AP BIO INSTA-REVIEW

TOPIC 6.1

DNA and RNA Structure

IST-1.K.1

DNA, and in some cases RNA, is the primary source of heritable information.

IST-1.K.2

Genetic information is transmitted from one generation to the next through DNA or RNA–

a. Genetic information is stored in and passed to subsequent generations through DNA molecules and, in some cases, RNA molecules.

b. Prokaryotic organisms typically have circular chromosomes, while eukaryotic organisms typically have multiple linear chromosomes.

AP BIO INSTA-REVIEW

TOPIC 6.1

DNA and RNA Structure

IST-1.K.3

Prokaryotes and eukaryotes can contain plasmids, which are small extra chromosomal, double-stranded, circular DNA molecules.

IST-1.L.1

DNA, and sometimes RNA, exhibits specific nucleotide base pairing that is conserved
through evolution: adenine pairs with thymine or uracil (A-T or A-U) and cytosine pairs with guanine (C-G)–
a. Purines (G and A) have a double ring structure.
b. Pyrimidines (C, T, and U) have a single ring structure.

AP BIO INSTA-REVIEW

TOPIC

6.1

What is the primary source of genetic information?

A. Carbohydrates

B. DNA/RNA

C. Lipids

D. Proteins

AP BIO INSTA-REVIEW

TOPIC 6.1

What is the primary source of genetic information?

B. DNA/RNA

DNA and RNA are nucleic acids. Nucleic acids are the source of genetic information for all organisms.

AP BIO INSTA-REVIEW

TOPIC

6.1

Prokaryotic DNA is...

A. Double stranded and circular

B. Double stranded and linear

C. Single stranded and circular

D. Single stranded and linear

AP BIO INSTA-REVIEW

TOPIC 6.1

Prokaryotic DNA is...

A. Double stranded and circular

Prokaryotes have a single circular DNA strand while eukaryotes have multiple linear DNA strands.

DNA is traditionally double stranded.

AP BIO INSTA-REVIEW

TOPIC

6.1

Eukaryotic DNA is...

A. Double stranded and circular

B. Double stranded and linear

C. Single stranded and circular

D. Single stranded and linear

AP BIO INSTA-REVIEW

TOPIC 6.1

Eukaryotic DNA is...

B. Double stranded and linear

Eukaryotes have multiple linear DNA strands while prokaryotes have a single circular DNA strand.

DNA is traditionally double stranded.

AP BIO INSTA-REVIEW

TOPIC

6.1

How do the number of origins of replication differ and why?

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TOPIC 6.1

How do the number of origins of replication differ and why?

Prokaryotic cells have ONE origin of replication, and Eukaryotic cells have MULTIPLE origins of replication. Prokaryotic cells have single circular DNA strands, so it would be more efficient to start at one location and move around the entire circle to make two DNA strands. Eukaryotic cells have multiple linear DNA strands, so they have multiple origins of replication to increase efficiency and allow for DNA to replicate quickly.

AP BIO INSTA-REVIEW

TOPIC

6.1

What is a plasmid?

AP BIO INSTA-REVIEW

TOPIC 6.1

What is a plasmid?

Small, extra chromosomal, double stranded, circular DNA molecule.

AP BIO INSTA-REVIEW

TOPIC

6.1

Both prokaryotic and eukaryotic cells have plasmids?

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.1

Both prokaryotic and eukaryotic cells have plasmids?

A. True

Although traditionally discussed in prokaryotes, plasmids have been found in eukaryotes.

Plasmids carry a minimum of one gene that is beneficial to the host but do not carry genetic information about the organism.

AP BIO INSTA-REVIEW

TOPIC

6.1

Plasmids can provide genetic variation to prokaryotes?

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.1

Plasmids can provide genetic variation to prokaryotes?

A. True

Plasmids are small, extra chromosomal, double stranded, circular DNA molecule. This is additional genetic information that can provide additional genetic information thus genetic variation.

AP BIO INSTA-REVIEW

TOPIC

6.1

In RNA, adenine pairs with...

A. Cytosine

B. Guanine

C. Thymine

D. Uracil

AP BIO INSTA-REVIEW

TOPIC 6.1

In RNA, adenine pairs with...

D. Uracil

RNA has four nucleotides: adenine, cytosine, guanine, and uracil. Base pairing is Adenine with Uracil and Cytosine with Guanine.

Apples Under the Tree (A-U)
Cars in the Garage (C-G)

AP BIO INSTA-REVIEW

TOPIC

6.1

In DNA, adenine pairs with...

A. Cytosine

B. Guanine

C. Thymine

D. Uracil

AP BIO INSTA-REVIEW

TOPIC 6.1

In DNA, adenine pairs with...

C. Thymine

DNA has four nucleotides: adenine, cytosine, guanine, and thymine. Base pairing is Adenine with Thymine and Cytosine with Guanine.

Apples in the Tree (A-T)
Cars in the Garage (C-G)

AP BIO INSTA-REVIEW

TOPIC

6.1

In RNA or DNA, cytosine pairs with...

A. Adenine

B. Guanine

C. Thymine

D. Uracil

AP BIO INSTA-REVIEW

TOPIC 6.1

In RNA or DNA, cytosine pairs with...

B. Guanine

There are five nucleotides: adenine, cytosine, guanine, thymine, and uracil. Base pairing is Adenine with Thymine or Uracil and Cytosine with Guanine.

Apples in the Tree (A-T)
Cars in the Garage (C-G)

AP BIO INSTA-REVIEW

TOPIC

6.1

What is a purine?

A. Carbohydrate with a single ring

B. Carbohydrate with a double ring

C. Nitrogenous base with a single ring

D. Nitrogenous base with a double ring

AP BIO INSTA-REVIEW

TOPIC 6.1

What is a purine?

D. Nitrogenous base with a double ring

Nucleotides are made up of pentose sugar, nitrogenous base, and phosphate group. There are two types of nitrogenous bases: purine (double-ring) and pyrimidine (single-ring). Adenine & Guanine are Purines and Cytosine, Uracil, and Thymine are Pyrimidines.

AP BIO INSTA-REVIEW

TOPIC

6.1

Which bases are purines?

A. Adenine and Cytosine

B. Adenine and Guanine

C. Cytosine and Guanine

D. Cytosine and Thymine

AP BIO INSTA-REVIEW

TOPIC 6.1

Which bases are purines?

B. Adenine and Guanine

Nucleotides are made up of pentose sugar, nitrogenous base, and phosphate group. There are two types of nitrogenous bases: purine (double-ring) and pyrimidine (single-ring). Adenine & Guanine are Purines and Cytosine, Uracil, and Thymine are Pyrimidines.

AP BIO INSTA-REVIEW

TOPIC

6.1

What are pyrimidines?

A. Carbohydrate with a single ring

B. Carbohydrate with a double ring

C. Nitrogenous base with a single ring

D. Nitrogenous base with a double ring

AP BIO INSTA-REVIEW

TOPIC 6.1

What are pyrimidines?

C. Nitrogenous base with a single ring

Nucleotides are made up of pentose sugar, nitrogenous base, and phosphate group. There are two types of nitrogenous bases: purine (double-ring) and pyrimidine (single-ring). Adenine & Guanine are Purines and Cytosine, Uracil, and Thymine are Pyrimidines.

AP BIO INSTA-REVIEW

TOPIC

6.1

Which bases are pyrimidines?

A. Adenine and Cytosine

B. Adenine and Guanine

C. Cytosine and Guanine

D. Cytosine and Thymine

AP BIO INSTA-REVIEW

TOPIC 6.1

Which bases are pyrimidines?

D. Cytosine and Thymine

Nucleotides are made up of pentose sugar, nitrogenous base, and phosphate group. There are two types of nitrogenous bases: purine (double-ring) and pyrimidine (single-ring). Adenine & Guanine are Purines and Cytosine, Uracil, and Thymine are Pyrimidines.

AP BIO INSTA-REVIEW

TOPIC

6.1

Contrast shape of DNA between prokaryotes and eukaryotes.

A. Eukaryotes have circular and prokaryotes have linear DNA

B. Prokaryotes have circular and eukaryotes have linear DNA

AP BIO INSTA-REVIEW

TOPIC

6.1

Contrast shape of DNA between prokaryotes and eukaryotes.

B. Prokaryotes have circular and eukaryotes have linear DNA

The DNA structure differs between prokaryotes and eukaryotes. Prokaryotes have a single circular DNA strand while eukaryotes have multiple linear DNA strands. Prokaryotes store theirs in the nucleoid while eukaryotes store theirs in the nucleus.

AP BIO INSTA-REVIEW

TOPIC

6.1

Contrast amount of DNA between prokaryotes and eukaryotes.

A. Eukaryotes have multiple DNA strands while prokaryotes have one DNA strand

B. Prokaryotes have multiple DNA strands while eukaryotes have one DNA strand

AP BIO INSTA-REVIEW

TOPIC

6.1

Contrast amount of DNA between prokaryotes and eukaryotes.

A. Eukaryotes have multiple DNA strands while prokaryotes have one DNA strand

The DNA structure differs between prokaryotes and eukaryotes. Prokaryotes have a single circular DNA strand while eukaryotes have multiple linear DNA strands. Prokaryotes store theirs in the nucleoid while eukaryotes store theirs in the nucleus.

AP BIO INSTA-REVIEW

TOPIC

6.1

Which organism has plasmids?

A. Bacteria (prokaryotes)

B. Yeast (eukaryotes)

C. Both bacteria and yeast

AP BIO INSTA-REVIEW

TOPIC 6.1

Which organism has plasmids?

C. Both bacteria and yeast

Both prokaryotes and eukaryotes have plasmids (small, extra chromosomal, double stranded, circular DNA molecule). It has been found in fungi, yeast, and some higher animals.

AP BIO INSTA-REVIEW

TOPIC

6.1

DNA is more stable than RNA

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.1

DNA is more stable than RNA

A. True

DNA is double stranded while RNA is single stranded. The double stranded component provides structural stability as it is harder to break and there is another strand to compare when an error occurs in replication.

AP BIO INSTA-REVIEW

TOPIC 6.2

Replication

IST-1.M.1

DNA replication ensures continuity of hereditary information–

a. DNA is synthesized in the 5' to 3' direction.
b. Replication is a semiconservative process–that is, one strand of DNA
serves as the template for a new strand of complementary DNA.
c. Helicase unwinds the DNA strands.
d. Topoisomerase relaxes supercoiling in front of the replication fork.

AP BIO INSTA-REVIEW

TOPIC 6.2

Replication

IST-1.M.1

DNA replication ensures continuity of hereditary information–

e. DNA polymerase requires RNA primers to initiate DNA synthesis.

f. DNA polymerase synthesizes new strands of DNA continuously on the leading strand and discontinuously on the lagging strand.

g. Ligase joins the fragments on the lagging strand.

AP BIO INSTA-REVIEW

TOPIC

6.2

Which direction is DNA read for DNA replication?

A. 3' -> 5'

B. 5' -> 3'

C. C terminus to N terminus

D. N terminus to C terminus

AP BIO INSTA-REVIEW

TOPIC 6.2

Which direction is DNA read for DNA replication?

A. 3' -> 5'

DNA is antiparallel, so it is read 3' -> 5' and synthesized 5' -> 3'. Recall the 5' end is the phosphate group and the 3' end is the hydroxyl of the deoxyribose.

AP BIO INSTA-REVIEW

TOPIC

6.2

Which direction is DNA synthesized in DNA replication?

