Cookin' Up Proteins...

The Importance of DNA

How do DNA and RNA control the structure and function of cells and of entire organisms?

Making Proteins is like Cooking...

Drag the ingredients into the pot

Much like cooking, Protein Synthesis requires special ingredients that must be combined together in a particular way in order for the "RECIPE" to turn out just right

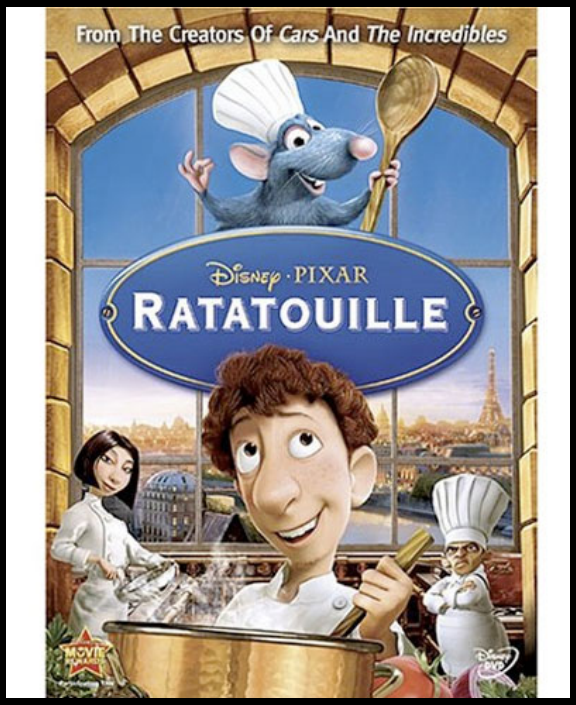
It gives the directions, or "RECIPE" that turns DNA into proteins

The process of turning DNA into Proteins is called Protein Synthesis

We already know that DNA controls all cells in living things

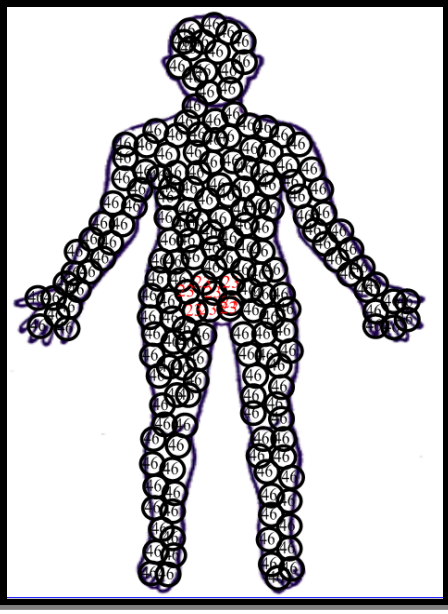
Proteins make up tissues, muscles, enzymes, antibodies, insulin, etc.

Protein Synthesis is Like…

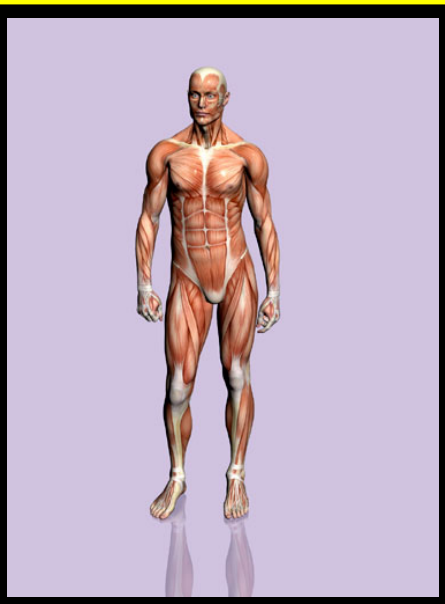


In other words...

How do we go from this?

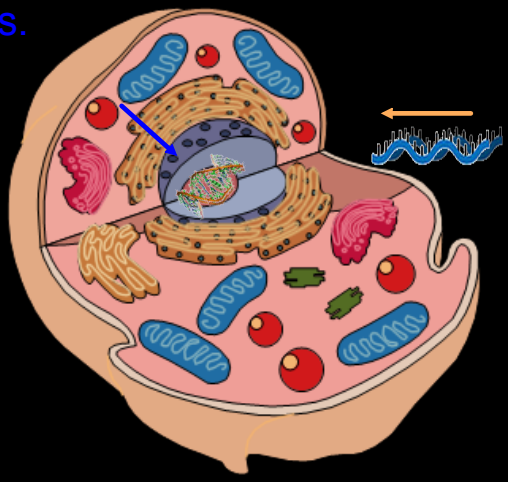


...to this?



The Situation with DNA...

