

8.5 Translation

► Using a secret code:

2-9-15-12-15-7-25

7-18-15-23-19

15-14

25-15-21

- | | | | |
|-----|---|-----|---|
| 1. | A | 14. | N |
| 2. | B | 15. | O |
| 3. | C | 16. | P |
| 4. | D | 17. | Q |
| 5. | E | 18. | R |
| 6. | F | 19. | S |
| 7. | G | 20. | T |
| 8. | H | 21. | U |
| 9. | I | 22. | V |
| 10. | J | 23. | W |
| 11. | K | 24. | X |
| 12. | L | 25. | Y |
| 13. | M | 26. | Z |

8.5 Translation

KEY CONCEPT - Translation converts an mRNA message into a **polypeptide**, or **protein**.

SB2.a Distinguish between DNA and RNA.

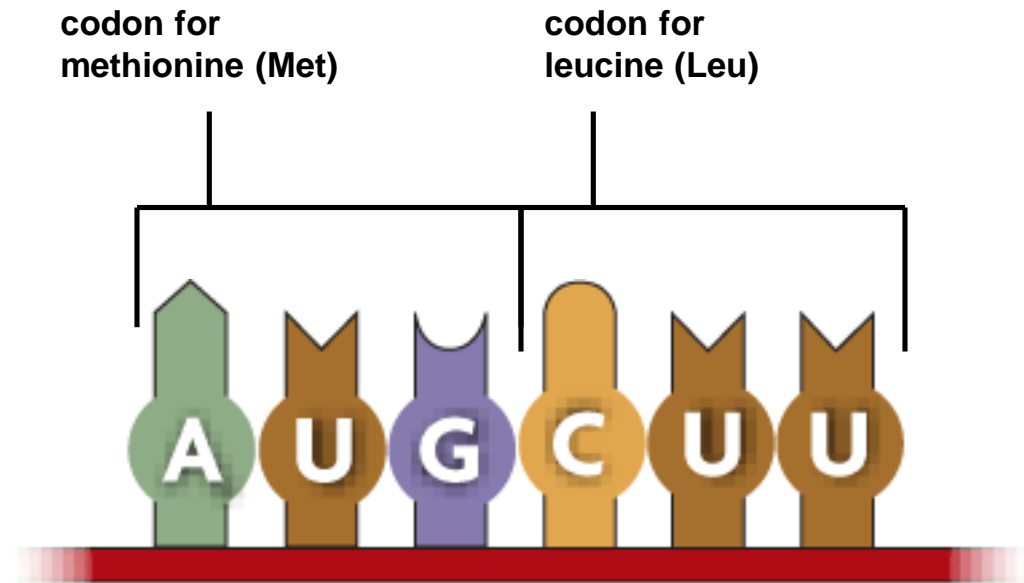
SB2.b Explain the role of DNA in storing & transmitting cellular information.

EQ – How is DNA used to make proteins?



▶ Amino acids are coded by mRNA base sequences.

- **Translation** converts mRNA messages into polypeptides.
- A **codon** is a sequence of **three** nucleotides on mRNA (triplet) that codes for an amino acid.
 - The **reading frame** is the series of 3 nonoverlapping nucleotides read, in order, by a cell; codons must be read in the correct reading frame for the correct protein to be made



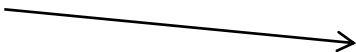
Segment of mRNA

- The **genetic code** matches each codon to its amino acid or function.

- one **start codon (AUG)**, codes start of translation & for the amino acid methionine
- three **stop codons** signal the end of a chain of amino acids (**UAA, UAG, UGA**)

