

## Assignment 2 (6 frame translation) is due Mon 17 Jan

Please hand in hard copy

Assignment 2. If you need a review, see [https://en.wikipedia.org/wiki/Genetic\\_code](https://en.wikipedia.org/wiki/Genetic_code)

2.1 Then, use the "Standard Genetic Code" table on the last page to generate the **six-frame translations** of the following sequence

5' AUGUCGCAGCAG 3'

(U is uracil – RNA uses Uracil in place of T, thymine, which is used by DNA)

Feel free to get help from classmates or from an on-line translation program, but a short example will be part of a quiz, so make sure you can do this. (Of course you will be able to use the table of the genetic code for the quiz.)

For example

5' ACCUACU 3'    complementary strand is  
3' UGGAUGA 5'

Frame 1: ACC|UAC|U    amino acids TY (U alone is not a codon)  
Frame 2: A|CCU|ACU                      PT (A alone is not a codon)  
Frame 3: AC|CUA|CU                      L (AC and CU alone are not codons)

The reverse of the complementary strand is

5' AGUAGGU 3'

Frame -1: AGU|AGG|U    SR  
Frame -2: A|GUA|GGU    VG  
Frame -3: AG|UAG|GU    \* (stop --UAG tells the ribosome to stop translating the mRNA into protein)

2.2 If we change the input sequence to

5' AUGUCGCAACAG 3'

which translations change, and what do they change to?

Amino acids biochemical properties			nonpolar	polar	basic	acidic	Termination: stop codon			
Standard genetic code										
1st base	2nd base								3rd base	
	U		C		A		G			
U	UUU	(Phe/F)	UCU	(Ser/S) Serine	UAU	(Tyr/Y) Tyrosine	UGU	(Cys/C) Cysteine	U	
	UUC	Phenylalanine	UCC		UAC		UGC		C	
	UUA		UCA		UAA	Stop (Ochre) <sup>[B]</sup>	UGA	Stop (Opal) <sup>[B]</sup>	A	
	UUG		UCG		UAG	Stop (Amber) <sup>[B]</sup>	UGG	(Trp/W) Tryptophan	G	
C	CUU	(Leu/L) Leucine	CCU	(Pro/P) Proline	CAU	(His/H) Histidine	CGU	(Arg/R) Arginine	U	
	CUC		CCC		CAC		CGC			C
	CUA		CCA		CAA	(Gln/Q) Glutamine	CGA			A
	CUG		CCG		CAG		CGG			G
A	AUU	(Ile/I) Isoleucine	ACU	(Thr/T) Threonine	AAU	(Asn/N) Asparagine	AGU	(Ser/S) Serine	U	
	AUC		ACC		AAC		AGC		C	
	AUA		ACA		AAA	(Lys/K) Lysine	AGA	(Arg/R) Arginine	A	
	AUG <sup>[A]</sup>	(Met/M) Methionine	ACG		AAG		AGG		G	
G	GUU	(Val/V) Valine	GCU	(Ala/A) Alanine	GAU	(Asp/D) Aspartic acid	GGU	(Gly/G) Glycine	U	
	GUC		GCC		GAC		GGC			C
	GUA		GCA		GAA	(Glu/E) Glutamic acid	GGA			A
	GUG		GCG		GAG		GGG			G

<sup>A</sup> The codon AUG both codes for methionine and serves as an initiation site: the first AUG in an mRNA's coding region is where translation into protein begins.<sup>[43]</sup>

<sup>B</sup> ^ ^ ^ The historical basis for designating the stop codons as amber, ochre and opal is described in an autobiography by Sydney Brenner<sup>[44]</sup> and in a historical article by Bob Edgar.<sup>[45]</sup>