A. 3' -> 5'

B. 5' -> 3'

C. C terminus to N terminus

D. N terminus to C terminus

AP BIO INSTA-REVIEW

TOPIC 6.2

Which direction is DNA synthesized in DNA replication?

B. 5' -> 3'

DNA is antiparallel, so it is synthesized 5' -> 3' and read 3' -> 5'. Recall the 5' end is the phosphate group and the 3' end is the hydroxyl of the deoxyribose.

AP BIO INSTA-REVIEW

TOPIC

6.2

What is found at the 3' end and 5' ends of DNA?

AP BIO INSTA-REVIEW

TOPIC 6.2

What is found at the 3' end and 5' ends of DNA?

5' end: phosphate

3' end: hydroxyl

Students a couple years ago would say the DNA is synthesized in the order of "P-OH".

AP BIO INSTA-REVIEW

TOPIC

6.2

How is DNA replicated?

A. Conservative

B. Dispersive

C. Lagging

D. Semiconservative

AP BIO INSTA-REVIEW

TOPIC 6.2

How is DNA replicated?

D. Semiconservative

The parent strand of DNA separates to provide a template strand for base pairing. The two separate strands base pair to synthesize the daughter strand. Each daughter strand has one parent strand (old) and one daughter strand (new) so the original sequence is conserved.

AP BIO INSTA-REVIEW

TOPIC

6.2

What does it mean to say the DNA replicates semiconservative?

AP BIO INSTA-REVIEW

TOPIC 6.2

What does it mean to say the DNA replicates semiconservative?

The parent strand of DNA separates to provide a template strand for base pairing. The two separate strands base pair to synthesize the daughter strand. Each daughter strand has one parent strand (old) and one daughter strand (new) so the original sequence is conserved.

AP BIO INSTA-REVIEW

TOPIC

6.2

Describe the experiment from Meselson & Stahl that proved semiconservative

AP BIO INSTA-REVIEW

TOPIC 6.2

Describe the experiment from Meselson & Stahl that proved semiconservative

They grew bacteria in the presence of nitrogen 15 (heavy nitrogen). Then put the bacteria into presence of nitrogen 14 (light nitrogen). After one round of replication, the DNA was a hybrid of heavy and light nitrogen. After two rounds of replication, there was a hybrid of heavy & light and a light strand.

AP BIO INSTA-REVIEW

TOPIC 6.2

Enzymes responsible for sealing phosphodiester linkage

A. Helicase

B. Ligase

C. Polymerase

D. Topoisomerase

AP BIO INSTA-REVIEW

TOPIC 6.2

Enzymes responsible for sealing phosphodiester link

B. Ligase

DNA ligase is used to form the phosphodiester linkage between two fragments of DNA on the sugar-phosphate backbone. This will seal the Okazaki fragments together (and the fragments from different origins of replication)

AP BIO INSTA-REVIEW

TOPIC

6.2

Enzymes responsible for relieve strand of double helix

A. Helicase

B. Ligase

C. Polymerase

D. Topoisomerase

AP BIO INSTA-REVIEW

TOPIC 6.2

Enzymes responsible for relieve strand of double helix

D. Topoisomerase

As helicase pulls apart the two strands of DNA (breaks the H bonds between the two strands), the strand gets supercoiled upstream. The topoisomerase will break the H bonds relieve the strain and then re-form the bonds.

AP BIO INSTA-REVIEW

TOPIC

6.2

Enzymes responsible for breaking H bonds between strands

A. Helicase

B. Ligase

C. Polymerase

D. Topoisomerase

AP BIO INSTA-REVIEW

TOPIC 6.2

Enzymes responsible for breaking H bonds between strands

A. Helicase

The helicase will break the H bonds between the two strands to allow access to the nucleotides for DNA replication. Recall, enzymes tell you what they do... helicase will break the bonds in the helix.

AP BIO INSTA-REVIEW

TOPIC

6.2

Enzymes responsible for synthesis of new DNA

A. Helicase

B. Ligase

C. Polymerase

D. Topoisomerase

AP BIO INSTA-REVIEW

TOPIC 6.2

Enzymes responsible for synthesis of new DNA

C. Polymerase

DNA polymerase synthesizes the new DNA strand. It will bind to an open 3' end to add the next nucleotide to the polynucleotide strand. Recall, enzymes tell you what they do... DNA polymerase makes a DNA polymer.

AP BIO INSTA-REVIEW

TOPIC

6.2

DNA polymerase can start replication independently

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.2

DNA polymerase can start replication independently

B. False

DNA polymerase requires an open 3' end for synthesis.

Primase will synthesize an RNA primer of 5-10 RNA nucleotides before the DNA strand.

AP BIO INSTA-REVIEW

TOPIC

6.2

What does DNA Polymerase require to initiate replication?

AP BIO INSTA-REVIEW

TOPIC 6.2

What does DNA Polymerase require to initiate replication?

An open 3' end. To initiate replication, primase will make an RNA primer. This primer has the open 3' end that is required for DNA polymerase for replication. The RNA will be replaced later with DNA by another type of DNA polymerase.

AP BIO INSTA-REVIEW

TOPIC

6.2

DNA is...

A. Antiparallel

B. Parallel

AP BIO INSTA-REVIEW

TOPIC 6.2

DNA is...

A. Antiparallel

The strands of DNA are antiparallel. The strands are equidistant due to a purine and pyrimidine bonding. The strands run in opposite directions. Notice in the figure, there's a 5' across from a 3'.

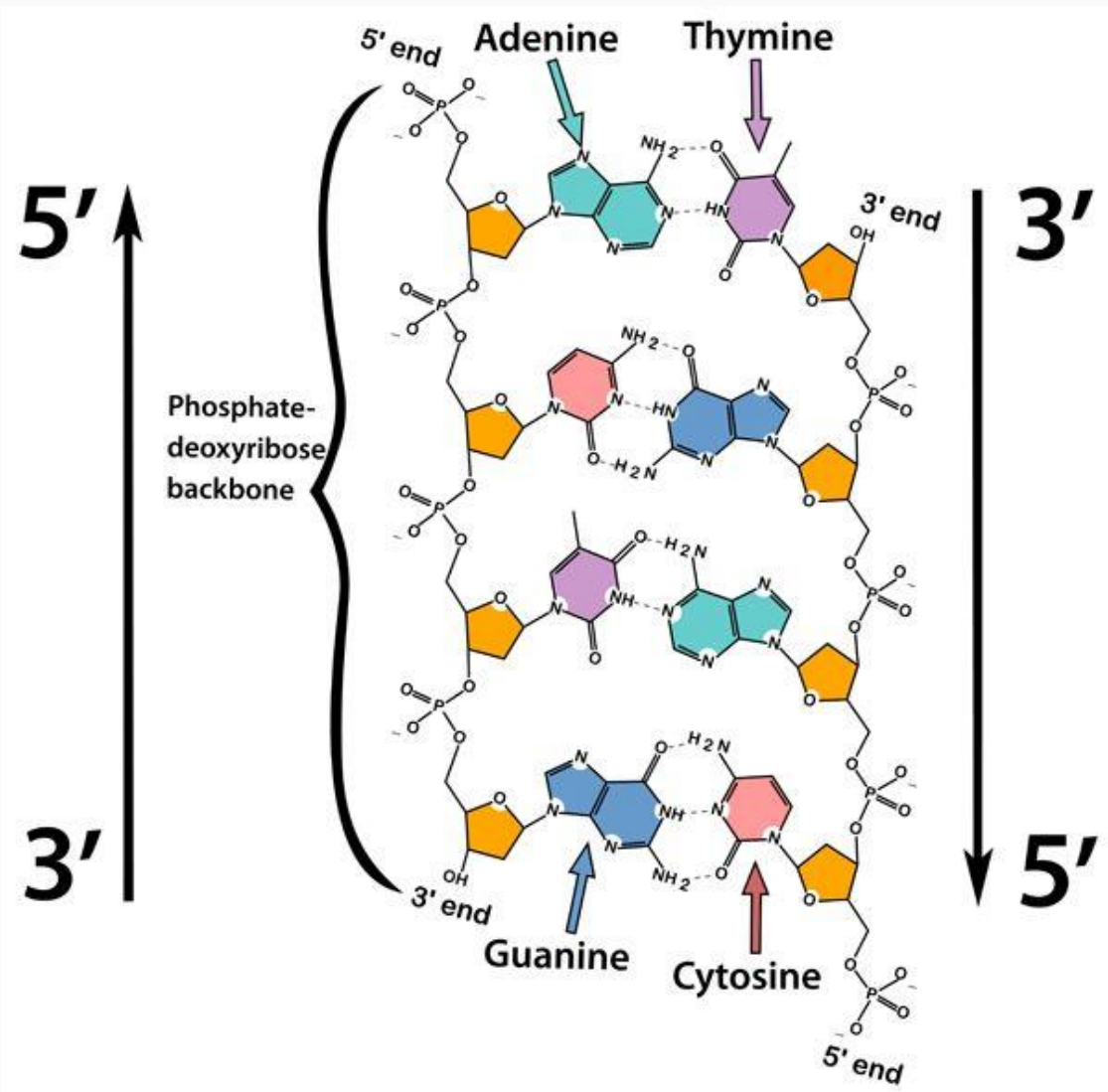
AP BIO INSTA-REVIEW

TOPIC

6.2

DNA is...

A. Antiparallel



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TOPIC

6.2

What is meant by leading and lagging strand?

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TOPIC 6.2

What is meant by leading and lagging strand?

Leading is synthesized continuous with replication fork with the replication fork while lagging strand is synthesized discontinuously. This occurs due to the antiparallel nature of DNA. The two strands when pulled apart only have one strand that can be read 3' to 5'(leading strand's template). Due to this, the lagging strand needs to move away from the replication fork so it can read the template strand in 3' to 5' direction.

AP BIO INSTA-REVIEW

TOPIC

6.2

Which enzyme connects the Okazaki fragments (lagging)

A. Helicase

B. Ligase

C. Polymerase

D. Topoisomerase

AP BIO INSTA-REVIEW

TOPIC 6.2

Which enzyme connects the Okazaki fragments (lagging)

B. Ligase

DNA ligase will form the phosphodiester linkage between DNA fragments to form a continuous sugar-phosphate backbone.

AP BIO INSTA-REVIEW

TOPIC

6.2

What is at the 5' end of DNA?