The genetic code matches each RNA **codon** with its amino acid or function

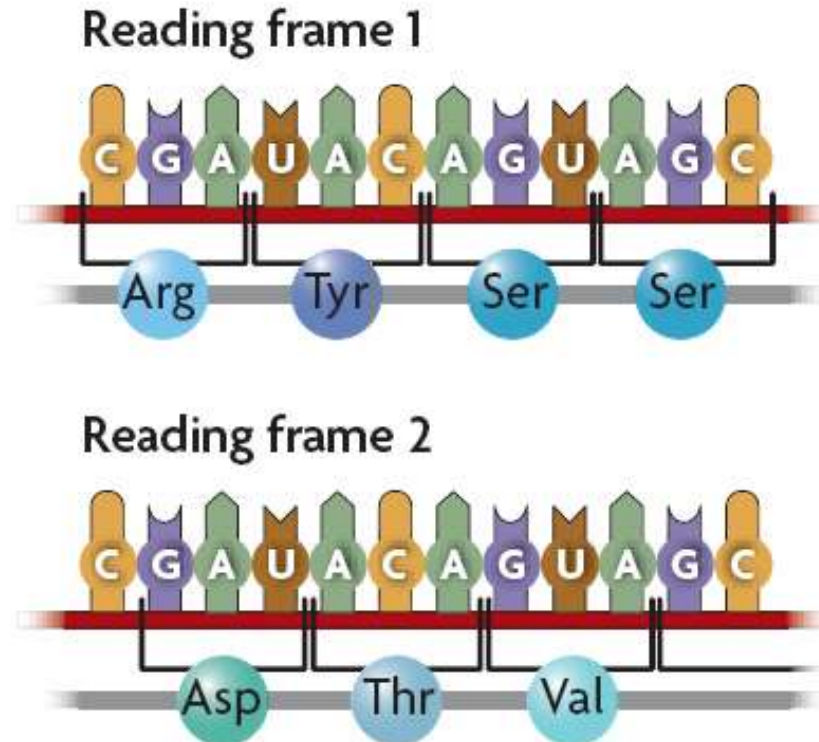
The Genetic Code:



- Find the first base, C, in the left column.
- Find the second base, A, in the top row. Find the box where these two intersect.
- Find the third base, U, in the right column. CAU codes for histidine, abbreviated as His.

		Second base							
		U		C		A		G	
First base U	UUU	phenylalanine (Phe)	UCU		UAU	tyrosine (Tyr)	UGU	cysteine (Cys)	U
	UUC		UCC	serine (Ser)	UAC		UGC		C
	UUA	leucine (Leu)	UCA		UAA	STOP	UGA	STOP	A
	UUG		UCG		UAG	STOP	UGG	tryptophan (Trp)	G
First base C	CUU		CCU		CAU	histidine (His)	CGU		U
	CUC	leucine (Leu)	CCC	proline (Pro)	CAC		CGC	arginine (Arg)	C
	CUA		CCA		CAA	glutamine (Gln)	CGA		A
	CUG		CCG		CAG		CGG		G
First base A	AUU		ACU		AAU	asparagine (Asn)	AGU	serine (Ser)	U
	AUC	isoleucine (Ile)	ACC	threonine (Thr)	AAC		AGC		C
	AUA		ACA		AAA	lysine (Lys)	AGA	arginine (Arg)	A
	AUG	methionine (Met)	ACG		AAG		AGG		G
First base G	GUU		GCU		GAU	aspartic acid (Asp)	GGU		U
	GUC	valine (Val)	GCC	alanine (Ala)	GAC		GGC	glycine (Gly)	C
	GUA		GCA		GAA	glutamic acid (Glu)	GGA		A
	GUG		GCG		GAG		GGG		G
		Third base							

- **Common language** (the genetic code) for almost all organisms is the same
- A change in the order in which codons are read changes the resulting protein.

