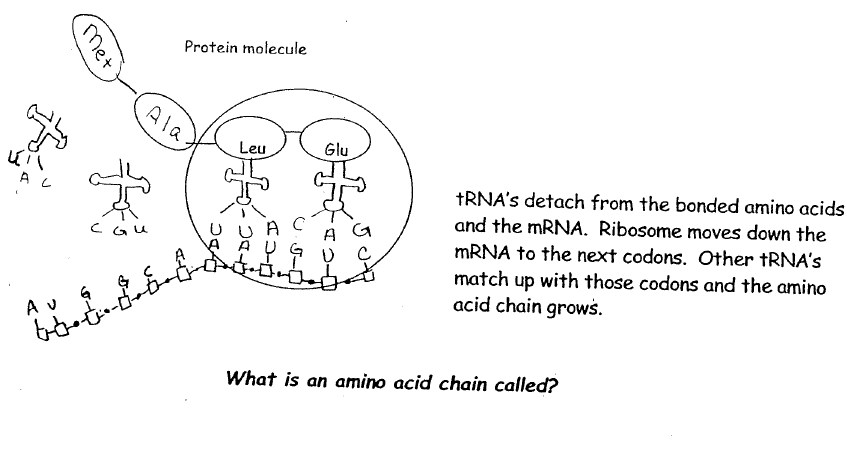
## Protein Synthesis Flow Chart

Directions: Fill in the flow chart below, using the following words: **Amino acids, mRNA, mRNA codon, nucleus, nuclear pore, peptide bonds, ribosome, transcription.**



## Organizing Protein Synthesis

Directions: Number the following pictures (#1-6) along the left hand side in the correct order of how protein synthesis takes place. Then answer the **bolded** question in each of the 6 sections.