A. Hydrogen

B. Hydroxyl

C. Nitrogenous Base

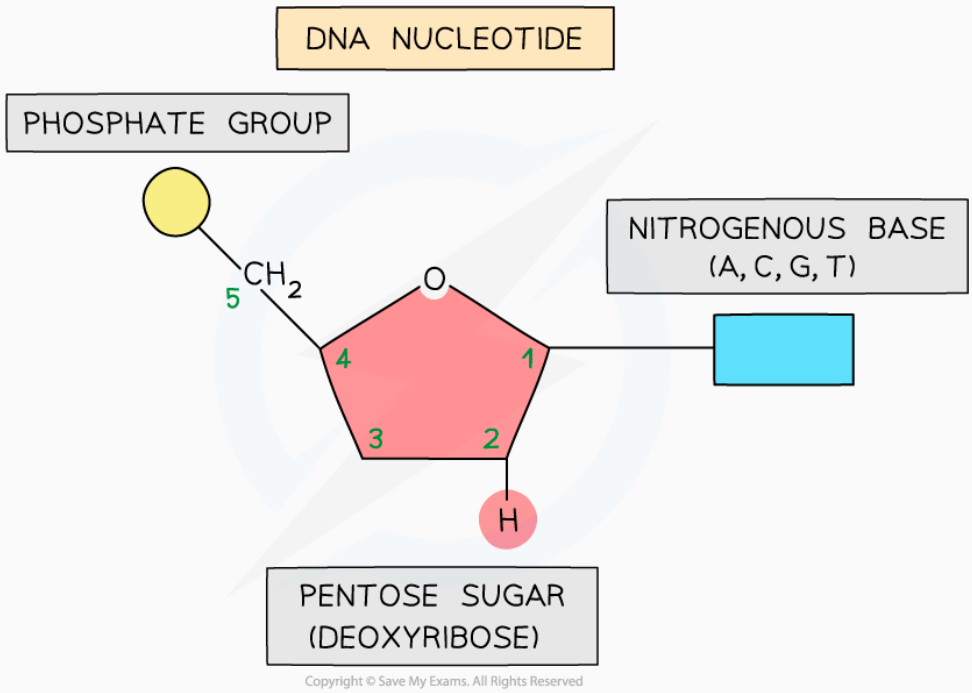
D. Phosphate

AP BIO INSTA-REVIEW

TOPIC 6.2

What is at the 5' end of DNA?

D. Phosphate



The 5' end has the phosphate group.
The 1' end has the nitrogenous base.
The 3' end has the hydroxyl group of the pentose sugar.

AP BIO INSTA-REVIEW

TOPIC

6.2

What is at the 3' end of DNA?

A. Hydrogen

B. Hydroxyl

C. Nitrogenous Base

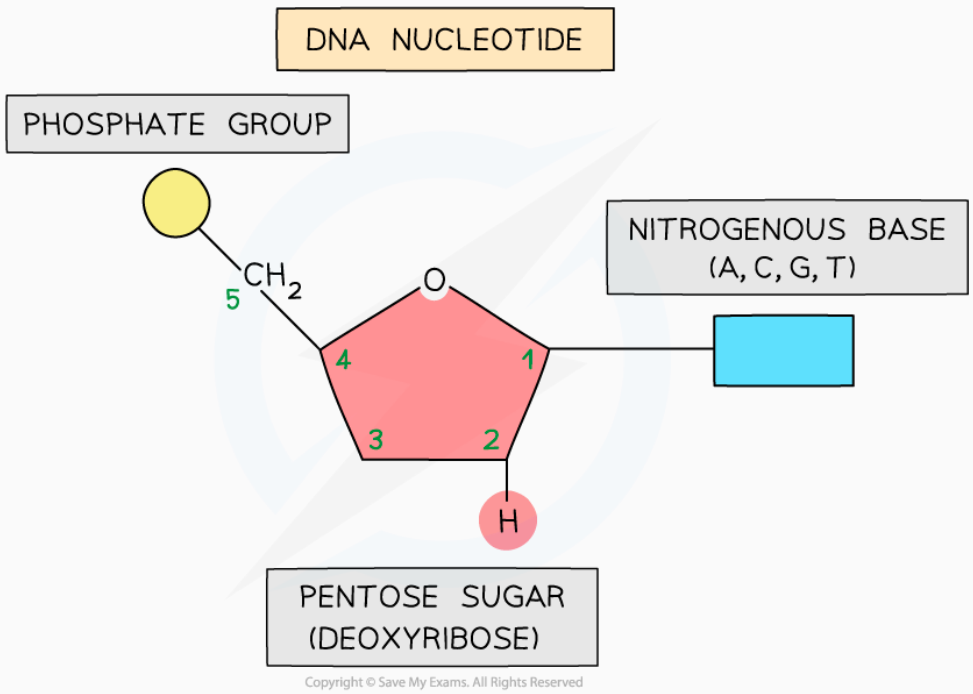
D. Phosphate

AP BIO INSTA-REVIEW

TOPIC 6.2

What is at the 3' end of DNA?

B. Hydroxyl



The 3' end has the hydroxyl group of the pentose sugar.

The 5' end has the phosphate group.

The 1' end has the nitrogenous base.

AP BIO INSTA-REVIEW

TOPIC

6.2

Describe the directionality of DNA

A. Antiparallel

B. Parallel

C. Perpendicular

D. Single Stranded 5' to 3'

AP BIO INSTA-REVIEW

TOPIC 6.2

Describe the directionality of DNA

A. Antiparallel

The strands of DNA are antiparallel. The strands are equidistant due to a purine and pyrimidine bonding. The strands run in opposite directions.

AP BIO INSTA-REVIEW

TOPIC

6.2

What does it mean that the DNA is antiparallel?

AP BIO INSTA-REVIEW

TOPIC

6.2

What does it mean that the DNA is antiparallel?

DNA is equidistant (recall it's a purine and pyrimidine so it has the same width). The two strands fun in opposite directions.

$$5' \rightarrow 3'$$
$$3' \leftarrow 5'$$

AP BIO INSTA-REVIEW

TOPIC

6.2

What is the enzyme responsible for breaking hydrogen bonds between nitrogenous bases?

A. DNA polymerase

B. Helicase

C. Ligase

D. Primase

AP BIO INSTA-REVIEW

TOPIC 6.2

What is the enzyme responsible for breaking hydrogen bonds between nitrogenous bases?

B. Helicase

Helicase will break the hydrogen bond between the nitrogenous bases. Recall, the enzymes tell you what they do so helicase will separate the helix.

AP BIO INSTA-REVIEW

TOPIC

6.2

What enzyme is responsible for synthesizing RNA start?

A. DNA polymerase

B. Helicase

C. Ligase

D. Primase

AP BIO INSTA-REVIEW

TOPIC 6.2

What enzyme is responsible for synthesizing RNA start?

D. Primase

DNA polymerase requires an RNA primer to provide the open 3' end to attach the DNA nucleotides. Recall, enzymes tell you what they do so primase will make a primer.

AP BIO INSTA-REVIEW

TOPIC

6.2

What enzyme is responsible for making the new DNA strand?

A. DNA polymerase

B. Helicase

C. Ligase

D. Primase

AP BIO INSTA-REVIEW

TOPIC 6.2

What enzyme is responsible for making the new DNA strand?

A. DNA polymerase

DNA polymerase will synthesize the new DNA strand. Recall, enzymes tell you what they do so DNA polymerase makes a DNA polymer.

AP BIO INSTA-REVIEW

TOPIC

6.2

Why does DNA require an RNA start (primer)?

AP BIO INSTA-REVIEW

TOPIC 6.2

Why does DNA require an RNA start (primer)?

DNA polymerase requires an open 3' end to build upon for replication

AP BIO INSTA-REVIEW

TOPIC

6.2

Which direction is DNA read?

A. 3' to 5'

B. 5' to 3'

C. Right to Left

D. Left to Right

AP BIO INSTA-REVIEW

TOPIC 6.2

Which direction is DNA read?

A. 3' to 5'

DNA is antiparallel, so it is read 3' -> 5' and synthesized 5' -> 3'. Recall the 5' end is the phosphate group and the 3' end is the hydroxyl of the deoxyribose.

AP BIO INSTA-REVIEW

TOPIC

6.2

Which direction is DNA synthesized?

A. 3' to 5'

B. 5' to 3'

C. Right to Left

D. Left to Right

AP BIO INSTA-REVIEW

TOPIC 6.2

Which direction is DNA synthesized?

B. 5' to 3'

DNA is antiparallel, so it is synthesized 5' -> 3' and read 3' -> 5'. Recall the 5' end is the phosphate group and the 3' end is the hydroxyl of the deoxyribose.

AP BIO INSTA-REVIEW

TOPIC

6.2

Which strand is formed continuously into the replication fork?

A. Lagging strand

B. Leading strand

AP BIO INSTA-REVIEW

TOPIC 6.2

Which strand is formed continuously into the replication fork?

B. Leading strand

The leading strand is synthesized continuously. This strand is synthesized towards the replication fork. DNA is antiparallel so moving in one direction, one strand will be in the correct orientation of 3' to 5' while the other strand will be "backwards" in the 5' to 3' orientation.

AP BIO INSTA-REVIEW

TOPIC

6.2

Which strand is formed discontinuously away from the replication fork?

A. Lagging strand

B. Leading strand

AP BIO INSTA-REVIEW

TOPIC 6.2

Which strand is formed discontinuously away from the replication fork?

A. Lagging strand

The lagging strand is synthesized discontinuously. This strand is synthesized away from the replication fork. DNA is antiparallel so moving in one direction, one strand will be in the correct orientation of 3' to 5' while the other strand will be "backwards" in the 5' to 3' orientation.

AP BIO INSTA-REVIEW

TOPIC

6.2

Lagging strand is made 3' to 5' and leading strand is made 5' to 3'.

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.2

Lagging strand is made 3' to 5' and leading strand is made 5' to 3'.

B. False

DNA is ALWAYS synthesized 5' to 3'. The leading strand is synthesize contineously towards the replication fork while the lagging strand is synthesized discontinuously away from the replication fork.

AP BIO INSTA-REVIEW

TOPIC 6.3

Transcription and RNA Processing

IST-1.N.1

The sequence of the RNA bases, together with the structure of the RNA molecule, determines RNA function–

a. mRNA molecules carry information from DNA to the ribosome.

AP BIO INSTA-REVIEW

TOPIC 6.3

Transcription and RNA Processing

IST-1.N.1

b. Distinct tRNA molecules bind specific amino acids and have anti-codon sequences that base pair with the mRNA. tRNA is recruited to the ribosome during translation to generate the primary peptide sequence based on the mRNA sequence.

c. rRNA molecules are functional building blocks of ribosomes.

AP BIO INSTA-REVIEW

TOPIC 6.3

Transcription and RNA Processing

IST-1.N.2

Genetic information flows from a sequence of nucleotides in DNA to a sequence of bases in an mRNA molecule to a sequence of amino acids in a protein.

IST-1.N.3

RNA polymerases use a single template strand of DNA to direct the inclusion of bases in the newly formed RNA molecule. This process is known as transcription.

AP BIO INSTA-REVIEW

TOPIC 6.3

Transcription and RNA Processing

IST-1.N.4

The DNA strand acting as the template strand is also referred to as the noncoding strand, minus strand, or antisense strand. Selection of which DNA strand serves as the template strand depends on the gene being transcribed.

IST-1.N.5

The enzyme RNA polymerase synthesizes mRNA molecules in the 5' to 3' direction by reading the template DNA strand in the 3' to 5' direction.

AP BIO INSTA-REVIEW

TOPIC 6.3

Transcription and RNA Processing

IST-1.N.6

In eukaryotic cells the mRNA transcript undergoes a series of enzyme-regulated modifications–

a. Addition of a poly-A tail.

b. Addition of a GTP cap.

c. Excision of introns & splicing & retention of exons.

d. Excision of introns and splicing and retention of exons can generate different versions of the resulting mRNA molecule; this is known as alternative splicing.

AP BIO INSTA-REVIEW

TOPIC

6.3

Which RNA functions as site of protein synthesis?

A. mRNA

B. rRNA

C. tRNA

AP BIO INSTA-REVIEW

TOPIC 6.3

Which RNA functions as site of protein synthesis?

B. rRNA

rRNA is the ribosomal RNA. Ribosomes, the site of protein synthesis, is composed of protein and rRNA.

AP BIO INSTA-REVIEW

TOPIC

6.3

Which RNA functions to bring amino acids to the ribosome?