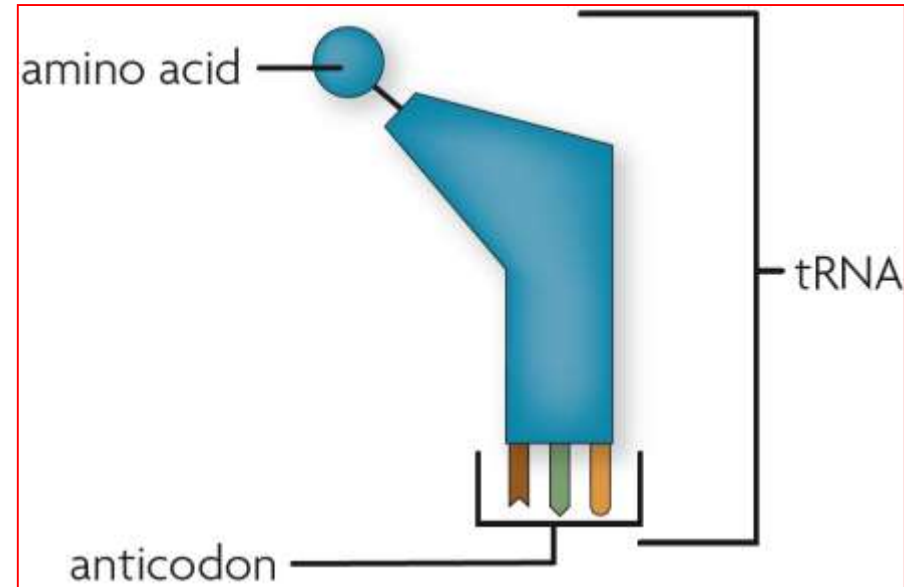
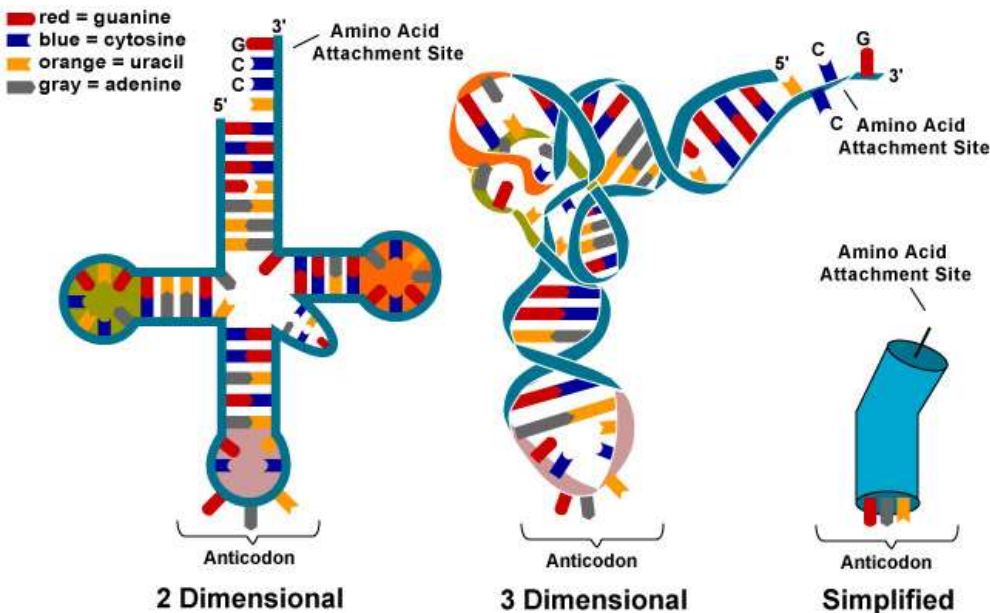


- Regardless of the organism, codons code for the same amino acid.