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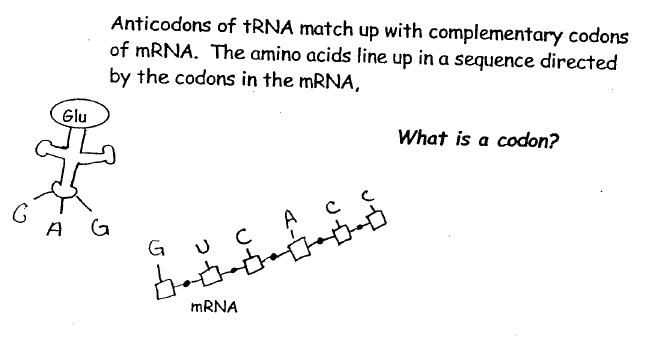
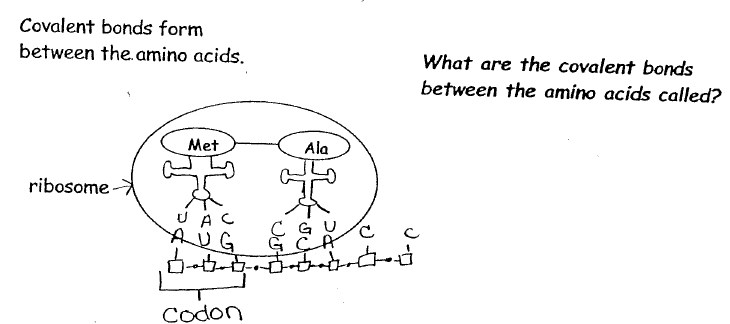
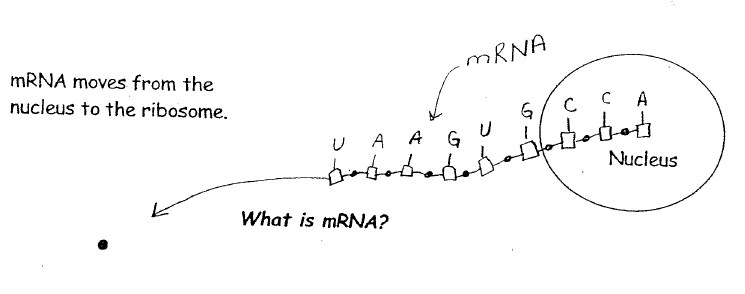
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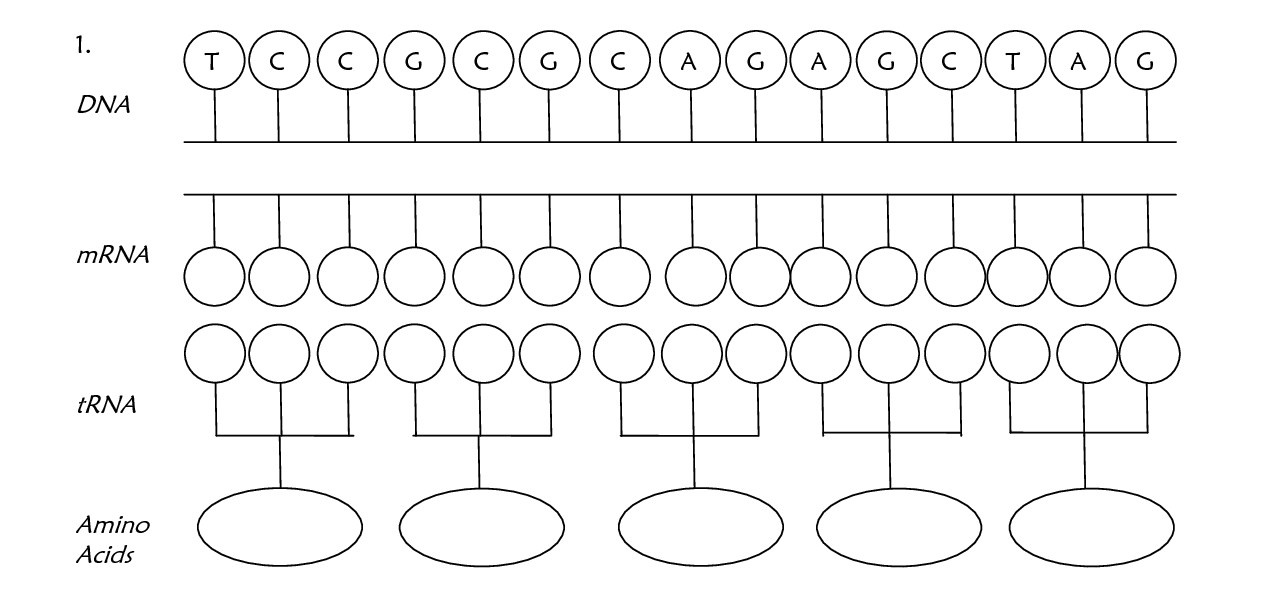