A. mRNA

B. rRNA

C. tRNA

AP BIO INSTA-REVIEW

TOPIC 6.3

Which RNA functions to bring amino acids to the ribosome?

C. tRNA

tRNA is the transfer RNA. There are two important binding sites on the tRNAs. At one end, the tRNA is bound to an amino acid and the other end has an anticodon which pairs with the codon on the mRNA.

AP BIO INSTA-REVIEW

TOPIC

6.3

Which RNA is the transcript from DNA template?

A. mRNA

B. rRNA

C. tRNA

AP BIO INSTA-REVIEW

TOPIC 6.3

Which RNA is the transcript from DNA template?

A. mRNA

mRNA is messenger RNA. It functions as a transcript of the DNA to carry the genetic code to the ribosome for protein synthesis.

AP BIO INSTA-REVIEW

TOPIC

6.3

Which RNA has an anticodon that pairs with codon?

A. mRNA

B. rRNA

C. tRNA

AP BIO INSTA-REVIEW

TOPIC 6.3

Which RNA has an anticodon that pairs with codon?

C. tRNA

tRNA is the transfer RNA. The main function of the tRNA is the bring amino acids to the ribosome. The tRNA has an anticodon that pairs with the mRNA codon to ensure the correct amino acid is added.

AP BIO INSTA-REVIEW

TOPIC

6.3

Which RNA has the codons sequence for translation?

A. mRNA

B. rRNA

C. tRNA

AP BIO INSTA-REVIEW

TOPIC 6.3

Which RNA has the codons sequence for translation?

A. mRNA

mRNA is the messenger RNA. It is a transcript of the DNA to carry to message to the ribosome for protein synthesis. The triplet code of nucleotides on the mRNA is called a codon.

AP BIO INSTA-REVIEW

TOPIC

6.3

Big picture, how do the three different RNA molecules work together?

AP BIO INSTA-REVIEW

TOPIC
6.3

Big picture, how do the three different RNA molecules work together?

mRNA is the product of transcription in the nucleus. It brings the "message" from the nucleus about the order for protein synthesis. mRNA binds to the small subunit of the ribosome.

tRNA brings the amino acids The tRNA has an anticodon at one end that base pairs with the codons on the mRNA and an amino acid on the other end. It binds to the large subunit of the ribosome.

rRNA is the site of protein synthesis. The rRNA binds with protein to form the ribosome.

AP BIO INSTA-REVIEW

TOPIC

6.3

How does the location of transcription differ in prokaryotes vs. Eukaryotes?

AP BIO INSTA-REVIEW

TOPIC 6.3

How does the location of transcription differ in prokaryotes vs. eukaryotes?

Due to the absence of a nuclear envelope, transcription occurs in the cytosol (nucleoid) of the prokaryote.

Due to the presence of a nuclear envelope, transcription occurs in the nucleus of an eukaryote.

AP BIO INSTA-REVIEW

TOPIC

6.3

Which enzyme is responsible for transcription?

A. Ligase

B. Primase

C. RNA Polymerase

D. Transcriptase

AP BIO INSTA-REVIEW

TOPIC 6.3

Which enzyme
is responsible
for transcription?

C. RNA Polymerase

RNA Polymerase is an enzyme that binds to the DNA and synthesizes a RNA strand. Remember: enzymes tell you what they do. RNA Polymerase makes an RNA polymer.

AP BIO INSTA-REVIEW

TOPIC

6.3

What is the name of the strand read for transcription?

AP BIO INSTA-REVIEW

TOPIC 6.3

What is the name of the strand read for transcription?

> Template strand

> Noncoding strand

> Minus strand

> Antisense strand

(Note: you should know all 4 of these terms as they are directly in the CED and can be used in the prompt.)

AP BIO INSTA-REVIEW

TOPIC

6.3

In transcription, which direction is DNA read?

A. 3' to 5'

B. 5' to 3'

C. C terminus to N terminus

D. N terminus to C terminus

AP BIO INSTA-REVIEW

TOPIC 6.3

In transcription, which direction is DNA read?

A. 3' to 5'

DNA and RNA are antiparallel. The DNA is read 3' to 5' while the RNA is synthesized 5' to 3'. Remember the 3' is the hydroxyl group of the pentose sugar and the 5' is the phosphate.

AP BIO INSTA-REVIEW

TOPIC

6.3

In transcription, which direction is RNA made?

A. 3' to 5'

B. 5' to 3'

C. C terminus to N terminus

D. N terminus to C terminus

AP BIO INSTA-REVIEW

TOPIC 6.3

In transcription, which direction is RNA made?

B. 5' to 3'

DNA and RNA are antiparallel. The RNA is synthesized 5' to 3' while the DNA is read 3' to 5'. Remember the 3' is the hydroxyl group of the pentose sugar and the 5' is the phosphate.

AP BIO INSTA-REVIEW

TOPIC

6.3

Describe the three changes made during post-transcription

AP BIO INSTA-REVIEW

TOPIC 6.3

Describe the three changes made during post-transcription

> Guanine cap added to 5' end

> Poly A tail added to 3' end

> Introns are removed by splicing

AP BIO INSTA-REVIEW

TOPIC 6.3

Function of 5' Cap...

A. Add phosphates to the RNA

B. Provide ATP for transcription

C, Protect from hydrolytic enzymes

D. Site of ribosome binding

AP BIO INSTA-REVIEW

TOPIC 6.3

Function of 5' Cap...

D. Site of ribosome binding

The 5' Cap has two functions. It binds with the ribosome for translation (which reads the RNA 5' to 3') at the 5' end. It facilitates the mRNA leaving the nucleus.

AP BIO INSTA-REVIEW

TOPIC

6.3

Function of Poly A tail...

A. Add phosphates to the RNA

B. Provide ATP for transcription

C. Protect from hydrolytic enzymes

D. Site of ribosome binding

AP BIO INSTA-REVIEW

TOPIC 6.3

Function of Poly A tail...

C. Protect from hydrolytic enzymes

The poly-A tail is made up of multiple adenines at the end of the mRNA. As the hydrolytic enzymes in the cytosol hydrolyze the mRNA, it prolongs its "life" in the cytosol to maximize protein synthesized.

AP BIO INSTA-REVIEW

TOPIC

6.3

What process allows the synthesis of different proteins from same DNA

AP BIO INSTA-REVIEW

TOPIC 6.3

What process allows the synthesis of different proteins from same DNA

Alternative RNA splicing

AP BIO INSTA-REVIEW

TOPIC

6.3

What is the process of transcription?

A. Synthesizing DNA under the direction of DNA
B. Synthesizing DNA under the direction of RNA
C. Synthesizing RNA under the direction of DNA
D. Synthesizing RNA under the direction of RNA

AP BIO INSTA-REVIEW

TOPIC 6.3

What is the process of transcription?

C. Synthesizing RNA under the direction of DNA

Transcription is the process of synthesizing a RNA molecule from an DNA template. The DNA must be protected as its the genetic code for the cell, so the RNA is a disposable copy of the information for cellular usage.

AP BIO INSTA-REVIEW

TOPIC

6.3

What is the order in the central dogma?

AP BIO INSTA-REVIEW

TOPIC 6.3

What is the order in the central dogma?

DNA → RNA → polypeptide

AP BIO INSTA-REVIEW

TOPIC 6.3

What type of virus will violate the central dogma?

A. Bacteriophage

B. DNA virus

C. Retrovirus

D. All of the above

AP BIO INSTA-REVIEW

TOPIC 6.3

What type of virus will violate the central dogma?

C. Retrovirus

Retroviruses have a RNA genome. They have reverse transcriptase, enzyme that synthesizes DNA from RNA template. The central dogma states DNA → RNA, but the retrovirus goes RNA → DNA.

AP BIO INSTA-REVIEW

TOPIC

6.3

What is the function of mRNA, rRNA, and tRNA?

AP BIO INSTA-REVIEW

TOPIC 6.3

What is the function of mRNA, rRNA, and tRNA?

mRNA is the messenger RNA, which brings the information about the order of amino acids to the ribosomes and base pairs the codon with the anticodon (on the tRNA)

tRNA is the transfer RNA, which brings the amino acids to the ribosome and base pairs the anticodon with the codon (on the mRNA)

rRNA is the ribosomal RNA, which makes up the ribosome in addition to proteins.

AP BIO INSTA-REVIEW

TOPIC

6.3

What enzyme is responsible for transcription?

A. DNA polymerase

B. Helicase

C. Primase

D. RNA polymerase

AP BIO INSTA-REVIEW

TOPIC 6.3

What enzyme is responsible for transcription?

D. RNA polymerase

RNA polymerase is the enzyme that functions in transcription. It will synthesize a RNA molecule from the DNA template.

AP BIO INSTA-REVIEW

TOPIC

6.3

Which strand is read for transcription?

A. 3' to 5' coding strand

B. 5' to 3' coding strand

C. 3' to 5' noncoding strand

D. 5' to 3' noncoding strand

AP BIO INSTA-REVIEW

TOPIC 6.3

Which strand is read for transcription?

C. 3' to 5' noncoding strand

DNA and RNA are antiparallel, so the DNA is read 3' to 5' and the RNA is synthesized 5' to 3'. Note: the DNA template strand can be called 4 different names: noncoding strand, minus strand, or antisense strand.

AP BIO INSTA-REVIEW

TOPIC

6.3

Which direction is RNA synthesized?

A. 3' to 5'

B. 5' to 3'

AP BIO INSTA-REVIEW

TOPIC 6.3

Which direction is RNA synthesized?

B. 5' to 3'

DNA and RNA are antiparallel, so the RNA is synthesized 5' to 3' and DNA is read 3' to 5'. Recall: the 5' end is the site of the phosphate and the 3' end is the hydroxyl group of the pentose sugar.

AP BIO INSTA-REVIEW

TOPIC

6.3

What three things happen to the mRNA before it leaves the nucleus?

AP BIO INSTA-REVIEW

TOPIC 6.3

What three things happen to the mRNA before it leaves the nucleus?

> Add a 5' guanine cap

> Add a poly A tail

> Cut out introns

AP BIO INSTA-REVIEW

TOPIC

6.3

What is the function of the poly A tail?

A. Binds to the promoter region

B. Decrease degradation by hydrolytic enzymes

C. Remove noncoding information

D. Site of ribosome binding

AP BIO INSTA-REVIEW

TOPIC 6.3

What is the function of the poly A tail?

B. Decrease degradation by hydrolytic enzymes

The poly-A tail is made up of multiple adenines at the end of the mRNA. As the hydrolytic enzymes in the cytosol hydrolyze the mRNA, it prolongs its "life" in the cytosol to maximize protein synthesized.

AP BIO INSTA-REVIEW

TOPIC

6.3

What is the function of the 5' cap?

A. Binds to the promoter region

B. Decrease degradation by hydrolytic enzymes

C. Remove noncoding information

D. Site of ribosome binding

AP BIO INSTA-REVIEW

TOPIC 6.3

What is the function of the 5' cap?

D. Site of ribosome binding

The 5' Cap has two functions. It binds with the ribosome for translation (which reads the RNA 5' to 3') at the 5' end. It facilitates the mRNA leaving the nucleus.

AP BIO INSTA-REVIEW

TOPIC

6.3

How can you have the same DNA, but result in multiple different proteins?

AP BIO INSTA-REVIEW

TOPIC 6.3

How can you have the same DNA, but result in multiple different proteins?