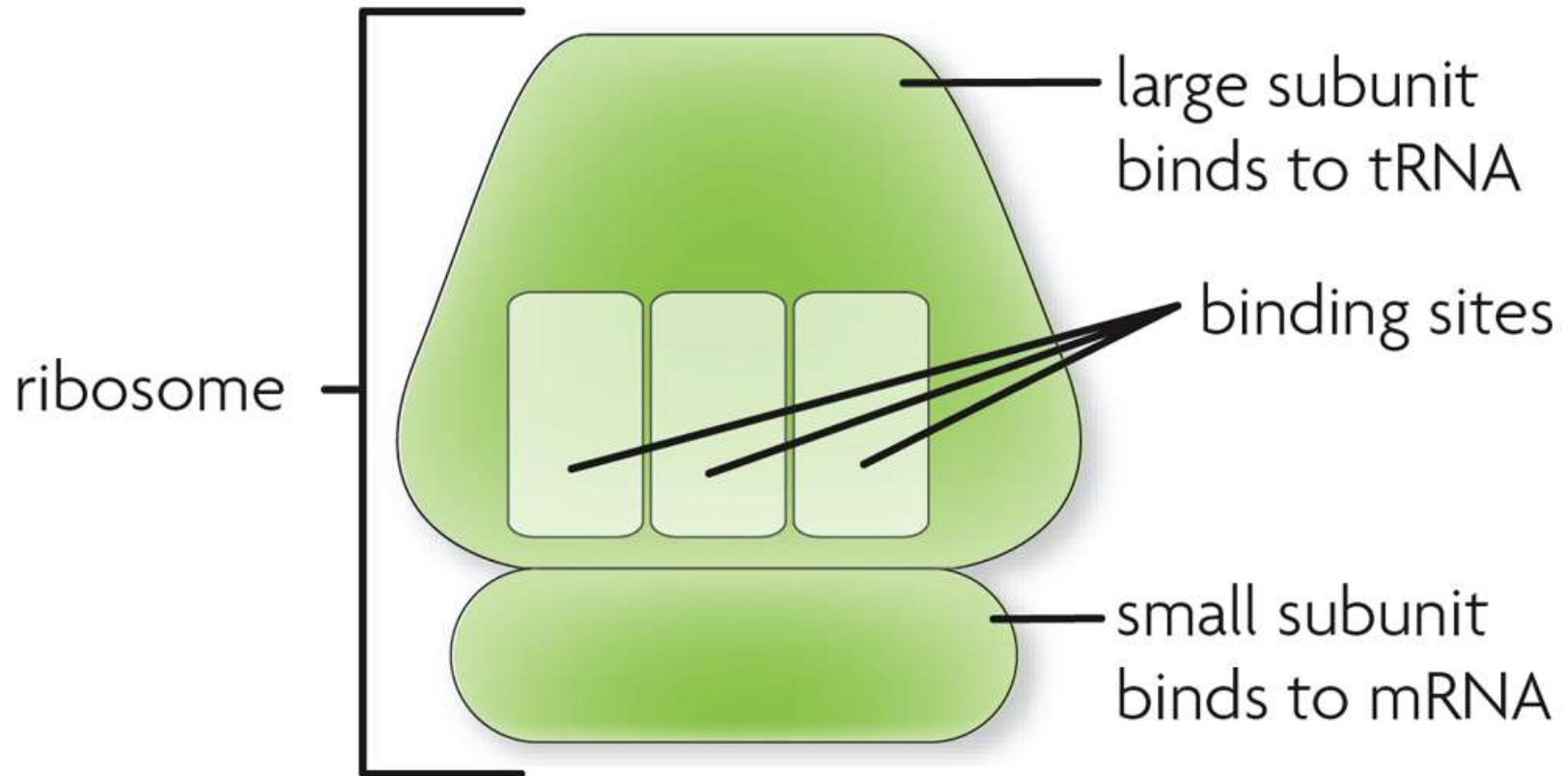
8.5 Translation

▶ Amino acids are linked to become a protein.

- A tRNA **anticodon** is a set of three nucleotides that is complementary to an mRNA codon.
- An **anticodon** is carried by a **tRNA** (type of RNA that carries amino acids from the cytoplasm to the ribosome; one end has a specific anticodon, the other end attaches to a specific amino acid.)

