Secret Pseudo-Protein Code

First Base	Second Base				Third Base
	U	C	A	G	
U	A	h	p	w	U
	a	I	Q	X	C
	B	i	STOP !	STOP .	A
	b	J	STOP ?	x	G
C	C	j	q	Y	U
	c	K	R	y	C
	D	k	r	Z	A
	d	L	S	z	G
A	E	l	s	Ñ	U
	e	M	T	ñ	C
	F	m	t	t	A
	START	N	U	ç	G
G	f	n	u	"	U
	G	O	V	;	C
	g	o	v	,	A
	H	P	W	space	G

Mutation activity.cwk
KEW 01/02

Name _____
Period _____
Date _____
Science KEY

Mutations by Analogy

Every three bases on the mRNA codes for an amino acid. Every three bases of our "Secret Pseudo-Protein Code" codes for a letter or punctuation mark. Since our "Secret Pseudo-Protein Code" is more familiar, we will use it to examine mutations. Remember the same rules hold for both codes:

1. All messages must begin with START.
2. There are no spaces between three letter words, one simply counts every three letters.

1. Original message:

H a l l o !

A U G G U G U U C A C U A C U G C A U A A

Point substitution mutation:

H e l l o !

A U G G U G A U C A C U A C U G C A U A A

What was the effect of this mutation?

One letter was changed.

If this had been an mRNA coding for a protein, what would have been changed?

One amino acid was changed.

2. Original message:

m i x t u r e

A U G A C A U C A U G G A G A G A U C A A A U C

Point deletion mutation:

m i .

A U G A C A U C A U G A G A G A U C A A A U C

What was the effect of this mutation?

Message stopped prematurely.

If this had been an mRNA coding for a protein, what would have been changed?

Only part of protein synthesized.
Protein unlikely to function correctly.

Does the size of this mutation's effect surprise you?

Name _____ KEY

3. Original message:

W h a t ?

A U G G A G U C U U U C A A A U A G U A G A G G

Point insertion mutation:

W h a S F g W

A U G G A G U C U U U C A A U A U A G U A G A G G

What was the effect of this mutation?

Wrong letters, no stop code.

If this had been an mRNA coding for a protein, what would have been changed?

Longer, but nonfunctioning, protein.

4. Original message:

P r o t e i n

A U G U A U C A A G C A A A A A U C U C A G C U

Point substitution mutation:

G U G U A U C A A G C A A A A A U C U C A G C U

What was the effect of this mutation?

No message because no start.

If this had been an mRNA coding for a protein, what would have been changed?

No protein because no start (MET).

5. Original message:

L a t e r .

A U G C C G U U C A A A A U C C A A U G A G C U

Point substitution mutation:

L a t e r .

A U G C C G U U C A G A A U C C A A U G A G C U

What was the effect of this mutation?

No change

If this had been an mRNA coding for a protein, what would have been changed?

No change in protein.

Secret Pseudo-Protein Code
Alternative List

U U U	**A**	U A U	**p**
U U C	**a**	U A C	**Q**
U U A	**B**	U A A	**!** stop
U U G	**b**	U A G	**?** stop
C U U	**C**	C A U	**q**
C Y C	**c**	C A C	**R**
C U A	**D**	C A A	**r**
C U G	**d**	C A G	**S**
A U U	**E**	A A U	**s**
A U C	**e**	A A C	**T**
A U A	**F**	A A A	**t**
A U G	**START**	A A G	**U**
G U U	**f**	G A U	**u**
G U C	**G**	G A C	**V**
G U A	**g**	G A A	**v**
G U G	**H**	G A G	**W**
U C U	**h**	U G U	**w**
U C C	**I**	U G C	**X**
U C A	**i**	U G A	• stop
U C G	**J**	U G G	**x**
C C U	**j**	C G U	**Y**
C C C	**K**	C G C	**y**
C C A	**k**	C G A	**Z**
C C G	**L**	C G G	**z**
A C U	**l**	A G U	**Ñ**
A C C	**M**	A G C	**ñ**
A C A	**m**	A G A	**t**
A C G	**N**	A G G	**ç**
G C U	**n**	G G U	**"**
G C C	**O**	G G C	**;**
G C A	**o**	G G A	**,**
G C G	**P**	G G G	**space**

Name _____
Period _____
Date _____
Science

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A U G G U G U U C A C U A C U G C A U A A

Point substitution mutation:

A U G G U G A U C A C U A C U G C A U A A

What was the effect of this mutation?

_____

If this had been an mRNA coding for a protein, what would have been changed?

_____

2. Original message:

A U G A C A U C A U G G A G A G A U C A A A U C

Point deletion mutation:

A U G A C A U C A U G A A A G A U C A A A U C

What was the effect of this mutation?

_____

If this had been an mRNA coding for a protein, what would have been changed?

_____

_____

Does the size of this mutation's effect surprise you?

_____

Name _____

3. Original message:

A U G G A G U C U U U C A A A U A G U A G A G G

Point insertion mutation:

A U G G A G U C U U U C A A U A U A G U A G A G G

What was the effect of this mutation?

_____

If this had been an mRNA coding for a protein, what would have been changed?

_____

4. Original message:

A U G U A U C A A G C A A A A A U C U C A G C U

Point substitution mutation:

G U G U A U C A A G C A A A A A U C U C A G C U

What was the effect of this mutation?

_____

If this had been an mRNA coding for a protein, what would have been changed?

_____

5. Original message:

A U G C C G U U C A A A A U C C A A U G A G C U

Point substitution mutation:

A U G C C G U U C A G A A U C C A A U G A G C U

What was the effect of this mutation?

_____

If this had been an mRNA coding for a protein, what would have been changed?

_____

Name _____
Period _____ KEY
Date _____
Science

6. During this activity you modeled protein synthesis using mRNA. But where did the mutation originally occur?

In DNA base-pair order.

7. What is a mutation?

Change in base order of DNA in a cell's chromosome.

8. How can a mutation in the DNA cause a change in an organism's protein?

Change in DNA → change in mRNA → change in order, or number, of amino acids in the protein.

9. Do all mutations in the DNA coding for mRNA cause a change in an organism? Why or why not?

No. The code is redundant: most amino acids (& STOP) have more than one code. Some changes in base order do NOT cause changes in amino acids.

10. Are mutations helpful or harmful?

Some are helpful (disease resistance) (Hallo! → Hello!)
Some are harmful (cancer) (What? → WhaSFgW)
Most are neutral (little or no change in organism) (Later. → Later.)
Whether a mutation is good or bad is often a function of the environment!

Name _____
Period _____
Date _____
Science

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_____

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10. Are mutations helpful or harmful?

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