Problem:
DNA is a huge molecule that cannot fit through the pores of the Nucleus.



Solution:
The nucleus uses a messenger to make a copy of the DNA that can be taken from the nucleus to the ribosmes..the site of protein synthesis.

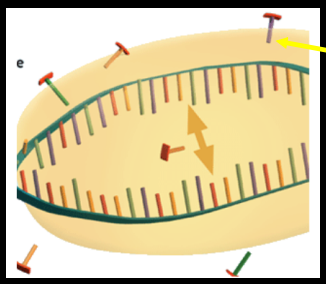
How is a messenger strand of RNA made?

This process of copying DNA into a messenger is known as *TRANSCRIPTION*...

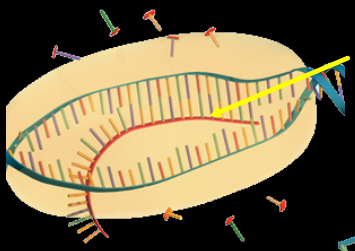
The actual "copy" is called *messenger RNA* or *mRNA*.

How does Transcription happen?

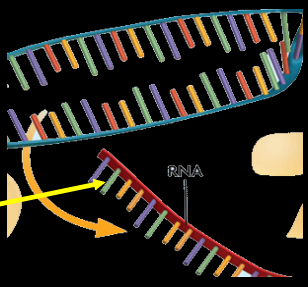
Click the silverware to reveal the steps



1. RNA Polymerase enzyme unwinds DNA



2. RNA uses one side of DNA as a template & bases pair together

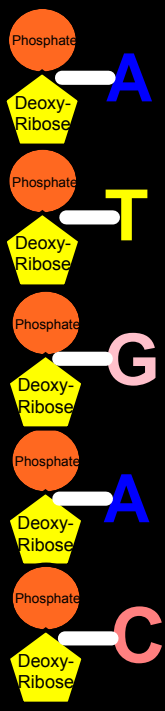


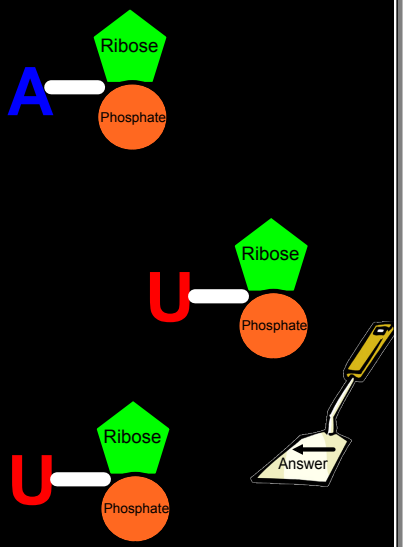
3. The messenger RNA is released

When transcription happens, DNA acts as a template for base pairing.

Drag the proper bases to complete transcription.

DNA Template





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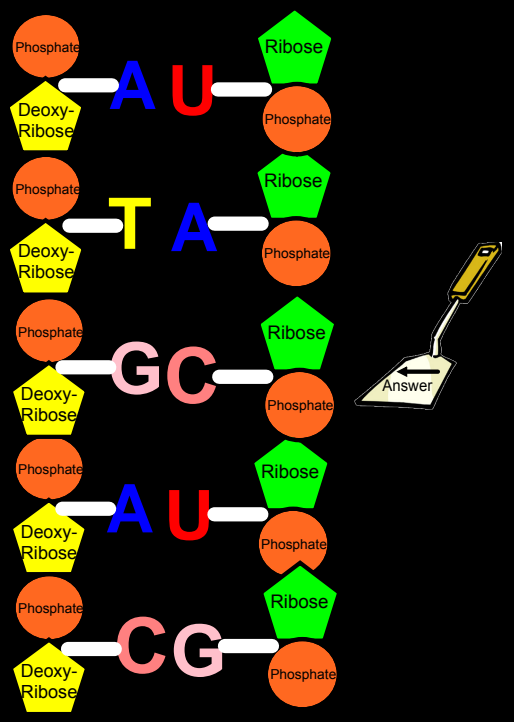
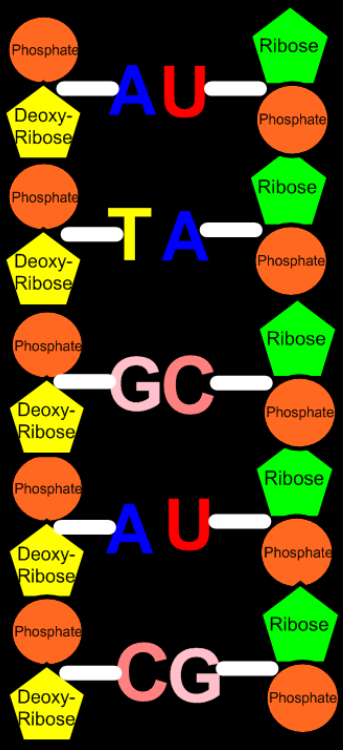
DNA Template





