AP BIO INSTA-REVIEW

TOPIC 6.4

Translation

IST-1.0.1

Translation of the mRNA to generate a polypeptide occurs on ribosomes that are present in the cytoplasm of both prokaryotic and eukaryotic cells and on the rough endoplasmic reticulum of eukaryotic cells.

AP BIO INSTA-REVIEW

TOPIC 6.4

Translation

IST-1.0.2

In prokaryotic organisms, translation of the mRNA molecule occurs while it is being transcribed.

IST-1.0.3

Translation involves energy and many sequential steps, including initiation, elongation, and termination.

AP BIO INSTA-REVIEW

TOPIC 6.4

Translation

IST-1.0.4

The salient features of translation include–

a. Translation is initiated when the rRNA in the ribosome interacts with the mRNA at the start codon.

b. The sequence of nucleotides on the mRNA is read in triplets called codons.

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TOPIC 6.4

Translation

IST-1.0.4

The salient features of translation include–

c. Each codon encodes a specific amino acid, which can be deduced by using a genetic code chart. Many amino acids are encoded by more than one codon.

d. Nearly all living organisms use the same genetic code, which is evidence for the common ancestry of all living organisms.

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TOPIC 6.4

Translation

IST-1.0.4

The salient features of translation include–

e. tRNA brings the correct amino acid to the correct place specified by the codon on the mRNA.

f. The amino acid is transferred to the growing polypeptide chain.

g. The process continues along the mRNA until a stop codon is reached.

h. The process terminates by release of the newly synthesized polypeptide/protein.

AP BIO INSTA-REVIEW

TOPIC 6.4

Translation

IST-1.0.5

Genetic information in retroviruses is a special case and has an alternate flow of information: from RNA to DNA, made possible by reverse transcriptase, an enzyme that copies the viral RNA genome into DNA. This DNA integrates into the host genome and becomes transcribed and translated for the assembly of new viral progeny.

AP BIO INSTA-REVIEW

TOPIC 6.4

What is the function of the ribosomes?

A. ATP Synthesis

B. Digestion

C. Protein Synthesis

D. Storage

AP BIO INSTA-REVIEW

TOPIC 6.4

What is the function of the ribosomes?

C. Protein Synthesis

Ribosomes are the site of protein synthesis. The mRNA is the transcript that brings the message to the ribosome. The tRNA transfers the amino acids so the ribosome can assemble the protein. The rRNA makes up the ribosome.

AP BIO INSTA-REVIEW

TOPIC

6.4

Identify two locations ribosomes are found in eukaryotic cells

AP BIO INSTA-REVIEW

TOPIC 6.4

Identify two locations ribosomes are found in eukaryotic cells

> Cytosol

> Endoplasmic Reticulum (rough)

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TOPIC

6.4

Transcription & Translation are simultaneously completed in a prokaryote

A. True

B. False

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TOPIC 6.4

Transcription & Translation are simultaneously completed in a prokaryote

A. True

Prokaryotes do not have a nuclear membrane. This means that the ribosomes are in the same area as the DNA, so as soon as the mRNA is being synthesized (transcription) the ribosomes can attach to start translation.

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TOPIC

6.4

Why does transcription and translation take place simultaneously in prokaryotic cell?

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TOPIC 6.4

Why does transcription and translation take place simultaneously in prokaryotic cell?

The absence of the nuclear membrane allows the ribosomes to gain access to the mRNA as it is synthesized.

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TOPIC

6.4

Which describes initiation of translation?

A. mRNA binds to tRNA with start codon

B. mRNA binds to small subunit

C. tRNA binds to rRNA with start codon

D. tRNA binds to Methionine

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TOPIC 6.4

Which describes initiation of translation?

B. mRNA binds to small subunit

Initiation is the start. To start translation, the mRNA binds to the small subunit of the ribosome. The ribosome searches for the start codon (AUG) before the large subunit binds with the tRNA containing methionine.

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TOPIC

6.4

What is the start codon?

A. AUG

B. GUA

C. TAC

D. UAC

AP BIO INSTA-REVIEW

TOPIC 6.4

What is the start codon?

A. AUG

The start codon is AUG, which will bring the amino acid methionine into the ribosome. This methionine is removed during post-translational processing.

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TOPIC

6.4

Describe steps in elongation phase of translation

AP BIO INSTA-REVIEW

TOPIC 6.4

Describe steps in elongation phase of translation

Polypeptide is attached to tRNA at the P site

New tRNA enters bringing the next amino acid (the anticodon pairs with the codon) at the A site

A new peptide bond forms between the growing polypeptide and the new amino acid

Translocation to move the empty tRNA from the P site to the E site (and to exit), the tRNA with the polypeptide to the P site, and the A site ready to accept a new amino acid

THEN REPEAT

AP BIO INSTA-REVIEW

TOPIC 6.4

One codon codes for multiple amino acids...

