Cube Critters

All of life as we know it is based off of DNA. Everything from the smallest and simplest organisms to the biggest and most complex creatures ever to live all begin with guanine, cytosine, adenine and thymine. To better understand the universal nature of DNA and to show how four things can create an almost infinite combination of traits, we are going to work with something most (if not all) of you are familiar with: the Rubik's Cube.

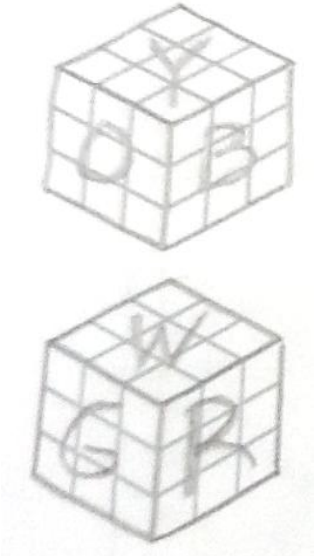
Despite being composed of only six colors and 20 moveable pieces, there are 43,252,003,274,489,856,000 unique combinations that can be made. To put that into perspective, if all 7 billion people alive on Earth today made the same number of combinations, with no one repeating those of anyone else, each person would need over 600 million cubes. For this reason alone, the Rubik's Cube is perfect for our study of transcription and translation.

On our cube, just like with DNA, we will have codons. In DNA, a codon is 3 bases read together and on our cube, a codon will be three squares, or one row of the cube. Each codon will code for an amino acid and in our simplified version, each amino acid will determine a trait. By the time you finish, you will have determined 18 individual traits for your organism and will then illustrate your newly designed critter.

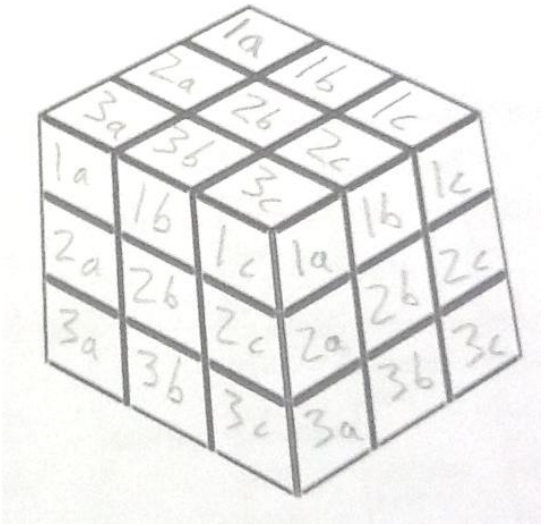
Important*: The center square on each side will never change its place. When a side is mentioned by color (for example: the "green" side), it is referring to the side with a green square in the center spot.*

Each side of the cube will code for 3 specific traits, all fitting a common theme. To insure that everyone reads their code the same way, the traits will be named in the following manner.

With the cube arranged:



The traits will be read in the order:



"1" signifies the first trait, "2" the second, and "3" the third. The "a", "b", and "c" refer to the first, second, and third base respectively for that given trait.

Procedure:

1) Scramble your Rubik's Cube thoroughly
2) Place the cube with the yellow face on the top and the orange face facing you.
3) Beginning with the top left corner of the yellow face, record the arrangement of your cube in Data Table 1 (It may be helpful to write down both the color on the cube and the base in the area provided)
4) For each set of three bases, find the corresponding amino acid on the codon table
5) Repeat steps 3 and 4 for the orange and blue faces.
6) After getting your information for the yellow, orange and blue faces, flip your cube over so the white face is on top and green face is towards you.
7) Repeat steps 3 and 4 for the three remaining faces.
8) After filling in the amino acids for all traits, complete Data Table 2 by writing the amino acid for each trait from Data Table 1 into the appropriate box and matching the amino acid to the trait description
9) Once all trait descriptions are written, draw a quick sketch of what each trait will look like in you finished critter
10) Draw and color a detailed image of your newly created critter on a separate sheet of paper, making sure to include all 18 of the traits in your drawing.

Codon Table*

	U		C		A		G		
U	UUU	Phenyl-alanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC		UCC		UAC		UGC		C
	UUA	Leucine	UCA		UAA	Fakeinine	UGA	Prentendisine	A
	UUG		UCG		UAG		UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC		CCC		CAC		CGC		C
	CUA		CCA		CAA	Glutamine	CGA		A
	CUG		CCG		CAG		CGG		G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC		ACC		AAC		AGC		C
	AUA		ACA		AAA	Lysine	AGA	Arginine	A
	AUG	Methionine	ACG		AAG		AGG		G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	Glutamic Acid	GGA		A
	GUG		GCG		GAG		GGG		G

* In a real codon table, the codons UAA, UAG, and UGA are considered "stop" codons where translation would end. For our activity, that would be a big problem so they are replaced with the two imaginary amino acids fakeinine and pretendisine