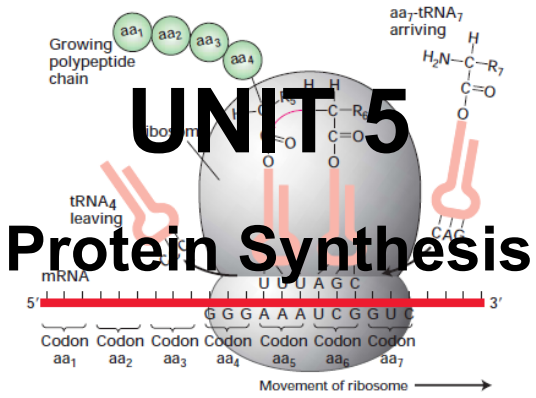
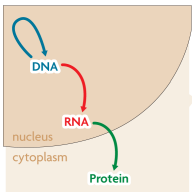


UNIT 5
Protein Synthesis

IV. Transcription (8.4)

A. RNA carries DNA's instruction

1. Francis Crick defined the **central dogma of molecular biology**



a. **Replication copies DNA**

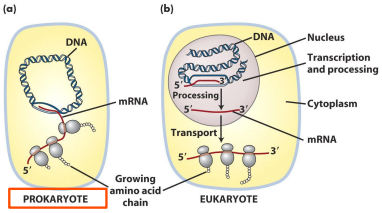
b. **Transcription** converts **DNA** message into intermediate molecule, called **RNA**

c. **Translation** interprets an **RNA** message into string of amino acids, called polypeptide **(protein)**

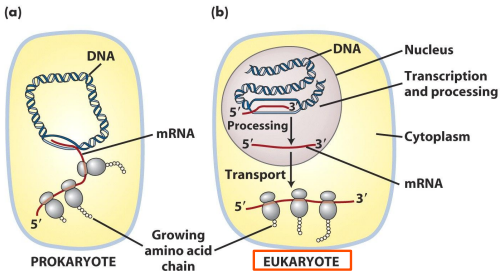
2. In **prokaryotic cells** processes take place in **cytoplasm**

a. Replication, transcription and translation occurs in cytoplasm of prokaryotes (no nucleus)

b. **Translation** begins while the mRNA is still being synthesized (transcription).

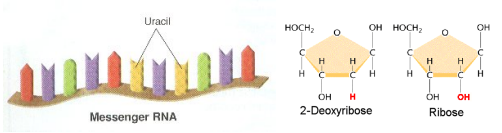


3. In **eukaryotic cells** processes are separated
    a. **Replication** and **Transcription** in **nucleus**
    b. **Translation** occurs in **cytoplasm**

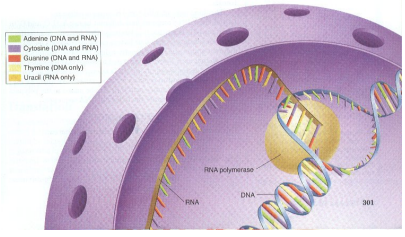


4. **RNA** acts as **messenger** between nucleus and protein synthesis in cytoplasm

5. RNA differs from DNA in three significant ways
    a. Sugar in RNA is **ribose** not deoxyribose
    b. RNA has the base **uracil** in place of thymine
    c. RNA is **single stranded** not double

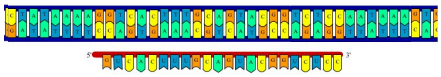


B. Transcription makes three types of RNA
    1. Transcription copies sequence of DNA (one **gene**) and is catalyzed by RNA polymerases
        a. DNA begins to unwind at specific site (gene)

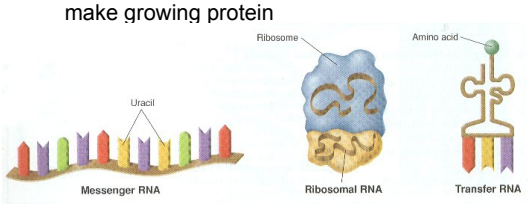


b. Using **one strand of DNA**, **complementary** strand of **RNA** is produced

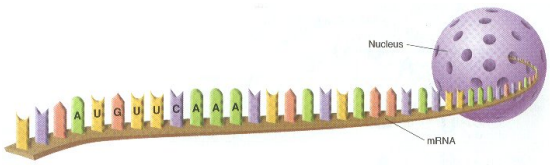
c. RNA strand detaches and DNA reconnects



2. Transcription produces 3 kinds of RNA
   a. **Messenger RNA (mRNA)-** code for translation
   b. **Ribosomal RNA (rRNA)-** forms part of ribosome
   c. **Transfer RNA (tRNA)-** brings amino acids from the cytoplasm to a ribosome to help make growing protein



3. The transcription process is similar to replication
   a. Both occur in **nucleus**
   b. Both involve **unwinding of DNA**
   c. Both involve **complementary base pairing**

