

Chapter 13-1, 13-2, 13-3: RNA and Protein Synthesis PRE-BIO

What is a gene?

A gene is a set of _____ instructions that control the _____ of _____ within the _____. This process, called _____, involves 2 steps: _____ and _____.

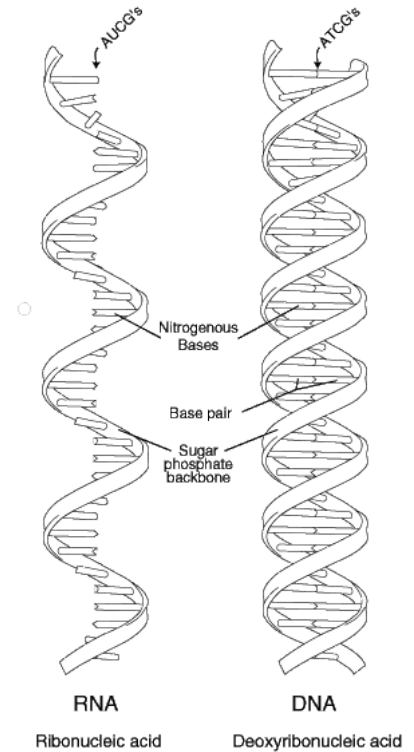
How does a gene work?

DNA cannot leave the _____, so a copy is made in the form of a similar _____ called RNA (ribonucleic acid) during transcription. After DNA is used to make _____, the RNA is then used to make _____ during translation by ribosomes in the cytoplasm.

How is DNA different from RNA?

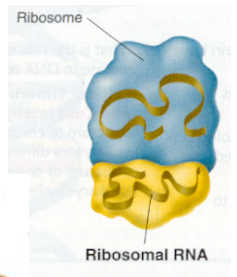
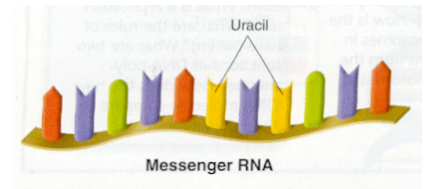
RNA is a _____ similar to DNA with 3 differences:

1. _____
2. _____
3. RNA contains _____ instead of _____. Uracil, like thymine, is a _____ (contains one ring).



Three types of RNA

1. messenger RNA (_____): carries a _____ of the information in DNA. This type of RNA acts as a “_____” bringing the information in the DNA to the _____.
2. ribosomal RNA (_____): this RNA is found with _____. Recall that ribosomes _____. Ribosomes are made of both proteins and rRNA.
3. transfer RNA (_____): this RNA brings _____ to the ribosome to be added to the _____ that is being made at the ribosome. There is one tRNA for each of the 20 amino acids.