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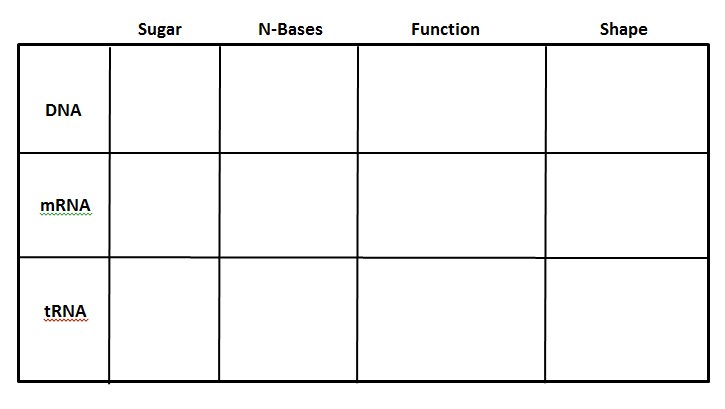
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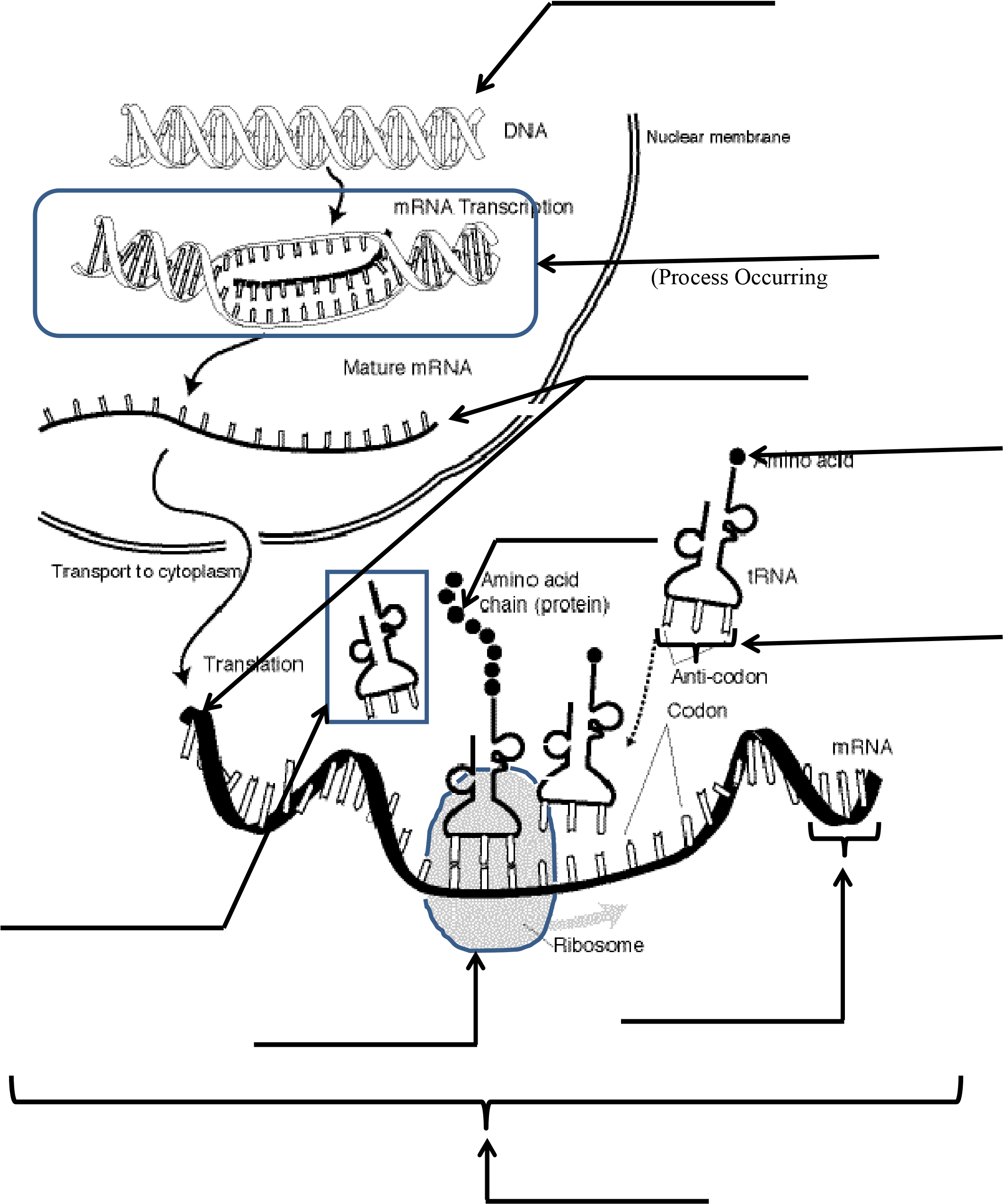
### Outlining the Steps of Protein Synthesis