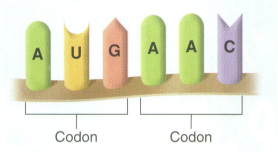


V. Translation (8.5)

A. **Amino acids** are **coded** by **mRNA base sequences**

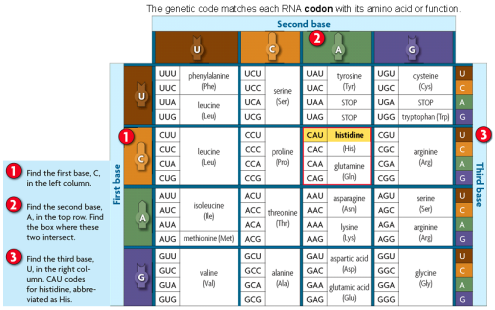
1. Translation **converts mRNA** messages into **polypeptides**

2. A **codon** is a sequence of **three nucleotides** that codes for an **amino acid.**



a. RNA could code **64 different combinations**

b. Plenty to cover the **20 amino acids** used to build proteins in human body and most other organisms

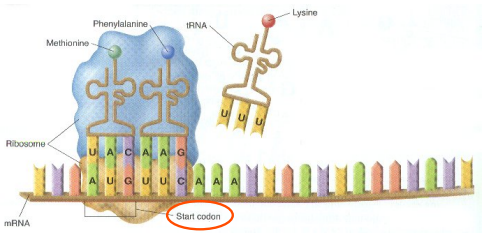


c. Many amino acids coded by more than one codon

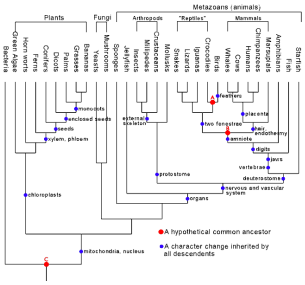
d. Also special codons

1). **Start codon**- signals start of translation

2). **Stop codon**- signals end of amino acid chain



3. This **code is universal**- same in almost all organisms



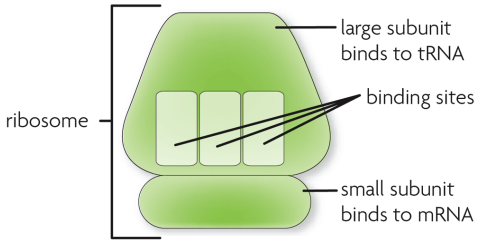
a. Suggests **common ancestor**

b. Means scientist can insert gene from one organism into another to make functional protein

B. **Amino acids** are <u>linked</u> to become a **protein**

1. Two important "tools" needed to translate a codon into an amino acid

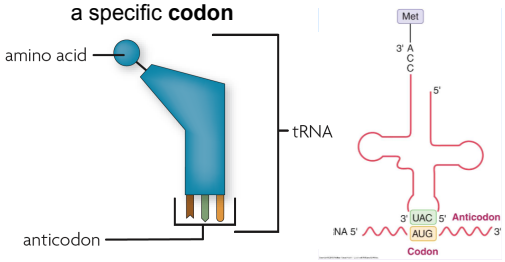
a. **Ribosome**- site of protein synthesis



b. **tRNA**- carries free-floating **amino acids** from cytoplasm to **ribosome**

1). tRNA attaches to specific **amino acid**

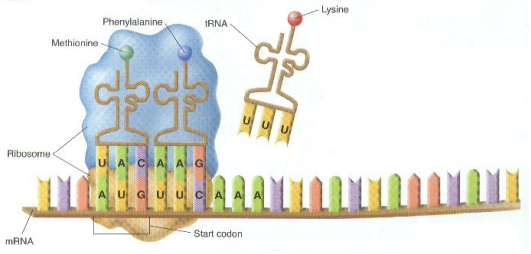
2). Has "3-letter" **anticodon** that recognizes a specific **codon**



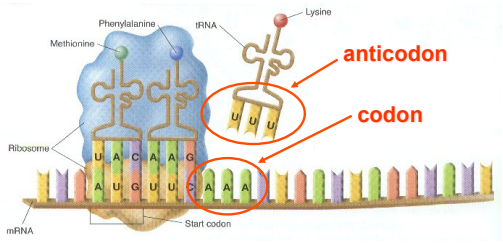
2. Translation occurs in cytoplasm of cell

   a. **mRNA** binds to **ribosome**

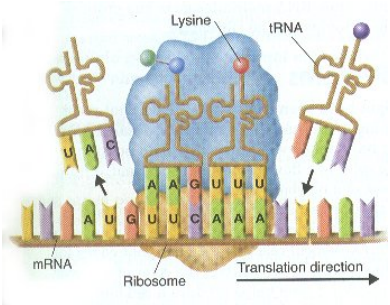
   b. **Ribosome** pulls mRNA strand through **one codon at a time**



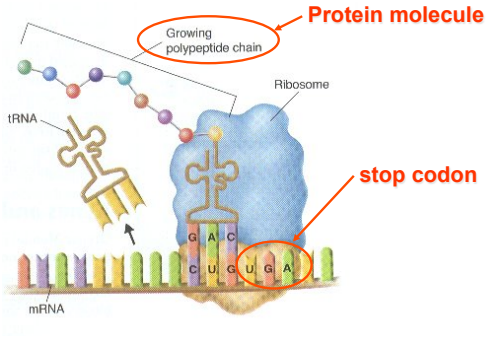
c. Exposed codon attracts **complementary tRNA** bearing an **amino acid**



d. **Amino acids bond together** and tRNA molecule leaves to find another amino acid



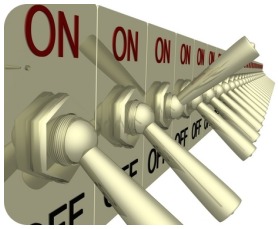
e. Ribosome moves down mRNA attaching more amino acids until reaches stop codon.