Alternative gene splicing

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.

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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)

AP BIO INSTA-REVIEW

TOPIC 6.4

Transcription & Translation are simultaneously completed in a prokaryote

A. True

B. False

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

TOPIC

6.4

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

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

TOPIC

6.4

One amino acid is coded by multiple codons...

A. True

B. False

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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).

AP BIO INSTA-REVIEW

TOPIC

6.4

What is added when the stop codon is reached

A. Amino Acid

B. ATP

C. Stop Codon

D. Water

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

TOPIC

6.4

HIV is a retrovirus. What does that mean?

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

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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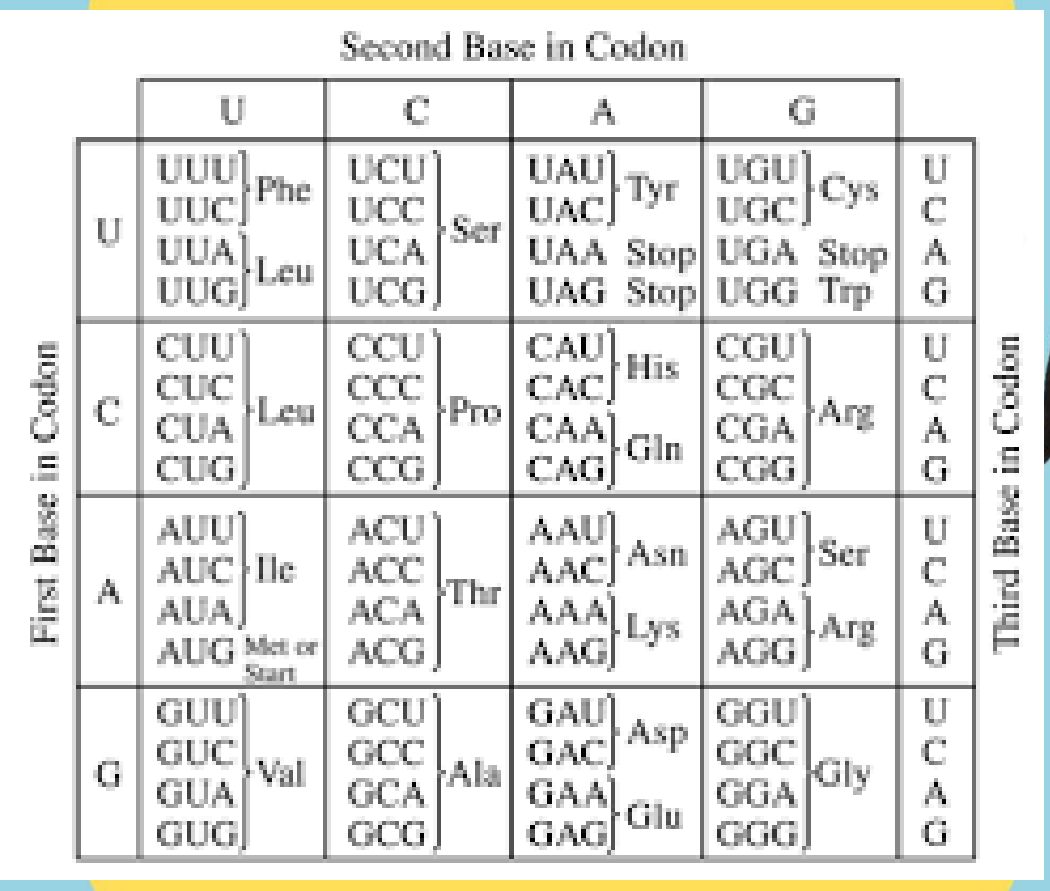
TOPIC

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, 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

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AP BIO INSTA-REVIEW

TOPIC

6.4

How do retroviruses violate the Central Dogma?

AP BIO INSTA-REVIEW

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

AP BIO INSTA-REVIEW

TOPIC

6.4

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

AP BIO INSTA-REVIEW

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.

AP BIO INSTA-REVIEW

TOPIC 6.5

Regulation of Gene Expression

IST-2.A.1

Regulatory sequences are stretches of DNA that interact with regulatory proteins to control transcription.

IST-2.A.2

Epigenetic changes can affect gene expression through reversible modifications of DNA or histones.

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TOPIC 6.5

Regulation of Gene Expression

IST-2.A.3

The phenotype of a cell or organism is determined by the combination of genes that are expressed and the levels at which they are expressed–

a. Observable cell differentiation results from the expression of genes for tissue specific proteins.

b. Induction of transcription factors during development results in sequential gene expression.

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TOPIC 6.5

Regulation of Gene Expression

IST-2.B.1

Both prokaryotes and eukaryotes have groups of genes that are coordinately regulated–

a. In prokaryotes, groups of genes called operons are transcribed in a single mRNA molecule. The lac operon is an example of an inducible system.

b. In eukaryotes, groups of genes may be influenced by the same transcription factors to coordinately regulate expression.

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TOPIC

6.5

Describe the effect of DNA methylation

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TOPIC 6.5

Describe the effect of DNA methylation

DNA methylation involves binding methyl groups to the DNA. This causes the strand to condense which will inhibit transcription (so decreases gene expression)

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TOPIC

6.5

Describe the effect of histone acetylation

AP BIO INSTA-REVIEW

TOPIC 6.5

Describe the effect of histone acetylation

Firstly, histones are the proteins that DNA wraps around to condense.

The acetylation decreases the binding between DNA and histone which causes the DNA to loosen. This increases transcription or stimulates gene expression.

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TOPIC

6.5

What are the transcription factors?

A. Molecules that provide ATP to transcription unit

B. Molecules that synthesize RNA during transcription

C. Molecules that bring amino acids to the transcription unit

D. Molecules that bind to enhance/inhibit transcription.

AP BIO INSTA-REVIEW

TOPIC 6.5

What are the transcription factors?

D. Molecules that bind to enhance/inhibit transcription.

Transcription factors bind to the enhancer regions to assist RNA polymerase to bind to the promoter to initiate transcription

AP BIO INSTA-REVIEW

TOPIC

6.5

All somatic (body) cells have the same genetic information

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.5

All somatic (body) cells have the same genetic information

A. True

All of your cells resulted from a single cell (zygote) that underwent mitosis so you could grow. All of your cells have the SAME DNA (except for your gametes due to meiosis)

AP BIO INSTA-REVIEW

TOPIC

6.5

If all the cells have the same DNA how are your cells so different?

AP BIO INSTA-REVIEW

TOPIC 6.5

If all the cells have the same DNA how are your cells so different?

Cell differentiation

The cells have different transcription factors/activators which will enhance transcription of certain genes.

AP BIO INSTA-REVIEW

TOPIC

6.5

What types of cells have operons?

A. Eukaryotes

B. Prokaryotes

C. Neither eukaryotes nor prokaryotes

D. Both eukaryotes and prokaryotes

AP BIO INSTA-REVIEW

TOPIC 6.5

What types of cells have operons?

B. Prokaryotes

Operons are only found in prokaryotes. Operons are made up of a promoter, operator, and the genes that they control. It is a simple way for the prokaryotes to organize for gene expression.

AP BIO INSTA-REVIEW

TOPIC

6.5

What are three components of an operon?

AP BIO INSTA-REVIEW

TOPIC 6.5

What are three components of an operon?

> Promoter

> Operator

> Genes it regulates

AP BIO INSTA-REVIEW

TOPIC

6.5

What binds to the promoter?

A. DNA polymerase

B. Operator

C. Repressor

D. RNA polymerase

AP BIO INSTA-REVIEW

TOPIC 6.5

What binds to the promoter?

D. RNA polymerase

The promoter is where the RNA polymerase to initiate transcription.

AP BIO INSTA-REVIEW

TOPIC

6.5

What makes up the TATA box?

A. Adenine & Cytosine

B. Cytosine & Guanine

C. Guanine & Thymine

D. Thymine & Adenine

AP BIO INSTA-REVIEW

TOPIC 6.5

What makes up the TATA box?

D. Thymine & Adenine

The TATA box is made up of T nucleotides (thymine) and A nucleotides (adenine). This is a site on the DNA where transcription factors will bind to aid in RNA polymerase binding.

AP BIO INSTA-REVIEW

TOPIC

6.5

Where is the TATA box located?

A. Near the introns

B. Near the exons

C. Near the poly adenylation sequence

D. Near the promoter

AP BIO INSTA-REVIEW

TOPIC 6.5

Where is the TATA box located?

D. Near the promoter

The TATA box is near the promoter. The TATA box indicates the DNA strand to be read. Transcription factors bind to this region to assist the RNA polymerase to bind to the promoter.

AP BIO INSTA-REVIEW

TOPIC

6.5

Describe the effect of adding methyl group to DNA.

A. Decreases condensation which decreases transcription

B. Decreases condensation which increases transcription

C. Increases condensation which decreases transcription

D. Increases condensation which increases transcription

AP BIO INSTA-REVIEW

TOPIC 6.5

Describe the effect of adding methyl group to DNA.

C. Increases condensation which decreases transcription

Adding methyl groups to the DNA will cause the DNA to condense which decreases transcription as the RNA polymerase is unable to access the DNA to transcribe.

Recall: XX individuals will undergo methylation to their extra X chromosome to form Barr Bodies.

AP BIO INSTA-REVIEW

TOPIC

6.5

Describe effect of acetylating the histone tails

A. Decreases condensation which decreases transcription

B. Decreases condensation which increases transcription

C. Increases condensation which decreases transcription

D. Increases condensation which increases transcription

AP BIO INSTA-REVIEW

TOPIC 6.5

Describe effect of acetylating the histone tails

B. Decreases condensation which increases transcription

When you acetylate the histone tails, it will cause the histone to be more negatively charged. The DNA and the histone will repel causing the DNA to decrease condensation and increase transcription as the RNA polymerase is able to access the DNA for transcription.

AP BIO INSTA-REVIEW

TOPIC

6.5

All somatic cells within one organism have the same DNA.

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.5

All somatic cells within one organism have the same DNA.

A. True

All cells originated from the zygote. The cells undergo mitosis forming identical cells that make up your body (somatic cells). The only cells in your body that are different are gametes due to the process of meiosis.

AP BIO INSTA-REVIEW

TOPIC

6.5

What is the function of transcription factors?

AP BIO INSTA-REVIEW

TOPIC 6.5

What is the function of transcription factors?

Binds to initiate transcription or inhibit transcription

Will turn on and off the genes of interest

AP BIO INSTA-REVIEW

TOPIC

6.5

Where does the repressor in an operon bind?

A. Operator

B. Promoter

C. Regulatory sequence

D. TATA box

AP BIO INSTA-REVIEW

TOPIC 6.5

Where does the repressor in an operon bind?

A. Operator

The operator is located in the promoter region. This is the site of binding for the repressor.

If the repressor is bound to the operator, the operon will be OFF. If the repressor is NOT bound to the operator, the operon will be ON.

AP BIO INSTA-REVIEW

TOPIC

6.5

If the repressor is bound to the operator...

A. RNA polymerase is able to bind, the operon is off

B. RNA polymerase is able to bind, the operon is on

C. RNA polymerase is unable to bind, the operon is off

D. RNA polymerase is unable to bind, the operon is on

AP BIO INSTA-REVIEW

TOPIC 6.5

If the repressor is bound to the operator...