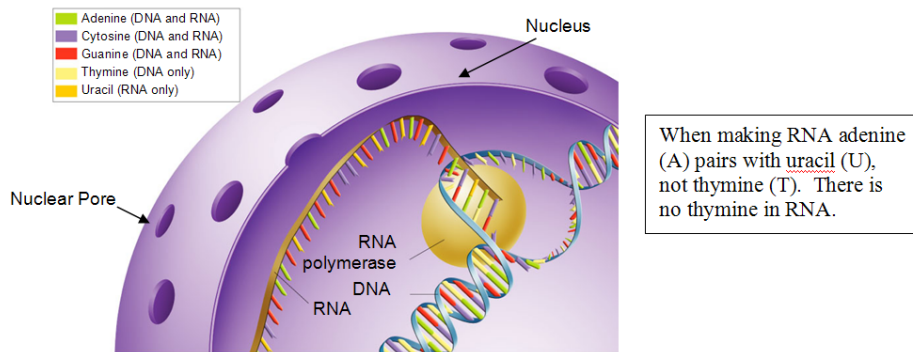
Central Dogma of Molecular Biology

DNA → RNA → protein

Transfer RNA

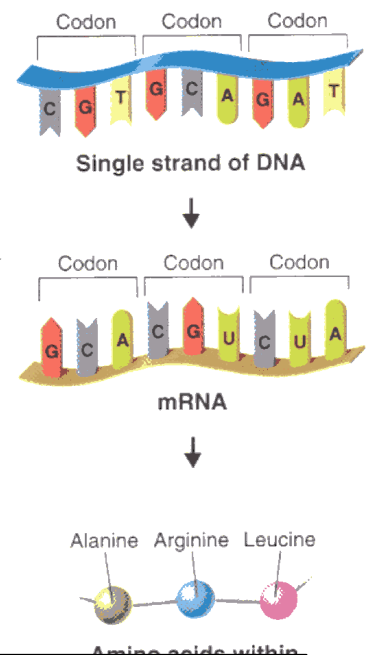
Transcription

- Transcription is the process in which the nucleotide sequence of _____ is copied, or _____ into a _____ sequence of _____.
- DNA is like the “_____” and RNA is like the “_____.”
- Because DNA is in the _____, transcription occurs in the nucleus of the cell.
- When transcription is finished, the _____ moves to the _____. DNA _____ leave the nucleus.
- The enzyme _____ is used to make RNA. RNA polymerase:
 - _____ to the DNA,
 - _____ the DNA, and
 - uses only one strand of DNA as a template to make a _____ RNA strand. RNA Polymerase reads _____.
 - Once RNA is made, the RNA detaches from the template strand, leaves the nucleus through _____ and enters the _____ of the cell.



Translation

- RNA is used to make _____ in a process called translation.
- Remember that proteins, a.k.a. _____, are macromolecules made of monomers called _____.
- The Genetic Code
 - In RNA, the nucleotides are read in “_____” made of 3 nucleotide “_____”. Each “word” is called a _____ and contains the genetic code for _____ amino acid.
 - The first “word” or _____ codon is always the same for every protein. It is always _____. Using the genetic code wheel or chart you can figure out which amino acid a codon represents. What amino acid is associated with the codon AUG? _____
 - There are a total of _____ different amino acids that can be arranged in different ways to make different _____.

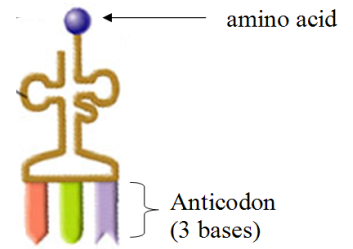


See Genetic Code wheel on page 311!
See pages 309-315 for additional pictures and descriptions of transcription and translation!

- During translation, ribosomes _____ or translate the mRNA message (made of nucleotides) to make polypeptide chains (made of amino acids). Ribosomes read _____.
- Before _____ can occur, mRNA must be made from DNA in _____ . Transcription occurs in the _____ , then the mRNA travels out of the nucleus into the _____ .
- Translation is done by _____ in the _____ .

The steps in translation include:

- _____ attach to the mRNA.
- Ribosomes read _____. As each codon of the mRNA moves through the ribosome, the correct amino acid is brought to the ribosome by _____ .
- Each tRNA molecule has a group of three nucleotides called the _____. These three nucleotides _____ with the nucleotides in the codon. The tRNA molecule also has an _____ attached.
- _____ bonds form between amino acids to form the _____ chain in a process called _____ because it makes the polypeptide chain longer.
 - This forms a peptide bond between the amino acids. This is why proteins are called polypeptides.
 - The empty tRNA molecule exits the mRNA and is _____ by the cell and can bind another _____.
- The ribosome continues to match the codons in the mRNA with anticodons in tRNA until it reads a codon in the mRNA that says “_____ ..” A tRNA for “stop” does not carry an amino acid. _____ will form, so the ribosome releases the _____ and the _____.
- Polypeptide will start to coil and bend, forming the _____ (recall the 4 level of protein structure)

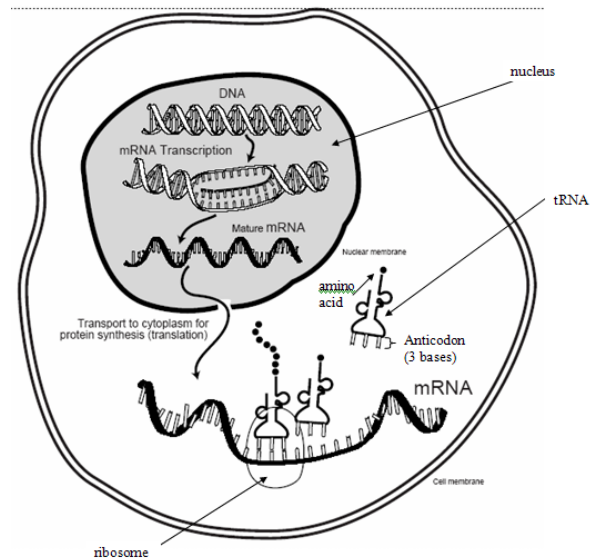


Transfer RNA

Why are proteins important?