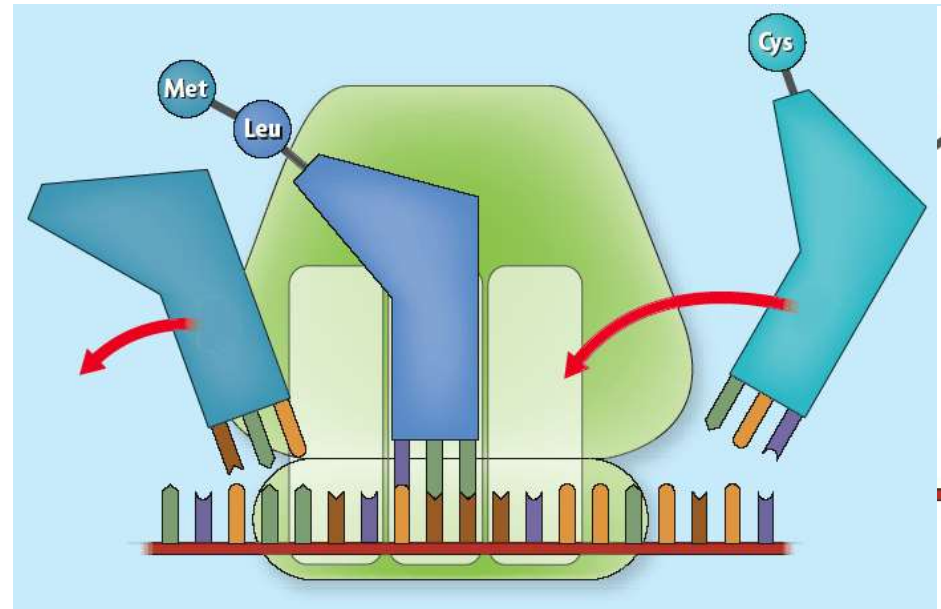


- Ribosomes consist of two subunits & are the site of protein synthesis; catalyzes the formation of peptide bonds between amino acids.
 - The **large subunit** has three binding sites for tRNA.
 - The **small subunit** binds to mRNA.



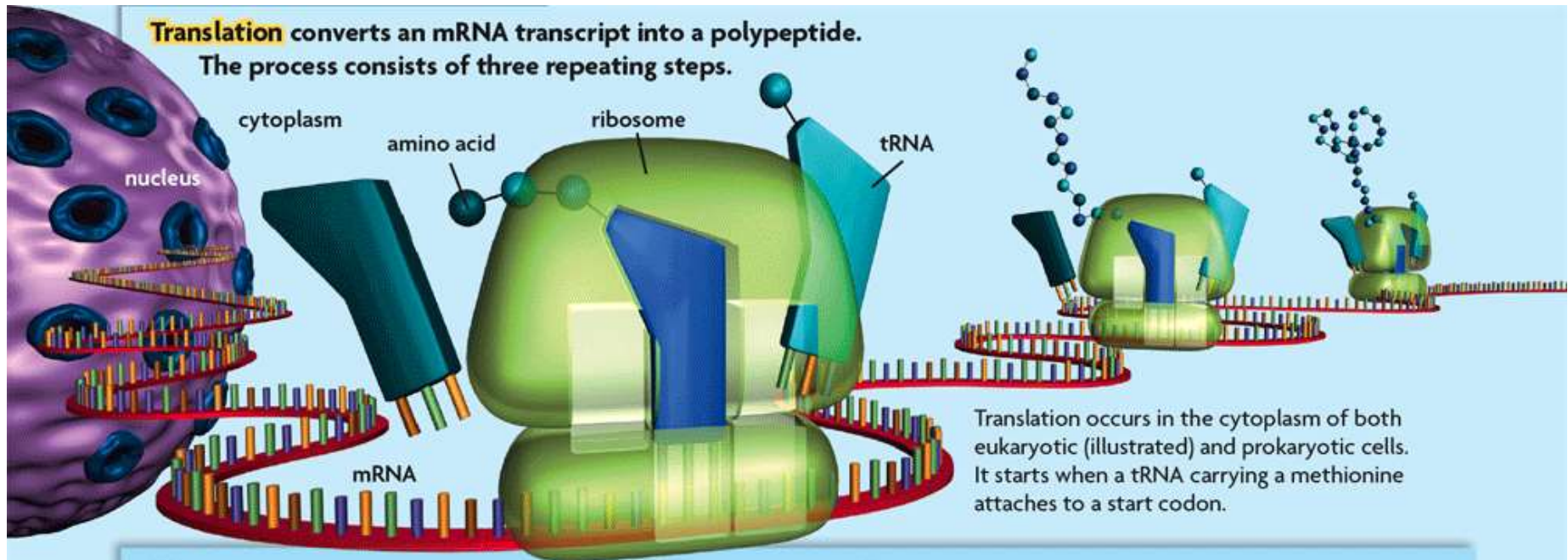
- PARTS:

1. Amino acid
2. Peptide bond
3. Large ribosomal subunit
4. tRNA
5. Codons
6. Small ribosomal subunit
7. mRNA
8. anticodon



8.5 Translation

- For translation to begin, tRNA binds to a start codon and signals the ribosome to assemble.
 - A complementary tRNA molecule binds to the exposed codon, bringing its amino acid close to the first amino acid.