C. RNA polymerase is unable to bind, the operon is off

Due to the repressor binding to the operator located in the promoter region, the repressor will block the binding of the RNA polymerase. If RNA polymerase is unable to bind, transcription will be inhibited.

AP BIO INSTA-REVIEW

TOPIC

6.5

The lac operon is...

A. Inducible operon so starts off and is activated by lactose

B. Inducible operon so starts on and is deactivated by lactose

C. Repressible operon so starts off and is activated by lactose

D. Repressible operon so starts on and is deactivated by lactose

AP BIO INSTA-REVIEW

TOPIC 6.5

The lac operon is...

A. Inducible operon so starts off and is activated by lactose

The lac operon synthesizes the enzymes to break down lactose. This operon will start as OFF and be stimulated by the presence of lactose. The lactose acts as an inducer to deactivate the repressor and turn the operon ON. This is an inducible operon.

AP BIO INSTA-REVIEW

TOPIC

6.5

The trp operon is a(n)...

A. Inducible operon – activated by trp

B. Inducible operon – deactivated by trp

C. Repressible operon – activated by trp

D. Repressible operon – deactivated by trp

AP BIO INSTA-REVIEW

TOPIC 6.5

The trp operon is a(n)...

D. Repressible operon – deactivated by trp

The trp operon synthesizes the enzymes needed to synthesize tryptophan. This operon will start ON. When trp is present, it will bind to the repressor activating it so it binds to the operator to inhibit transcription and turn the operon OFF. This operon is repressible by the presence of trp.

AP BIO INSTA-REVIEW

TOPIC

6.5

Note:

Histones are proteins that the DNA wraps around to organize it. I think of it like spaghetti (DNA) wrapped around a fork (histone) will allow you to access specific segments of the noodles versus the plate of unorganized pasta.

The histone is positively charged so attracted to DNA which is negatively charged (the phosphate groups each have 2 minus charge)

AP BIO INSTA-REVIEW

TOPIC 6.6

Gene Expression and Cell Specialization

IST-2.C.1

Promoters are DNA sequences upstream of the transcription start site where RNA polymerase and transcription factors bind to initiate transcription.

IST-2.C.2

Negative regulatory molecules inhibit gene expression by binding to DNA and blocking transcription.

AP BIO INSTA-REVIEW

TOPIC 6.6

Gene Expression and Cell Specialization

IST-2.D.1

Gene regulation results in differential gene expression and influences cell products and function.

IST-2.D.2

Certain small RNA molecules have roles in regulating gene expression.

AP BIO INSTA-REVIEW

TOPIC

6.6

What is the function of the promoter?

AP BIO INSTA-REVIEW

TOPIC 6.6

What is the function of the promoter?

Location for RNA polymerase to bind.

AP BIO INSTA-REVIEW

TOPIC

6.6

What is the function of RNA Polymerase?

A. Synthesize RNA primer

B. Synthesize RNA transcript

C. Use RNA template to synthesize DNA

D. Use RNA template to synthesize protein

AP BIO INSTA-REVIEW

TOPIC 6.6

What is the function of RNA Polymerase?

B. Synthesize RNA transcript

RNA polymerase is an enzyme that uses a DNA template to synthesize a RNA transcript. Recall enzymes tell you what they do, RNA Polymerase makes an RNA polymer.

AP BIO INSTA-REVIEW

TOPIC

6.6

How do transcription factors affect transcription?

AP BIO INSTA-REVIEW

TOPIC 6.6

How do transcription factors affect transcription?

They regulate transcription/gene expression. They can bind to enhance the binding of RNA polymerase.

I explain it like a baseball/softball glove. When you catch a ball, you would rather catch it in your glove with TWO hands instead of bare handling it. Why? It's more stable. The transcription factors create a "secure" fit for the RNA polymerase to get started

AP BIO INSTA-REVIEW

TOPIC

6.6

What are siRNA?

A. Small interfering RNA

B. Short introns of RNA

C. Serine in RNA

AP BIO INSTA-REVIEW

TOPIC 6.6

What are siRNA?

A. Small interfering RNA

siRNA are small interfering RNA. These are single stranded RNA that bind to mRNA to inhibit translation or degrade the mRNA.

AP BIO INSTA-REVIEW

TOPIC

6.6

Describe what is the function of siRNA

AP BIO INSTA-REVIEW

TOPIC 6.6

Describe what is the function of siRNA

Small interfering RNAs (siRNA)
> short segments of RNA (21-28 bases) bind to mRNA, create sections of double-stranded mRNA, "death" tag for mRNA (triggers degradation of mRNA)
> cause gene "silencing" by post-transcriptional control, turns off gene so no protein produced

AP BIO INSTA-REVIEW

TOPIC

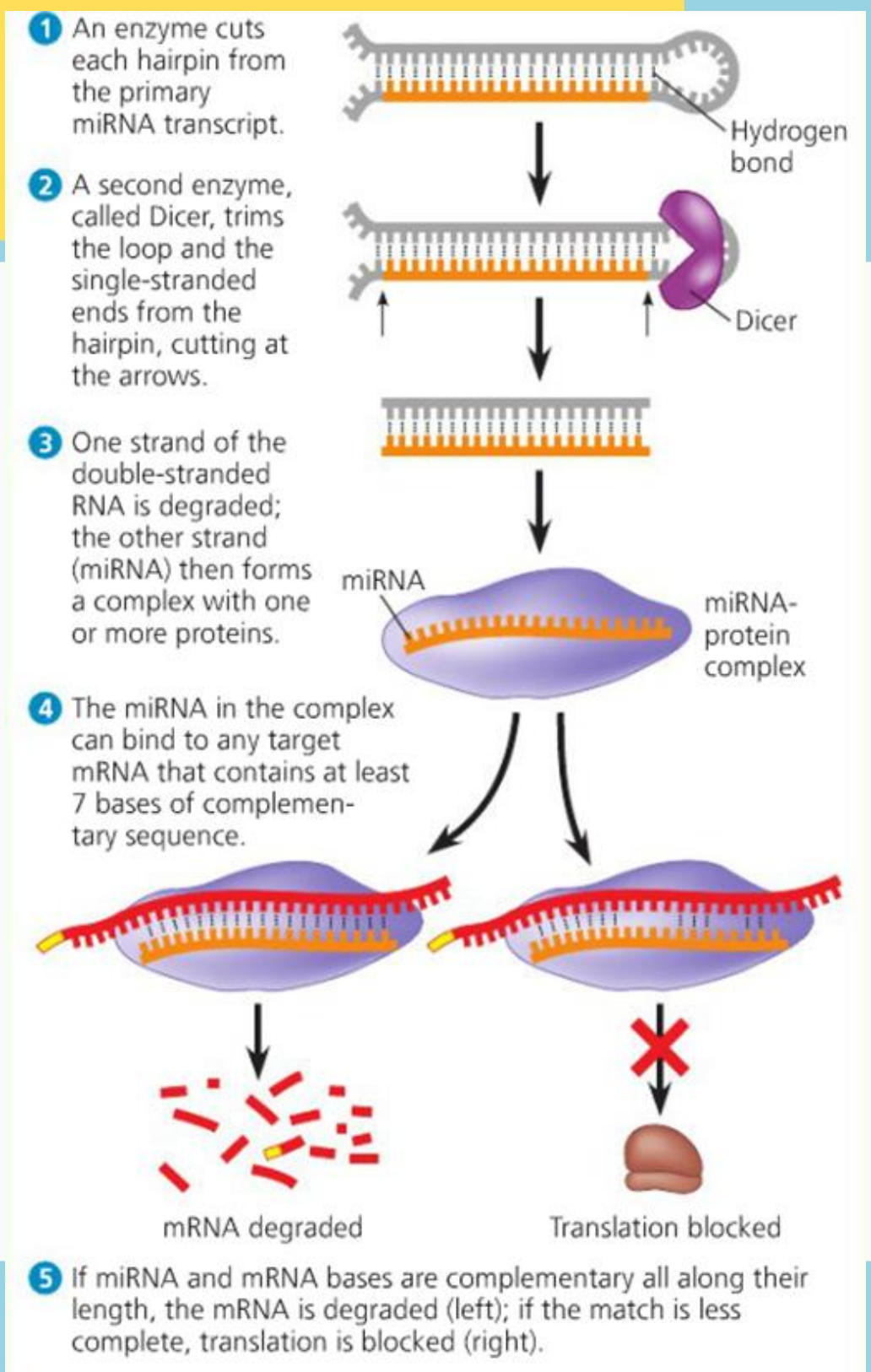
6.6

Describe the mechanism involved with miRNA

AP BIO INSTA-REVIEW

TOPIC 6.6

Describe the mechanism involved with miRNA



AP BIO INSTA-REVIEW

TOPIC

6.6

What is the function of the promoter?

A. Activators bind to promote transcription

B. Motor proteins binds with actin for transcription

C. Repressors bind to initiate transcription

D. Site of RNA polymerase binding for transcription

AP BIO INSTA-REVIEW

TOPIC 6.6

What is the function of the promoter?

D. Site of RNA polymerase binding for transcription

The promoter is the region of DNA where the RNA polymerase binds to initiate transcription.

AP BIO INSTA-REVIEW

TOPIC

6.6

What is the function of transcription factors?

AP BIO INSTA-REVIEW

TOPIC 6.6

What is the function of transcription factors?

Molecules bind to the enhancer region to promote transcription

The binding of transcription factors enhances the binding of RNA polymerase to promoter region to facilitate transcription

They are component of the initiation transcription complex

AP BIO INSTA-REVIEW

TOPIC

6.6

What is the function of RNA polymerase?

A. Binds to DNA to synthesize an RNA primer

B. Binds to DNA to synthesize an RNA transcript

C. Binds to RNA to base pair with other RNA strand

D. Binds to RNA to seal phosphodiester linkages

AP BIO INSTA-REVIEW

TOPIC 6.6

What is the function of RNA polymerase?

B. Binds to DNA to synthesize an RNA transcript

RNA polymerase is an enzyme that initiates transcription. The RNA polymerase binds to the DNA at the promoter. It uses the DNA as a template to synthesize a RNA transcript.

AP BIO INSTA-REVIEW

TOPIC

6.6

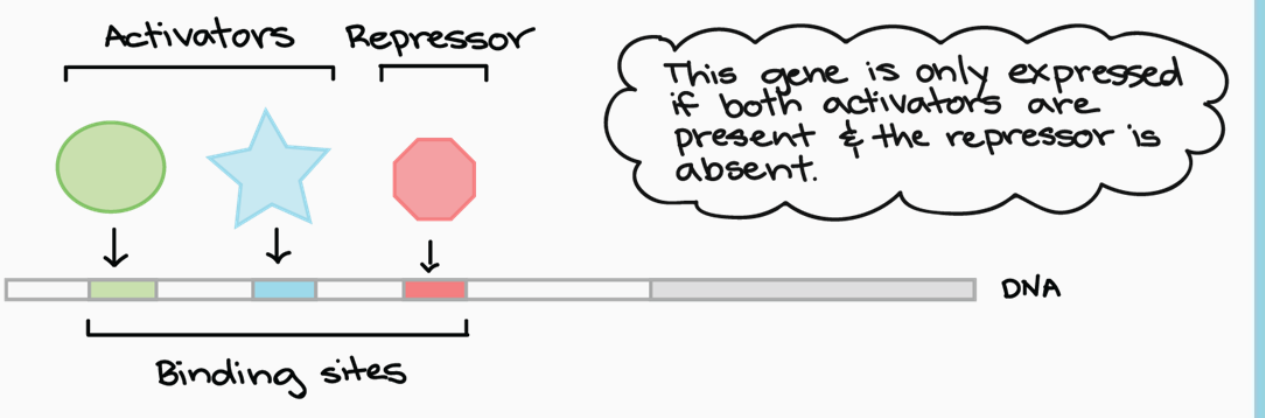
What is differential gene expression?