Each protein has a specific function within living cells. Some functions of proteins are:

-
-
-
-



Where in the cell does transcription take place?

Where in the cell does translation take place?

Chapter 13-3: Mutations

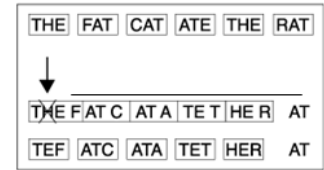
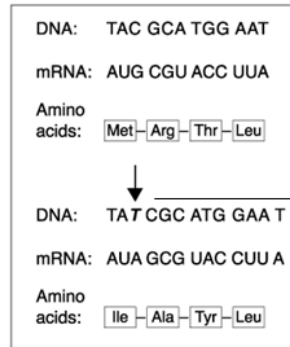
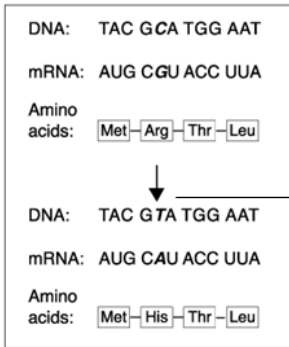
Mutations are _____ in the genetic code. They come from _____ that are made by _____ during replication. If a cell has a mutation, _____ of its daughter cells will have that same mutation.

Kinds of mutations: Mutations come in many shapes and _____.

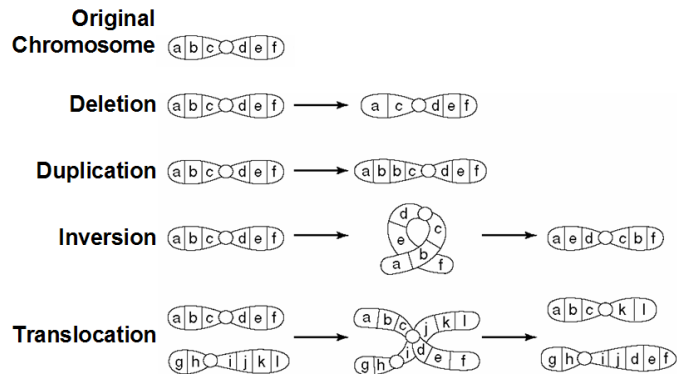
1. Mutations that produce a change in a single gene are called _____ mutations.
2. Other mutations produce changes in whole chromosomes (and affect _____ genes). These mutations are called _____ mutations.

Gene mutations: affect _____ gene

1. _____ mutations: involve changes in one or a few _____ at one point in the DNA sequence.
 - a. _____: where one base is changed to another. These usually affect only one amino acid.
 - b. Frameshift mutations (Insertions or Deletions): an extra base is _____ or removed. These usually affect a large part of the protein. Remember, bases are read in groups of three, but if one base is added or removed, this shifts the “reading frame” of the genetic code and can change all _____ after the site of the mutation.



2. _____ mutations: involve changes in the number or structure of the chromosomes.
 - c. Can change the _____ of genes on chromosomes
 - i. _____: reverses the direction of parts of the chromosomes
 - ii. _____: part of one chromosome breaks off and attaches to another.
 - d. Can change the _____ of copies of some genes
 - i. _____: a part of the chromosome is lost
 - ii. _____: there is an extra copy of part of the chromosome



3. Causes of mutations:

- a.
- b.

4. Effects of Mutations

- a. _____: No effect on protein function
- b. _____: Cause genetic diseases and _____
- c. _____: Plants with extra sets of chromosomes are larger and stronger
- d. Any _____ trait in a population, good or bad, is a result of a mutation.