

Name _____

DNA Translation Lab

Edible Version

DNA contains thousands of genes, each of which is a code for making a specific enzyme (aka protein).

Proteins are long chains of _____ .

In this lab, we will crack the code that turns DNA into amino acids and therefore enzymes.

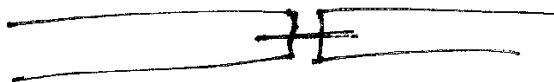
Phase I: The Double-Helix

The story starts off in the nucleus of the cell. DNA is usually found as a double-helix. To make a model of this, we will need to look at the different parts of the structure of DNA.

DNA is made out of a _____ of deoxy-ribose and phosphate molecules and four different bases called _____ .

Model	Real-Life
Red Twizzlers	
Pink Marshmallows	
Green Marshmallows	
Orange Marshmallows	
Yellow Marshmallows	
Toothpicks	

To begin with, you will need 4 red twizzlers and two toothpicks. At the small end of each toothpick, snap a piece off that's about half an inch long. Insert each end of the toothpick into each of two twizzlers so that you have what looks like one long twizzler. Repeat with the other toothpick and two twizzlers so that you have two long twizzlers.



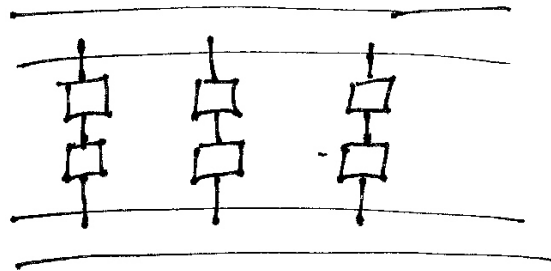
Now we will begin by filling in the bases. Remember that Cytosine always pairs with Guanine and Thymine always pairs with Adenine.

_____ marshmallows always pair with _____ marshmallows
AND
_____ marshmallows always pair with _____ marshmallows

The code that you will have to make on your DNA is the following:

TACTAAGCTCGCCGAATT

This will go on one side of the DNA, and you will have the complement for each nucleic acid on the other side. Thread the marshmallows through the toothpick as shown in the drawing below. Make sure to space them so that all 18 bases fit on your DNA.



Write the code for the complementary strand of DNA here:

When you are finished, check with Kris to make sure everything is correct. While you are waiting, you can twist your model to make it look like the double-helix it likes to be in.

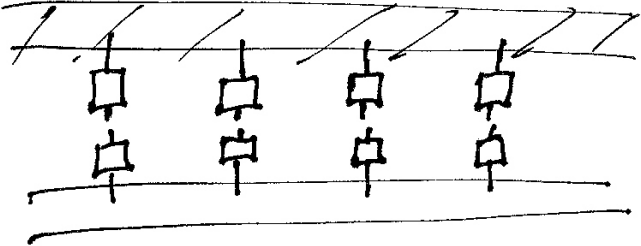
Phase II: mRNA

“mRNA” stands for “messenger ribo-nucleic acid” or just “messenger RNA.” RNA likes to be in a single strand instead of a double strand like DNA. The sugar molecules in RNA have an additional oxygen molecule that DNA has, so the backbone looks a little different. In addition, Thymine doesn’t like RNA, so it uses Uracil instead. Uracil looks pretty similar to Thymine, so Adenine can’t tell the difference and pairs with it anyway.

Model	Real-Life
Brown Twizzlers	
Pink Marshmallows	
Green Marshmallows	
Orange Marshmallows	
Yellow Marshmallows	
Toothpicks	

Messenger RNA wants to take the DNA code to the ribosomes, which is the place in the cell where the enzymes are made. The ribosomes are outside the nucleus however, and the DNA can't go there. That's the reason that mRNA is used. In order to copy the DNA code onto the RNA, however, we have to "unzip" the DNA. Use scissors to cut through the toothpicks between the two nucleic acids. You'll end up with two long chains of single-stranded DNA.

The RNA strand immediately moves in and starts building itself. Use half-toothpicks and more marshmallows to make one RNA strand to copy the code onto the RNA as shown below (you will have to first connect two brown twizzlers to make one long one).



Write your mRNA sequence here:

Remember to check with Kris before moving on.

Phase III: t-RNA and Polypeptides

The mRNA floats out to the ribosome, where it meets up with the tRNA. tRNA stands for "Transfer RNA," which means that it transfers the DNA code into a chain of amino acids, which we call an enzyme.

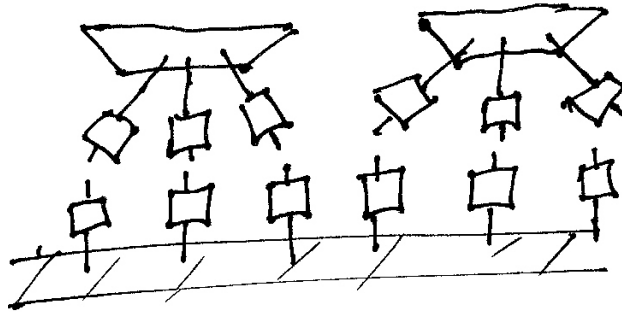
The DNA code is made up of the four different nucleotides, but it must represent over 20 different amino acids. We read the mRNA in groups of three letters, called a codon. The tRNA meets up with the other side of the mRNA, with sets of three letters called anticodons. Really. I'm not making this up. Each anticodon attaches itself to a specific amino acid, which you can figure out by the chart on the back page. The chart is based on the mRNA codons, not the tRNA anticodons.

Write down the six codons here:

Now write down the amino acid sequence it codes for:

Model	Real-Life
Brown Twizzlers	
Pink Marshmallows	
Green Marshmallows	
Orange Marshmallows	
Yellow Marshmallows	
Toothpicks	
Mr. Goodbar	
Hershey's Bar	
Hershey's Dark Chocolate	
Krackle	
Masking Tape	

The way you will represent the tRNA attached to the amino acids is by sticking marshmallows on half-toothpicks and inserting them into the chocolate bars, as shown below. You'll have to decide which chocolate bar represents which amino acids.



As the tRNA molecules bring the amino acids together, they detach from the amino acids, and the amino acids bond together into a chain we call a polypeptide. You'll model this by taping together the chocolate bars in order and removing the toothpicks.

You're done now! Show Kris your polypeptide when you're done to see if you've successfully cracked the code of DNA.

DNA Code—mRNA Codons

First Base	Second Base				Third Base
	U	C	A	G	
U	Phenylalanine	Serine	Tyrosine	Cysteine	U
	Phenylalanine	Serine	Tyrosine	Cysteine	C
	Leucine	Serine	Stop	Stop	A
	Leucine	Serine	Stop	Tryptophan	G
C	Leucine	Proline	Histidine	Arginine	U
	Leucine	Proline	Histidine	Arginine	C
	Leucine	Proline	Glutamine	Arginine	A
	Leucine	Proline	Glutamine	Arginine	G
A	Isoleucine	Threonine	Asparagine	Serine	U
	Isoleucine	Threonine	Asparagine	Serine	C
	Isoleucine	Threonine	Lysine	Arginine	A
	Methionine (start)	Threonine	Lysine	Arginine	G
G	Valine	Alanine	Aspartic Acid	Glycine	U
	Valine	Alanine	Aspartic Acid	Glycine	C
	Valine	Alanine	Glutamic Acid	Glycine	A
	Valine	Alanine	Glutamic Acid	Glycine	G