VI. Gene Expression and Regulation (8.6)

A. Your cells can control when gene is "turned on or off"

B. Different in prokaryotic and eukaryotic cells



C. Because cells are specialized in multicellular organisms, only certain genes are expressed in each type of cell.

VII. Mutations (8.7)

A. Some mutations affect a **single gene**, while others affect an **entire chromosome**

1. **Mutation**- a change in an organism's DNA

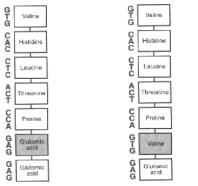
2. **Mutations** that affect a **single gene** usually happen during **replication**

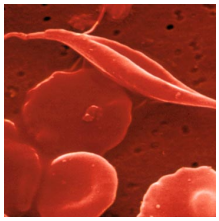
3. **Mutations** that affect **group of genes** or **chromosome** happen during **meiosis**

B. **Gene Mutations**

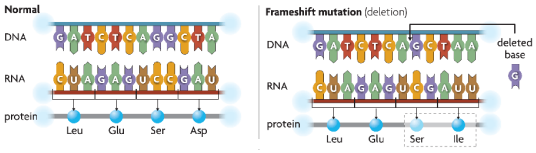
1. **Point mutation**- one nucleotide is substituted for another

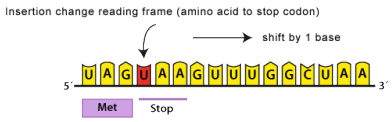
Result of simple point mutation





2. **Frameshift mutation**- involves insertion or deletion of a nucleotide in DNA sequence

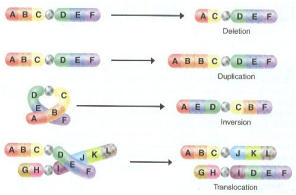




3. **Chromosomal mutations**-

a. **Gene duplication**-exchange of DNA segments through crossing over during meiosis

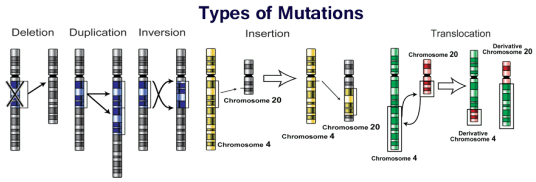
b. **Gene translocation**- results from the exchange of DNA segments between nonhomologous chromosomes



C. **Mutations** <u>may or may not affect</u> **phenotype**

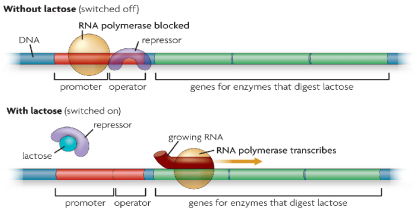
1. Impact on phenotype-

a. **Chromosomal mutations** affect many genes and have **big affect on organism**



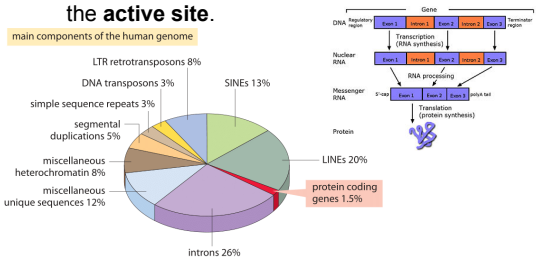
b. Some gene mutations **change** phenotype.

1. A mutation may cause a premature **stop codon.**
2. A mutation may change **protein shape** or the **active site**
3. A mutation may change **gene regulation**



c. Some gene mutations **do not** affect phenotype

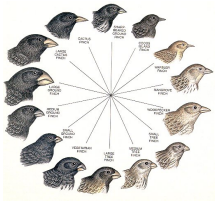
1. A mutation may be **silent**
2. A mutation may occur in a **noncoding region**
3. A mutation <u>may not</u> affect **protein folding** or the **active site**.



2. Mutations in **body cells** do not affect offspring.

3. Mutations in **sex cells** can be **harmful** or **beneficial** to offspring

4. **Natural selection** often removes mutant alleles from a population when they are less adaptive.



D. Mutations can be caused by several factors

1. **Replication errors** can cause mutations

2. **Mutagens**, such as UV ray and chemicals, can cause mutations

3. Some **cancer drugs** use **mutagenic properties** to kill cancer cells.