The next step is to use mRNA to decode the nucleotides into amino acids

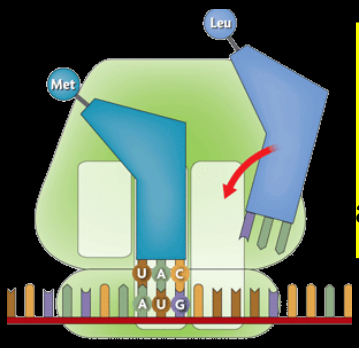
The Process of converting mRNA to Proteins is called <u>Translation</u>

Remeber that proteins are long polypeptides of amino acids that help direct all of our cellular functions.

There are 20 amino acids, whose orders change to determine the function of the protein.

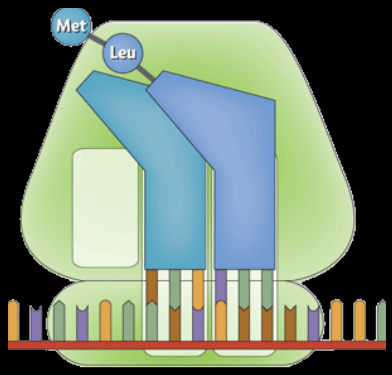
How does Translation happen?

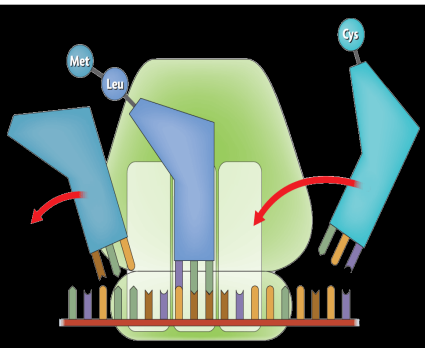
Click the dishes to reveal



1. The ribosome moves along the strand of mRNA and exposes a codon. The tRNA with the matching anticodon is brought in along with the proper amino acid.

2. This pattern continues and each amino acid begins to bind together via a peptide bond.





3. The ribosome continues to pull along the mRNA exposing another codon and getting rid of the old tRNAs until a stop codon is reached.

4. The process of translation happens at many points along the mRNA allowing proteins to be made rapidly.

The Genetic Code

Just like a chef must understand "cooking lingo" to make a recipe... DNA and RNA also communicate in their own language.

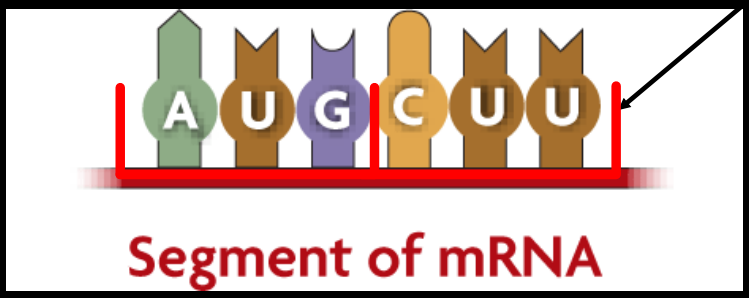
The Language of DNA & RNA is based on four letters-

A, U, G, C

The combinations of these letters determines what amino acids will be made and then turned into proteins.

The Nucleotides are read in groups of 3, meaning that each word is 3 letters long.

Every three bases creates a genetic word called a codon



Each codon represents a particular amino acid, which is determined by the use of an ***Amino Acid Chart***.

Can you identify the codons below?

Identify the amino acids that will be created from these codons.

Amino Acid Chart

First Position	Second Position				Third Position
U	U	C	A	G	
	Phe (F)	Ser (S)	Tyr (Y)	Cys (C)	U
	Phe (F)	Ser (S)	Tyr (Y)	Cys (C)	C
	Leu (L)	Ser (S)	Stop	Stop	A
	Leu (L)	Ser (S)	Stop	Trp (W)	G
C	Leu (L)	Pro (P)	His (H)	Arg (R)	U
	Leu (L)	Pro (P)	His (H)	Arg (R)	C
	Leu (L)	Pro (P)	Gln (Q)	Arg (R)	A
	Leu (L)	Pro (P)	Gln (Q)	Arg (R)	G
A	Ile (I)	Thr (T)	Asn (N)	Ser (S)	U
	Ile (I)	Thr (T)	Asn (N)	Ser (S)	C
	Ile (I)	Thr (T)	Lys (K)	Arg (R)	A
	Met (M)	Thr (T)	Lys (K)	Arg (R)	G
G	Val (V)	Ala (A)	Asp (D)	Gly (G)	U
	Val (V)	Ala (A)	Asp (D)	Gly (G)	C
	Val (V)	Ala (A)	Glu (E)	Gly (G)	A
	Val (V)	Ala (A)	Glu (E)	Gly (G)	G

UUA

ACC

GGU

AGU

Identify the amino acids that will be created from these codons.