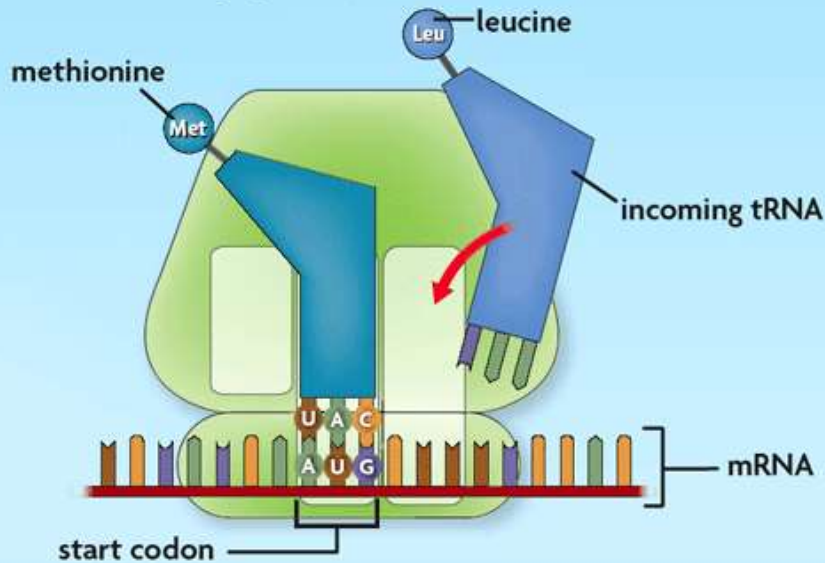


8.5 Translation

- The ribosome helps form a polypeptide bond between the amino acids.
- The ribosome pulls the mRNA strand the length of one codon.

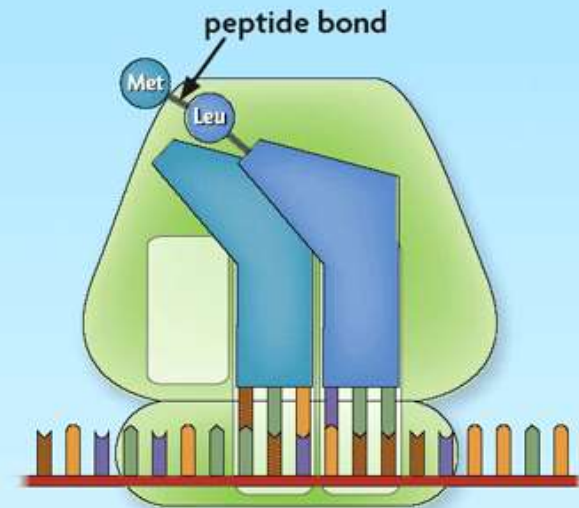
1

The exposed codon in the first site attracts a complementary tRNA bearing an amino acid. The tRNA anticodon pairs with the mRNA codon, bringing it very close to the other tRNA molecule.