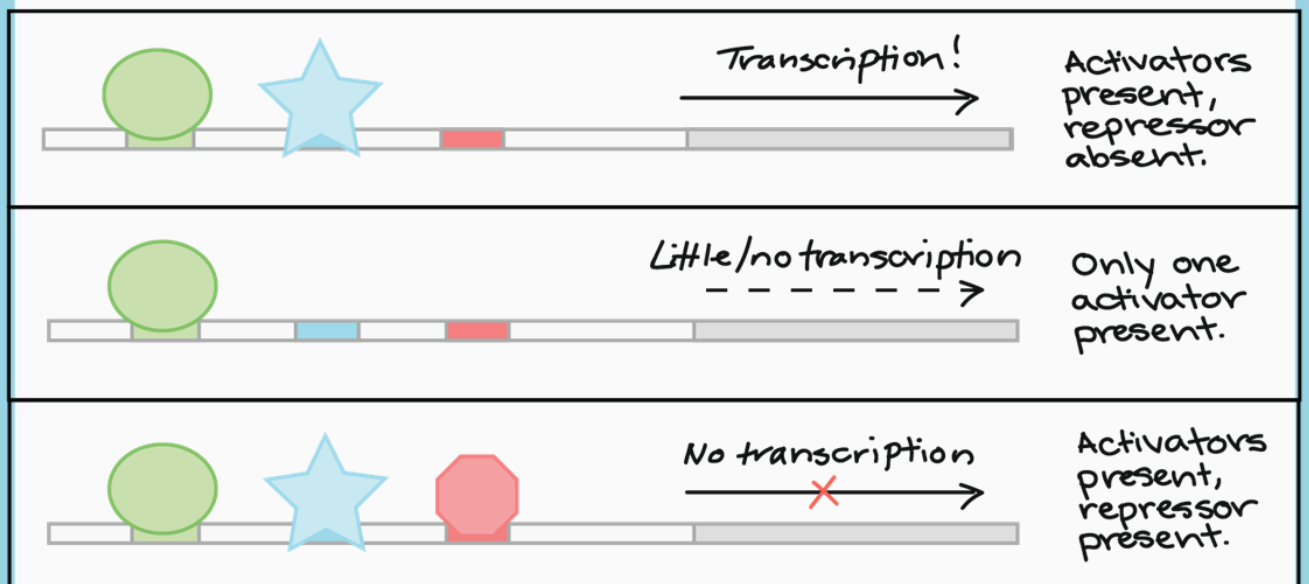
AP BIO INSTA-REVIEW

TOPIC

6.6

What is differential gene expression?





Credit: Khan Academy

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TOPIC

6.6

What is the function of transcription factors?

AP BIO INSTA-REVIEW

TOPIC 6.6

What is the function of transcription factors?

Different genes are expressed by different cells

So even though all of your cell have the same DNA, a liver cell has the components and functionality of a liver cell vs your lens (eye) cell has the components and functionality of a lens cell.

AP BIO INSTA-REVIEW

TOPIC

6.6

What is siRNA?

A. Small RNA strand that binds to mRNA to inhibit translation

B. Small RNA strand that binds to DNA to inhibit transcription

C. Small RNA strand that removes introns from mRNA

D. Small RNA strand that removes exons from mRNA

AP BIO INSTA-REVIEW

TOPIC 6.6

What is siRNA?

A. Small RNA strand that binds to mRNA to inhibit translation

siRNA is a small interfering RNA. This single stranded RNA will bind to mRNA to inhibit translation or degrade the mRNA.

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutations

IST-2.E.1

Changes in genotype can result in changes in phenotype–

a. The function and amount of gene products determine the phenotype of organisms.

i. The normal function of the genes and gene products collectively comprises the normal function of organisms.

ii. Disruptions in genes and gene products cause new phenotypes.

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutations

IST-2.E.2

Alterations in a DNA sequence can lead to changes in the type or amount of the protein produced and the consequent phenotype. DNA mutations can be positive, negative, or neutral based on the effect or the lack of effect they have on the resulting nucleic acid or protein and the phenotypes that are conferred by the protein.

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutations

IST-4.A.1

Errors in DNA replication or DNA repair mechanisms, and external factors, including radiation and reactive chemicals, can cause random mutations in the DNA–

a. Whether a mutation is detrimental, beneficial, or neutral depends on the environmental context.

b. Mutations are the primary source of genetic variation.

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutations

IST-4.A.2

Errors in mitosis or meiosis can result in changes in phenotype–

a. Changes in chromosome number often result in new phenotypes, including sterility caused by triploidy, and increased vigor of other polyploids.

b. Changes in chromosome number often result in human disorders with developmental limitations, including Down syndrome/ Trisomy and Turner syndrome.

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutations

IST-4.B.1

Changes in genotype may affect phenotypes that are subject to natural selection. Genetic changes that enhance survival and reproduction can be selected for by environmental conditions–

a. The horizontal acquisitions of genetic information primarily in prokaryotes via transformation (uptake of naked DNA), transduction (viral transmission of genetic information), conjugation (cell-to-cell transfer of DNA), and transposition (movement of DNA segments within and between DNA molecules) increase variation.

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutations

IST-4.B.1

Changes in genotype may affect phenotypes that are subject to natural selection. Genetic changes that enhance survival and reproduction can be selected for by environmental conditions–

b. Related viruses can combine/recombine genetic information if they infect the same host cell.

c. Reproduction processes that increase genetic variation are evolutionarily conserved and are shared by various organisms.

AP BIO INSTA-REVIEW

TOPIC

6.7

What are mutations?

AP BIO INSTA-REVIEW

TOPIC 6.7

What are mutations?

Changes in the DNA sequence or the DNA quantity in a cell.

AP BIO INSTA-REVIEW

TOPIC 6.7

Which mutation results in a change in the amino acid?

A. Frameshift

B. Missense

C. Nonsense

D. Silent

AP BIO INSTA-REVIEW

TOPIC 6.7

Which mutation results in a change in the amino acid?

B. Missense

A missense mutation is a substitution point mutation. One nucleotide is substituted with another. This substitution causes ONE amino acid to be substituted for ANOTHER amino acid.

This is similar to a word being substituted in a sentence.

I took my dog for a walk.

I took my fish for a walk.

AP BIO INSTA-REVIEW

TOPIC 6.7

Which mutation results in no change in the amino acid?

A. Frameshift

B. Missense

C. Nonsense

D. Silent

AP BIO INSTA-REVIEW

TOPIC 6.7

Which mutation results in no change in the amino acid?

D. Silent

A silent mutation is a substitution point mutation. One nucleotide is substituted with another. This substitution causes ONE amino acid to be substituted for the SAME amino acid.

Since you have the same amino acid, it is not obvious that there has been a mutation so it is SILENT.

AP BIO INSTA-REVIEW

TOPIC

6.7

Which mutation results from +/- one nucleotide base?

A. Frameshift

B. Missense

C. Nonsense

D. Silent

AP BIO INSTA-REVIEW

TOPIC 6.7

Which mutation results from +/- one nucleotide base?

A. Frameshift

If ONE nucleotide has been inserted or deleted, this will shift the reading frame. Recall, the reading frame is the group of triplets read as codons. If there is a shift by 1 or 2, the ribosome will be pairing the wrong codons. This will cause a change to all amino acids downstream from the insertion or deletion.

AP BIO INSTA-REVIEW

TOPIC

6.7

Frameshift mutation in what area causes most damage?

A. Intron

B. Start of exon

C. Middle of exon

D. End of exon

AP BIO INSTA-REVIEW

TOPIC 6.7

Frameshift mutation in what area causes most damage?

B. Start of exon

If the frameshift mutation occurs at the start of the expressed exons, all of the codons downstream will be affected. This will cause the most damage of the options.

AP BIO INSTA-REVIEW

TOPIC

6.7

How does a heterozygote and homozygous dominant produce same phenotype?

AP BIO INSTA-REVIEW

TOPIC 6.7

How does a heterozygote and homozygous dominant produce same phenotype?

The single dominant allele produces enough enzyme/protein products to produce the desired phenotypic result.

AP BIO INSTA-REVIEW

TOPIC

6.7

What is the primary source of genetic variation?

A. Crossing over

B. Independent assortment

C. Mutations

D. Random fertilization

AP BIO INSTA-REVIEW

TOPIC 6.7

What is the primary source of genetic variation?

C. Mutations

Mutations will add NEW variation to the population. This will increase genetic variation.

AP BIO INSTA-REVIEW

TOPIC

6.7

Which of the following is the cause of Trisomy 21?

A. Duplication

B. Frameshift mutation

C. Nondisjunction

D. Point mutation

AP BIO INSTA-REVIEW

TOPIC 6.7

Which of the following is the cause of Trisomy 21?

C. Nondisjunction

Individuals with Trisomy 21 has an additional chromosome 21. This results from nondisjunction. Nondisjunction results from homologous chromosomes or sister chromatids not separating during anaphase I or II.

AP BIO INSTA-REVIEW

TOPIC

6.7

What phase of meiosis is cause of nondisjunction? Describe nondisjunction.

AP BIO INSTA-REVIEW

TOPIC 6.7

What phase of meiosis is cause of nondisjunction? Describe nondisjunction.

Anaphase I or II

Nondisjunction involves the chromatids or homologous chromosomes not separating during anaphase. This results in a gamete with an additional chromosome or missing a chromosome.

AP BIO INSTA-REVIEW

TOPIC 6.7

Triploid organisms are sterile (unable to reproduce)

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.7

Triploid organisms are sterile (unable to reproduce)

A. True

Triploid organisms lack homologous chromosomes. They have THREE of each chromosome thus cannot pair during prophase I, line up during metaphase I, nor segregate evenly during anaphase I.

AP BIO INSTA-REVIEW

TOPIC

6.7

Why are triploid organisms sterile?

AP BIO INSTA-REVIEW

TOPIC 6.7

Why are triploid organisms sterile?

Unable for homologous chromosomes to pair up during meiosis.

(Triploid is three sets, how can you get paired off with three)

AP BIO INSTA-REVIEW

TOPIC 6.7

Which enzyme has proofreading capabilities?

A. DNA Polymerase

B. Helicase

C. Ligase

D. Topoisomerase

AP BIO INSTA-REVIEW

TOPIC 6.7

Which enzyme has proofreading capabilities?

A. DNA Polymerase

DNA polymerase is the enzyme responsible for DNA replication. A $3' \rightarrow 5'$ proofreading exonuclease domain is intrinsic to most DNA polymerases. It allows the enzyme to check each nucleotide during DNA synthesis and excise mismatched nucleotides in the $3'$ to $5'$ direction.

AP BIO INSTA-REVIEW

TOPIC

6.7

Which is responsible for halting DNA replication because of error?

A. DNA Polymerase

B. Helicase

C. p53

D. Ras

AP BIO INSTA-REVIEW

TOPIC 6.7

Which is responsible for halting DNA replication because of error?

C. p53

p53 is a tumor suppressor gene/protein. p53 is a transcription factor that activates many genes involved in essential maintenance of genetic stability. This gene will inhibit the cell cycle in the presence of DNA damage.