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.4

One codon codes for multiple amino acids...

B. False

Each codon will only code for ONE amino acid, but there can be multiple codons that code for the SAME amino acid.

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TOPIC

6.4

One amino acid is coded by multiple codons...

A. True

B. False

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TOPIC 6.4

One amino acid is coded by multiple codons...

A. True

There can be multiple codons that code for the **SAME** amino acid, but each codon will only code for **ONE** amino acid.

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TOPIC

6.4

Second Base in Codon

First Base in Codon	U	C	A	G	Third Base in Codon
U	UUU Phe UUC Phe UUA Leu UUG Leu	UCU Ser UCC Ser UCA Ser UCG Ser	UAU Tyr UAC Tyr UAA Stop UAG Stop	UGU Cys UGC Cys UGA Stop UGG Trp	U C A G
C	CUU Leu CUC Leu CUA Leu CUG Leu	CCU Pro CCC Pro CCA Pro CCG Pro	CAU His CAC His CAA Gln CAG Gln	CGU Arg CGC Arg CGA Arg CGG Arg	U C A G
A	AUU Ile AUC Ile AUA Ile AUG Met or Start	ACU Thr ACC Thr ACA Thr ACG Thr	AAU Asn AAC Asn AAA Lys AAG Lys	AGU Ser AGC Ser AGA Arg AGG Arg	U C A G
G	GUU Val GUC Val GUA Val GUG Val	GCU Ala GCC Ala GCA Ala GCG Ala	GAU Asp GAC Asp GAA Glu GAG Glu	GGU Gly GGC Gly GGA Gly GGG Gly	U C A G

What does AGU code for?

A. Arg

B. Leu

C. Phe

D. Ser

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TOPIC 6.4

What does AGU code for?

D. Ser

Look in the codon chart for AGU:

Left column for the A – third row

Top row for the G – fourth column

Check the square for the AGU – Ser

Second Base in Codon

First Base in Codon	U	C	A	G	Third Base in Codon
U	UUU, UUC: Phe; UUA, UUG: Leu	UCU, UCC, UCA, UCG: Ser	UAU, UAC: Tyr; UAA Stop; UAG Stop	UGU, UGC: Cys; UGA Stop; UGG Trp	U C A G
C	CUU, CUC, CUA, CUG: Leu	CCU, CCC, CCA, CCG: Pro	CAU, CAC: His; CAA, CAG: Gln	CGU, CGC, CGA, CGG: Arg	U C A G
A	AUU, AUC, AUA: Ile; AUG: Met or Start	ACU, ACC, ACA, ACG: Thr	AAU, AAC: Asn; AAA, AAG: Lys	AGU, AGC: Ser; AGA, AGG: Arg	U C A G
G	GUU, GUC, GUA, GUG: Val	GCU, GCC, GCA, GCG: Ala	GAU, GAC: Asp; GAA, GAG: Glu	GGU, GGC, GGA, GGG: Gly	U C A G

AP BIO INSTA-REVIEW

TOPIC

6.4

Prokaryotes can synthesize human insulin...

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.4

Prokaryotes can synthesize human insulin...

A. True

All organisms have the same genetic code. The same codons code for the same amino acids. A gene from one organism can be inserted into another organism and the same protein can be synthesized.

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TOPIC

6.4

What does it tell us that prokaryotes are able to synthesize human insulin?

AP BIO INSTA-REVIEW

TOPIC 6.4

What does it tell us that prokaryotes are able to synthesize human insulin?

Common ancestry of all living things because of common genetic code among all living things.

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TOPIC

6.4

Which is not a stop codon?

A. UAA

B. UAG

C. UGA

D. UGG

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TOPIC 6.4

Which is not a stop codon?

D. UGG

The three stop codons are UGA, UAA, and UAG. The code of UGG is not a stop codon, but it codes for Trp (trypthophan).

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TOPIC

6.4

What is added when the stop codon is reached

A. Amino Acid

B. ATP

C. Stop Codon

D. Water

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TOPIC 6.4

What is added when the stop codon is reached

D. Water

The stop codon causes a release factor to bind which will allow water to be used to break the bond. Recall: hydrolysis is the breaking of a water molecule to break a bond.

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TOPIC

6.4

HIV is a retrovirus. What does that mean?

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TOPIC 6.4

HIV is a retrovirus. What does that mean?

Retroviruses have an RNA genome. They use the enzyme reverse transcriptase to catalyze the synthesis of DNA from their RNA template for insertion in host DNA.