 **Directions:** *Transcribe DNA🡪 mRNA. Then determine the anticodons in tRNA & finally use your amino acid chart to determine the 5 amino acids.*

**Directions:** *Complete the following chart by comparing the 3 types of genetic material.*



**Directions:** *Label all of the structures in the diagram below.*



(Process Occurring

### DNA & Protein Synthesis Review Worksheet

1. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is a segment of DNA that codes for a protein.
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is uncoiled DNA.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is coiled DNA.
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the enzyme that runs along the parent chain of DNA and bonds free floating nucleotides to those of the parent (original) chain-- based on base pairing rules.
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are short segment of DNA synthesized discontinuously in small segments in the 3’-5’ direction by DNA polymerase.

1. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a set of three nitrogen bases representing an amino acid.
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the DNA strand that is continuously built by the addition of nucleotides to the 3’ end during replication.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the DNA strand that is discontinuously built into small Okazaki fragments during replication.
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the enzyme that chemically links Okazaki fragments together.
5. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a polymer made up of amino acids.
6. During \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, parental strands of DNA separate, serve as a template, and produce DNA molecules that have one strand of parental DNA and one strand of new DNA.
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is the process through which mRNA is decoded and forms a protein.
8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the process through which DNA transfers the code to mRNA.

14) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the sugar in RNA.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the sugar in DNA.
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are 3 nitrogen bases that are complement to the mRNA codon.
3. The order of bases in a molecule of mRNA is determined by the sequence of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the DNA.
4. What are the nitrogen bases for DNA?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. What are the nitrogen bases for mRNA?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

20) What are the 3 parts that make up a DNA nucleotide?

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

21) What are the 3 parts that make up a mRNA nucleotide?

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

22) What is the function of mRNA?

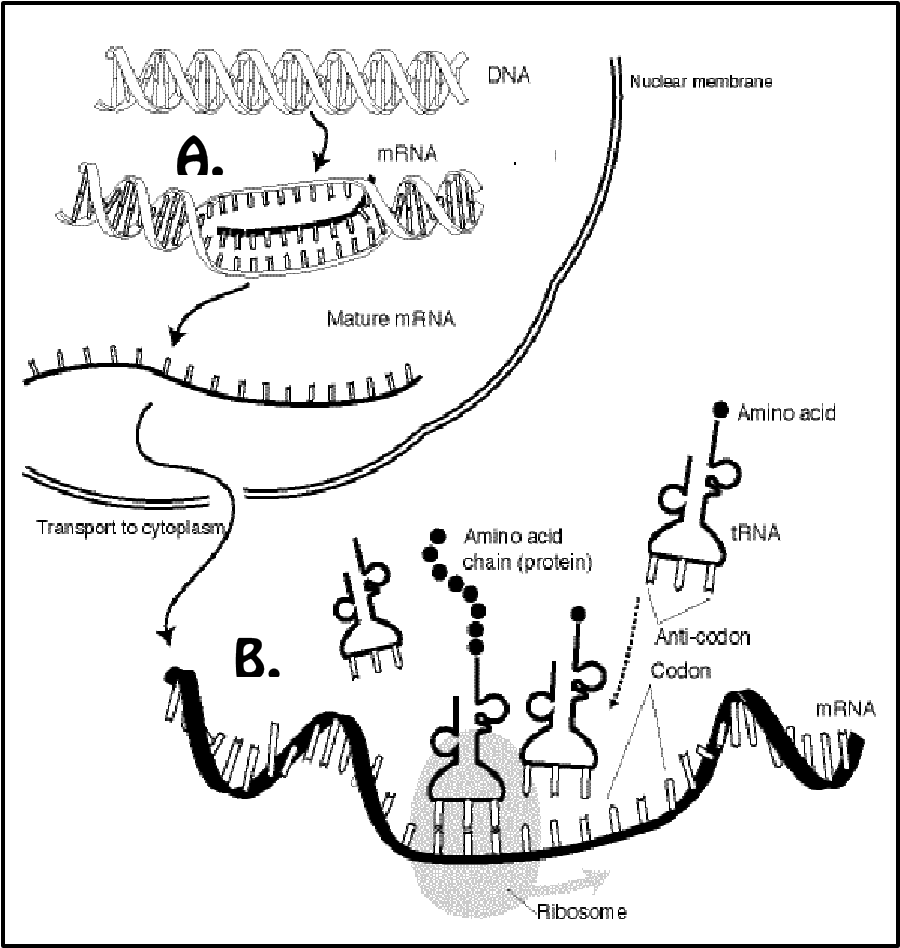
1. What is the function of tRNA?
2. What is the function of rRNA?

1. Where are proteins made? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What scientists are credited with the “base-pairing” rules? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What type of bonds hold together the nitrogen bases in a DNA molecule? \_\_\_\_\_\_\_\_\_
3. Where in a cell can mRNA be found? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

29) True or False: DNA can leave the nucleus.