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First Position	Second Position				Third Position
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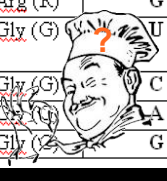
	Phe (F)	Ser (S)	Tyr (Y)	Cys (C)	U
	Phe (F)	Ser (S)	Tyr (Y)	Cys (C)	C
	Leu (L)	Ser (S)	Stop	Stop	A
	Leu (L)	Ser (S)	Stop	Trp (W)	G
C	Leu (L)	Pro (P)	His (H)	Arg (R)	U
	Leu (L)	Pro (P)	His (H)	Arg (R)	C
	Leu (L)	Pro (P)	Gln (Q)	Arg (R)	A
	Leu (L)	Pro (P)	Gln (Q)	Arg (R)	G
A	Ile (I)	Thr (T)	Asn (N)	Ser (S)	U
	Ile (I)	Thr (T)	Asn (N)	Ser (S)	C
	Ile (I)	Thr (T)	Lys (K)	Arg (R)	A
	Met (M)	Thr (T)	Lys (K)	Arg (R)	G
G	Val (V)	Ala (A)	Asp (D)	Gly (G)	U
	Val (V)	Ala (A)	Asp (D)	Gly (G)	C
	Val (V)	Ala (A)	Glu (E)	Gly (G)	A
	Val (V)	Ala (A)	Glu (E)	Gly (G)	G

Leu

Thr

Gly

Ser

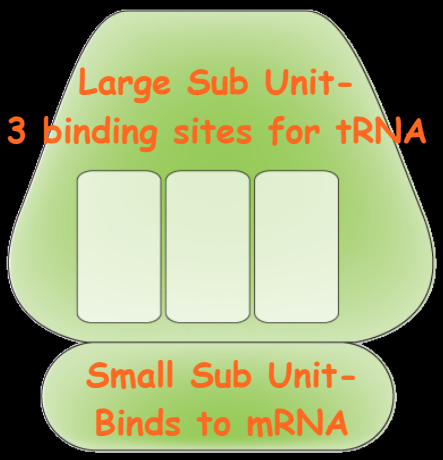


Notice a few unique codons? These codons tell the ribosome when to start and stop translation.

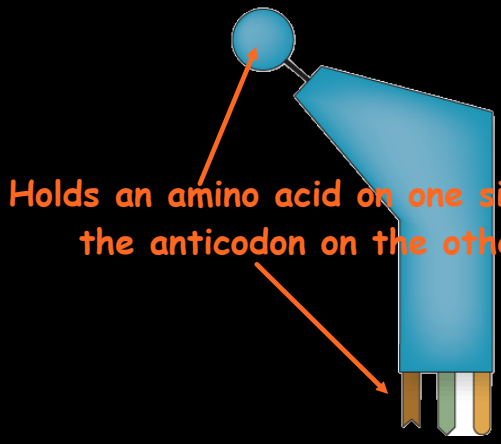
Important Structures in Translation

The Finished Product

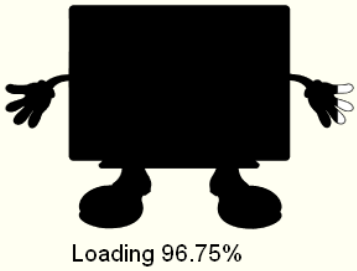
Ribosme



tRNA



The Leading Roles…



What really makes a protein carry out a specific job

Click to reveal

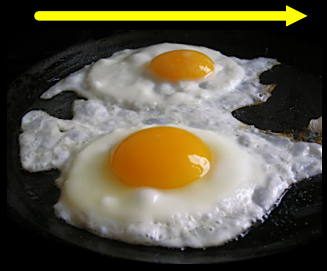
Once proteins are made, they are a linear chain of amino acids.

The final step in creating a protein, is when it folds into a 3-D shape due the interaction of amino acids.

Those shapes determine their function!

Proteins and REAL life... (a few examples)

Egg whites denature and turn "white" once exposed to heat



Insulin used by diabetics to regulate blood sugar must be kept "Cool" so that it does not denature.


1/2 CU

Attachments

Ratatouille clip.wmv

protein folding .wmv

Protein Denaturation .wmv

From RNA to Protein Synthesis .wmv