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TOPIC

6.4

What is translation?

A. Synthesize DNA under direction of DNA

B. Synthesize RNA under direction of DNA

C. Synthesize polypeptides under direction of DNA

D. Synthesize polypeptides under direction of RNA

AP BIO INSTA-REVIEW

TOPIC 6.4

What is translation?

D. Synthesize polypeptides under direction of RNA

Translation is the using a mRNA transcript to synthesize a polypeptide. The mRNA is a disposible copy of the genetic information that is used to assemble the amino acids to form the polypeptide.

AP BIO INSTA-REVIEW

TOPIC 6.4

Where does translation take place?

A. Cytosol

B. Golgi Bodies

C. Nucleus

D. Ribosome

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TOPIC 6.4

Where does translation take place?

D. Ribosome

Translation takes place in the ribosome. The ribosome will bind to the mRNA (for the message) and the tRNA (for the amino acids) to synthesize the polypeptide.

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TOPIC 6.4

What is the function of the A site on the ribosome?

A. Adds the new amino acids

B. Attached the new amino acids to the polypeptide

C. Location where adenine pairs with uracil

D. Location where the empty tRNA leaves the ribosome

AP BIO INSTA-REVIEW

TOPIC 6.4

What is the function of the A site on the ribosome?

A. Adds the new amino acids

The A site is where the tRNA that is bringing in the next amino acid binds. The A site is where we ADD the next AMINO ACID.

AP BIO INSTA-REVIEW

TOPIC

6.4

What is the function of the P site on the ribosome?

A. Holds the growing polypeptide

B. Holds phosphorylated polypeptide

C. Site that binds to the primary structure of a polypeptide

D. Site where the phosphate group binds

AP BIO INSTA-REVIEW

TOPIC 6.4

What is the function of the P site on the ribosome?

A. Holds the growing polypeptide

A peptide bond forms between the growing polypeptide and the new amino acid. Then translocation will move the tRNA with the polypeptide to the P site. The P site has the growing POLYPEPTIDE chain.

AP BIO INSTA-REVIEW

TOPIC

6.4

How many nucleotides make up a codon?

A. 1
B. 2
C. 3
D. 4

AP BIO INSTA-REVIEW

TOPIC 6.4

How many nucleotides make up a codon?

C. 3

There are three nucleotides in each codon.

If there was only 1 nucleotide per codon, there are only 4 different combinations which isn't enough for the 20 amino acids. If there was only 2 nucleotides per codon, there are only 16 different combiantion which isn't enough for the 20 amino acids. If there were 3 nucleotides per codon, it would be able to code for 64 different combinations which is enough for the 20 amino acids.

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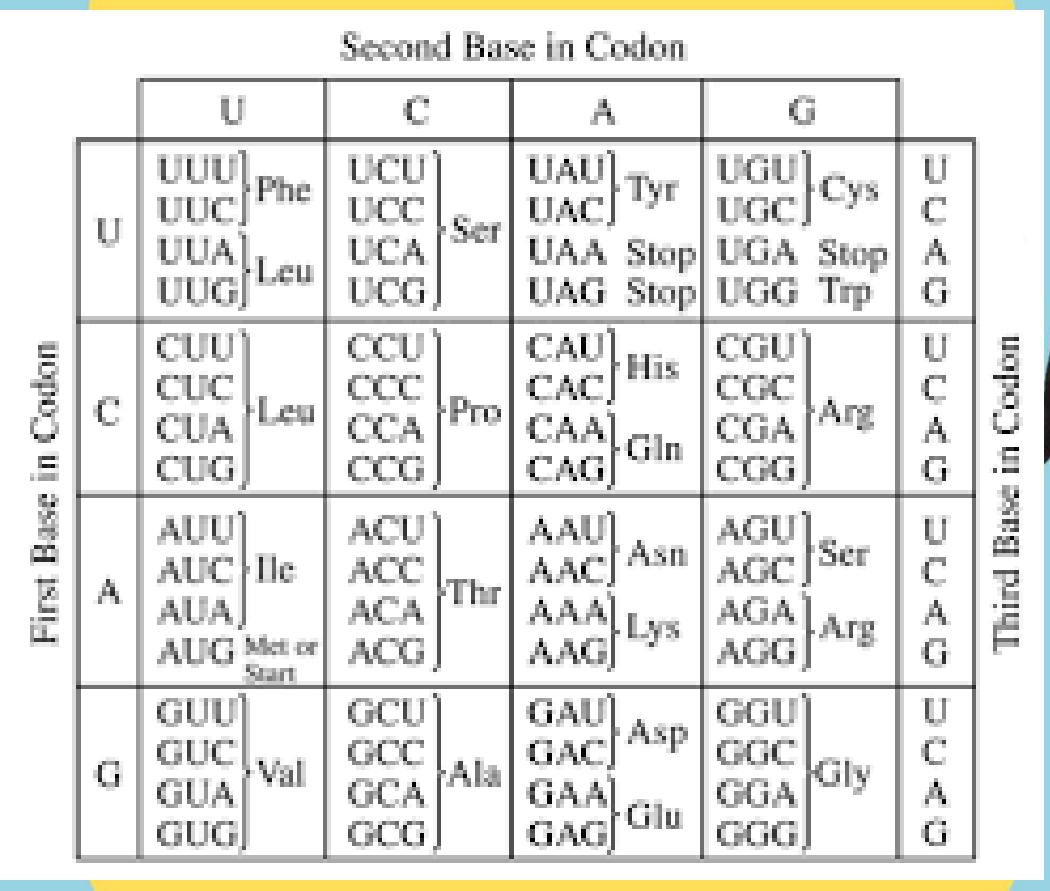
TOPIC