1. What is the difference between DNA replication and protein synthesis?



1. Look at the diagram on the right.
   1. What process is occurring at “A”?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

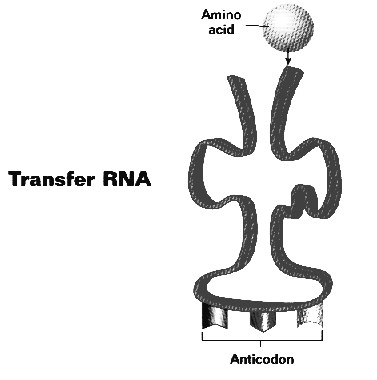
* 1. What process is occurring at “B”?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What was the purpose of the lysis solution used during the DNA extraction lab?

1. Identify the following molecule. \_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. Label the 2 parts of the molecule below.

B.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



A.

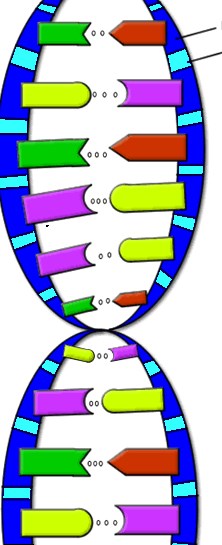
\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_

1. Using the following DNA sequence, complete the process of protein synthesis. DNA strand: **TAC GGA CAC TTG**

mRNA codon: \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

tRNA anticodon: \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

Amino acids: \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

DNA & Protein Synthesis Vocabulary:

1. **DNA** = blueprint of life (has the instructions for making an organism)

1. **Chromatin *=*** uncoiled DNA

1. **Chromosome** = coiled DNA

1. **Gene** = a segment of DNA that codes for a protein, which in turn codes for a trait (skin tone, eye color, etc); a gene is a stretch of DNA

1. **Purines** = adenine (A) and guanine (G)

1. **Pyrimidines**= thymine (T) and cytosine (C)

1. **Nitrogen bases *=*** A, T, C, G

1. **Replication** = process where DNA makes a copy of itself

1. **Semiconservative replication** = parental strands of DNA separate, serve as a template, and produce DNA molecules that have one strand of parental DNA and one strand of new DNA.

1. **DNA polymerase** =(enzyme) runs along the parent chain of DNA and bonds free floating nucleotides to those of the parent (original) chain-- based on base pairing rules
2. **DNA helicase** = enzymes that unwinds and unzips the parental DNA molecule

1. **Okazaki fragment** = short segment of DNA synthesized discontinuously in small segments in the 3’5’ direction by DNA polymerase.
2. **DNA ligase** = enzyme that chemically links Okazaki fragments together
3. **Leading strand** = DNA strand that is continuously built by the addition of nucleotides to the 3’ end during replication
4. **Lagging strand** = DNA strand that is discontinuously built into small Okazaki fragments during replication
5. **Ribose** = sugar in RNA

1. **Uracil** = nitrogen base of RNA

1. **RNA** = Ribonucleic Acid

1. **mRNA** = messenger RNA; *Structure:* single stranded; *Function:* Carries the DNA message from the nucleus to the ribosomes

1. **tRNA** = transfer RNA; *Structure:* has an anticodon that is a complement to the mRNA codon at one end and a amino acid at the other end; *Function:* Carries the amino acids to the ribosomes for protein production.
2. **rRNA** = ribosomal RNA; *Structure:* Apart of ribosome; *Function:* Creates the peptide bonds between the amino acids during protein production.

1. **Transcription** = is the process through which DNA transfers the code to mRNA

1. **Codon** = set of three nitrogen bases representing an amino acid

1. **Amino acid** = building blocks of a protein

1. **Translation** = is the process through which mRNA is decoded and forms a protein

1. **Ribosomes** = tiny organelles where proteins are assembled

1. **Peptide bond** = a covalent bond that holds amino acids together in a protein

1. **Protein** = a polymer made up of amino acids

1. **Anticodon** = 3 nitrogen bases that are complement to the mRNA codon
2. **Protein synthesis** = forming proteins based on information in DNA and carried out by RNA
3. **Polypeptide chain** = a chain of amino acid linked together by peptide bonds