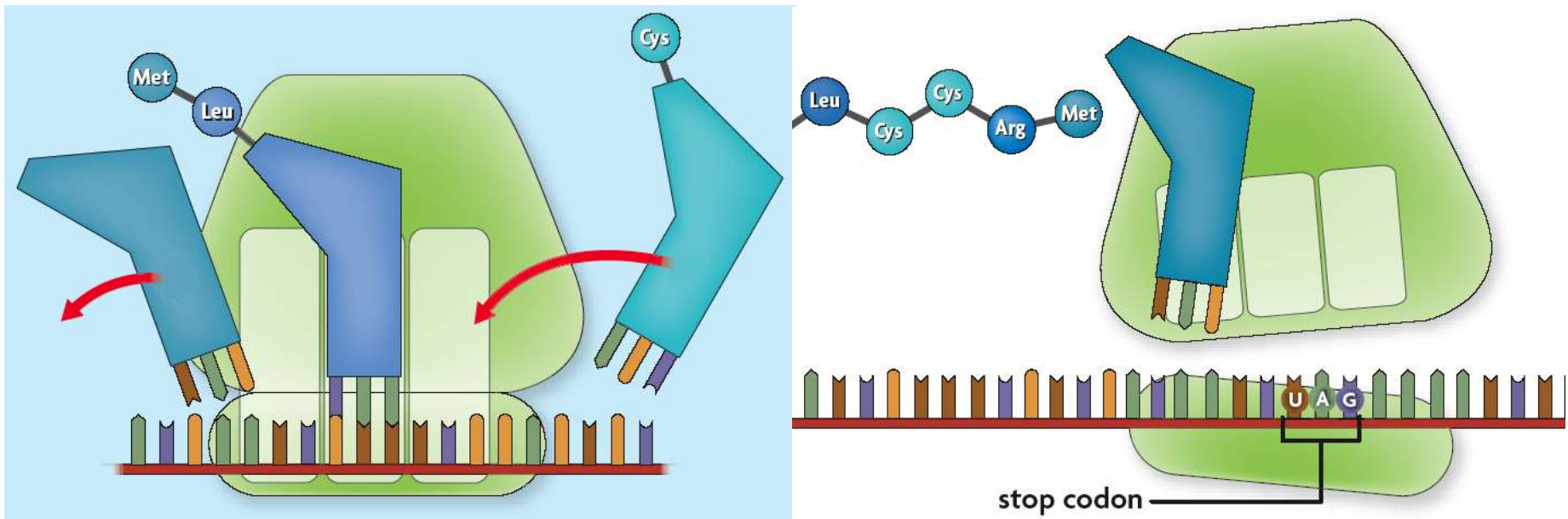
2

The ribosome forms a peptide bond between the two amino acids and breaks the bond between the first tRNA and its amino acid.



8.5 Translation

- The now empty tRNA molecule exits the ribosome.
- A complementary tRNA molecule binds to the next exposed codon.
- Once the stop codon is reached, the ribosome releases the protein and disassembles.



- PROCESS:

1. Ribosome assembles at the start codon; complementary tRNA molecule pairs with the exposed codon
2. Ribosome helps bond the new amino acid to the start codon and breaks the bond between the amino acid and the first tRNA
3. Ribosome pulls the mRNA strand the length of one codon; first tRNA returns to the cytoplasm; another codon is exposed for tRNA binding

8.5 Transl

Second base

		Second base							
		U		C		2 A		G	
U	UUU	phenylalanine (Phe)	UCU	serine (Ser)	UAU	tyrosine (Tyr)	UGU	cysteine (Cys)	U
	UUC		UCC		UAC		UGC		C
	UUA	leucine (Leu)	UCA		UAA	STOP	UGA	STOP	A
	UUG		UCG		UAG	STOP	UGG	tryptophan (Trp)	G
1 C	CUU	leucine (Leu)	CCU	proline (Pro)	CAU	histidine (His)	CGU	arginine (Arg)	U
	CUC		CAC			CGC	C		
	CUA		CAA		glutamine (Gln)	CGA	A		
	CUG		CAG			CGG	G		
A	AUU	isoleucine (Ile)	ACU	threonine (Thr)	AAU	asparagine (Asn)	AGU	serine (Ser)	U
	AUC		AAC			AGC	C		
	AUA		AAA		lysine (Lys)	AGA	arginine (Arg)	A	
	AUG	methionine (Met)	ACG		AAG		AGG	G	
G	GUU	valine (Val)	GCU	alanine (Ala)	GAU	aspartic acid (Asp)	GGU	glycine (Gly)	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	glutamic acid (Glu)	GGA		A
	GUG		GCG		GAG		GGG		G

Find the first base, C, in the left column.

Find the second base, A, in the top row. Find the box where these two intersect.

Find the third base, U, in the right column. CAU codes for histidine, abbreviated as His.

3

Third base

8.5