6.4



Second Base in Codon

First Base in Codon	U	C	A	G	Third Base in Codon
U	UUU Phe UUC Phe UUA Leu UUG Leu	UCU Ser UCC Ser UCA Ser UCG Ser	UAU Tyr UAC Tyr UAA Stop UAG Stop	UGU Cys UGC Cys UGA Stop UGG Trp	U C A G
C	CUU Leu CUC Leu CUA Leu CUG Leu	CCU Pro CCC Pro CCA Pro CCG Pro	CAU His CAC His CAA Gln CAG Gln	CGU Arg CGC Arg CGA Arg CGG Arg	U C A G
A	AUU Ile AUC Ile AUA Ile AUG Met or Start	ACU Thr ACC Thr ACA Thr ACG Thr	AAU Asn AAC Asn AAA Lys AAG Lys	AGU Ser AGC Ser AGA Arg AGG Arg	U C A G
G	GUU Val GUC Val GUA Val GUG Val	GCU Ala GCC Ala GCA Ala GCG Ala	GAU Asp GAC Asp GAA Glu GAG Glu	GGU Gly GGC Gly GGA Gly GGG Gly	U C A G

What amino acid has a codon of GAC?

A. Asn

B. Asp

C. Glu

D. Gly

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TOPIC 6.4

What amino acid has a codon of GAC?

B. Asp

Look in the codon chart for GAC:

Left column for the G – fourth row

Top row for the A – third column

Check the square for the GAC – Asp

Second Base in Codon

First Base in Codon	U	C	A	G	Third Base in Codon
U	UUU Phe UUC Phe UUA Leu UUG Leu	UCU Ser UCC Ser UCA Ser UCG Ser	UAU Tyr UAC Tyr UAA Stop UAG Stop	UGU Cys UGC Cys UGA Stop UGG Trp	U C A G
C	CUU Leu CUC Leu CUA Leu CUG Leu	CCU Pro CCC Pro CCA Pro CCG Pro	CAU His CAC His CAA Gln CAG Gln	CGU Arg CGC Arg CGA Arg CGG Arg	U C A G
A	AUU Ile AUC Ile AUA Ile AUG Met or Start	ACU Thr ACC Thr ACA Thr ACG Thr	AAU Asn AAC Asn AAA Lys AAG Lys	AGU Ser AGC Ser AGA Arg AGG Arg	U C A G
G	GUU Val GUC Val GUA Val GUG Val	GCU Ala GCC Ala GCA Ala GCG Ala	GAU Asp GAC Asp GAA Glu GAG Glu	GGU Gly GGC Gly GGA Gly GGG Gly	U C A G

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TOPIC

6.4

How do retroviruses violate the Central Dogma?

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TOPIC 6.4

How do retroviruses violate the Central Dogma?

Retroviruses have an RNA genome. They use their RNA to make a DNA template then insert into the host DNA to remain dormant until environmental cue

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TOPIC

6.4

Describe the difference between the protein made by free vs bound ribosomes

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TOPIC 6.4

How do retroviruses violate the Central Dogma?

Free ribosomes are freely floating in the cytosol – responsible for cytosolic proteins

Bound ribosomes are bound to the rough ER – responsible for membrane proteins or proteins for secretion

AP BIO INSTA-REVIEW

TOPIC

6.4

Free ribosomes and bound ribosomes are the same.

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.4

Free ribosomes and bound ribosomes are the same.

A. True

All ribosomes begin as free ribosomes. There is a signal peptide which will bring to a SRP (signal recognition particle) to move the ribosome to the rough ER membrane to finish translation as a bound ribosome.