AP BIO INSTA-REVIEW

TOPIC 6.7

In disease with too many copies of genes (Huntington's)...

A. Deletion

B. Duplication

C. Inversion

D. Translocation

AP BIO INSTA-REVIEW

TOPIC 6.7

In disease with too many copies of genes (Huntington's)...

B. Duplication

Duplication results when a gene is duplicated resulting in multiple copies of the gene.

Huntington's Disease is an autosomal dominant trait that results from duplication.

AP BIO INSTA-REVIEW

TOPIC 6.7

Involved in cri-du-chat where chromosome is shorter

A. Deletion

B. Duplication

C. Inversion

D. Translocation

AP BIO INSTA-REVIEW

TOPIC 6.7

Involved in cri-du-chat where chromosome is shorter

A. Deletion

Deletion results in a region of the chromosome being removed.

Cri-du-chat ("cry of the cat") is a genetic disorder resulting from a piece of chromosome 5 is missing.

AP BIO INSTA-REVIEW

TOPIC 6.7

Involved in down syndrome without nondisjunction

A. Deletion

B. Duplication

C. Inversion

D. Translocation

AP BIO INSTA-REVIEW

TOPIC 6.7

Involved in down syndrome without nondisjunction

D. Translocation

Translocation results from chromosome segments changing positions.

This sometimes takes place in Down Syndrome and Patau syndrome resulting an additional chromosome in the offspring.

AP BIO INSTA-REVIEW

TOPIC

6.7

What is horizontal transmission of traits?

AP BIO INSTA-REVIEW

TOPIC 6.7

What is horizontal transmission of traits?

Transmission of traits NOT from parent-progeny

AP BIO INSTA-REVIEW

TOPIC 6.7

Cell-to-cell transmission?

A. Conjugation

B. Transduction

C. Transformation

D. Transposition

AP BIO INSTA-REVIEW

TOPIC 6.7

Cell-to-cell transmission?

A. Conjugation

Prokaryotes are able to undergo cell-to-cell transmission by passing genetic information through sex pili in a process called conjugation.

AP BIO INSTA-REVIEW

TOPIC 6.7

Movement of DNA between or within segments?

A. Conjugation

B. Transduction

C. Transformation

D. Transposition

AP BIO INSTA-REVIEW

TOPIC 6.7

Movement of DNA between or within segments

D. Transposition

Transposition involves the DNA moving to a new location so it transfers position when it undergoes transposition.

AP BIO INSTA-REVIEW

TOPIC

6.7

Viral transmission of traits

A. Conjugation

B. Transduction

C. Transformation

D. Transposition

AP BIO INSTA-REVIEW

TOPIC 6.7

Viral transmission of traits

B. Transduction

As seen during the Hershey and Chase experiment, bacteriophages traditionally will transduce their genetic information into the host nucleus.

AP BIO INSTA-REVIEW

TOPIC 6.7

Uptake naked DNA

A. Conjugation

B. Transduction

C. Transformation

D. Transposition

AP BIO INSTA-REVIEW

TOPIC 6.7

Uptake naked DNA

C. Transformation

During the transformation experiment, bacteria will take up genetic information (plasmids) from the environment to become antibotic resistant bacteria/green glowing bacteria.

AP BIO INSTA-REVIEW

TOPIC

6.7

What type of virus is able to insert its genome into host genome?

AP BIO INSTA-REVIEW

TOPIC 6.7

What type of virus is able to insert its genome into host genome?

Retrovirus

Viruses like HIV have an RNA genome. They can use reverse transcriptase to make a complement DNA strand then inserts in genome to become a pro virus.

AP BIO INSTA-REVIEW

TOPIC

6.7

What is the genotype?

A. Genes in a genetic library for transformation

B. Physical characteristics due to gene expression

C. Specific genes an organism has (ex: heterozygous)

D. The type of genetic material the organism has

AP BIO INSTA-REVIEW

TOPIC 6.7

What is the genotype?

C. Specific genes an organism has (ex: heterozygous)

Genotype is the genetic information within the DNA. This is traditionally discussed as homozygous dominant, heterozygous, or homozygous recessive.

For example, Pp.

AP BIO INSTA-REVIEW

TOPIC

6.7

What is the phenotype?

A. Genes in an organism causing physical traits

B. Good genes that increase reproductive fitness

C. Physical characteristics of an organism

D. Showing types of genes (ex. homozygous dominant)

AP BIO INSTA-REVIEW

TOPIC 6.7

What is the phenotype?

C. Physical characteristics of an organism

Phenotype is the physical characteristics that result from the genotype.

For example, purple flowers.

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutation resulting in a different amino acid

A. Chromosomal

B. Missense

C. Nonsense

D. Silent

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutation resulting in a different amino acid

B. Missense

Missense mutation results in a DIFFERENT amino acid. This is due to a single nucleotide substitution.

Example: Sickle Cell, Cystic Fibrosis

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutation resulting in the same amino acid

A. Chromosomal

B. Missense

C. Nonsense

D. Silent

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutation resulting in the same amino acid

D. Silent

Silent mutations have no observable difference in the amino acid sequence. The codon before and after will code for the same amino acid.

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutation resulting in a stop codon (premature stop)

A. Chromosomal

B. Missense

C. Nonsense

D. Silent

AP BIO INSTA-REVIEW

TOPIC 6.7

Mutation resulting in a stop codon (premature stop)

C. Nonsense

A nonsense mutation results in a stop codon for a substitution of codon that codes for an amino acid which leads to a shorter protein product.

AP BIO INSTA-REVIEW

TOPIC

6.7

If a nucleotide base pair was deleted in an intron, what would be the result?

A. Frameshift mutation

B. Longer protein product

C. No change in synthesized protein

D. Shorter protein product

AP BIO INSTA-REVIEW

TOPIC 6.7

If a nucleotide base pair was deleted in an intron, what would be the result?

C. No change in synthesized protein

Recall, the introns are removed during post-transcriptional modification. If a mutation takes place in the intron, then it will not be observed as the introns are removed.

AP BIO INSTA-REVIEW

TOPIC

6.7

What happens if a nucleotide base pair inserted into an exon?

A. Frameshift mutation

B. Longer protein product

C. No change in synthesized protein

D. Shorter protein product

AP BIO INSTA-REVIEW

TOPIC 6.7

What happens if a nucleotide base pair inserted into an exon?

A. Frameshift mutation

If a single nucleotide base pair is inserted, this will shift the reading frame resulting in a frameshift mutation.

AP BIO INSTA-REVIEW

TOPIC

6.7

What is the result of a mutation?

A. Gain new trait

B. Loss of trait

C. No change in trait

D. All of the above

AP BIO INSTA-REVIEW

TOPIC 6.7

What is the result of a mutation?

D. All of the above (Gain, Loss, or No change in trait)

The mutation could cause a different ligand to bind which could result in a new function.

The mutation could inhibit binding of a ligand which could result in the absence of a function.

The mutation could have no effect on the binding site or on the folding of the protein resulting in no change in function.

AP BIO INSTA-REVIEW

TOPIC

6.7

Which results in new genetic variability?

A. Crossing over

B. Independent assortment

C. Mutations

D. Random fertilization

AP BIO INSTA-REVIEW

TOPIC 6.7

Which results in new genetic variability?

C. Mutations

Mutations results in new traits. If there are more traits available, the genetic variability has increased.

AP BIO INSTA-REVIEW

TOPIC

6.7

What does it mean to be triploid?

A. Three units of chromosomes

B. Three sets of a chromosome

C. Three sets of organisms born

D. Three sets of population

AP BIO INSTA-REVIEW

TOPIC 6.7

What does it mean to be triploid?

A. Three units of chromosomes

The prefix of "tri" means THREE.

The suffix of "ploid" means having CHROMOSOME SETS

Triploid has THREE SETS of CHROMOSOMES

AP BIO INSTA-REVIEW

TOPIC

6.7

Why are triploid organisms sterile?

AP BIO INSTA-REVIEW

TOPIC 6.7

Why are triploid organisms sterile?

They are unable to pair up the homologous chromosomes during meiosis to synthesize the gametes

AP BIO INSTA-REVIEW

TOPIC

6.7

Natural selection acts on genotype.

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.7

Natural selection acts on genotype.

B. False

Natural selection cannot act on what it cannot observe. Natural selection acts on phenotype, but it does affect the genotype resulting is an increase in allele frequency.

AP BIO INSTA-REVIEW

TOPIC

6.7

Natural selection affects genotype.

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 6.7

Natural selection affects genotype.

A. True

Natural selection will select individuals with favorable traits that align with the environment. As these traits are selected, the allele frequency will change which affects the genotype of the organisms.

AP BIO INSTA-REVIEW

TOPIC

6.7

Taking up DNA from the environment

A. Conjugation

B. Transduction

C. Transformation

D. Transposition

AP BIO INSTA-REVIEW

TOPIC 6.7

Taking up DNA from the environment

C. Transformation

Transformation was observed in the Griffith experiment. The living R cells are transformed into living S cells as they took up DNA from the heat-killed S cells.

AP BIO INSTA-REVIEW

TOPIC

6.7

Insertion of DNA by bacteriophage

A. Conjugation

B. Transduction

C. Transformation

D. Transposition

AP BIO INSTA-REVIEW

TOPIC 6.7

Insertion of DNA by bacteriophage

B. Transduction

Transduction is the process of a bacteriophage injecting the generic infomation which transduces the host cell.

AP BIO INSTA-REVIEW

TOPIC

6.7

DNA moves to new position in genome

A. Conjugation

B. Transduction

C. Transformation

D. Transposition

AP BIO INSTA-REVIEW

TOPIC 6.7

DNA moves to new position in genome

D. Transposition

Genetic information is able to be transferred to another position through transposition.

AP BIO INSTA-REVIEW

TOPIC

6.7

Genetic exchange between bacteria

A. Conjugation

B. Transduction

C. Transformation

D. Transposition

AP BIO INSTA-REVIEW

TOPIC 6.7

Genetic exchange between bacteria

A. Conjugation

Conjugation is the attachement of two prokaryotes then transferring genetic infomration between the two which increases the genetic variability.

AP BIO INSTA-REVIEW

TOPIC 6.8

Biotechnology

IST-1.P.1

Genetic engineering techniques can be used to analyze and manipulate DNA and RNA–

a. Electrophoresis separates molecules according to size and charge.
b. During polymerase chain reaction (PCR), DNA fragments are amplified.
c. Bacterial transformation introduces DNA into bacterial cells.
d. DNA sequencing determines the order of nucleotides in a DNA molecule

AP BIO INSTA-REVIEW

TOPIC

6.8

Which DNA tech separates fragments by size/charge?

A. Gel electrophoresis

B. PCR

C. Sequencing

D. Transformation

AP BIO INSTA-REVIEW

TOPIC 6.8

Which DNA tech separates fragments by size/charge?

A. Gel electrophoresis

Gel electrophoresis involves using an electrical current to draw DNA, RNA, or protein through a gel. The gel has pores which allows the small fragments to travel farther.

AP BIO INSTA-REVIEW

TOPIC

6.8

Why does the DNA move towards positive end?

A. Deoxyribose is negatively charged

B. Deoxyribose is positively charged

C. Phosphate is negatively charged

D. Phosphate is positively charged

AP BIO INSTA-REVIEW

TOPIC 6.8

Why does the DNA move towards positive end?

C. Phosphate is negatively charged

Recall, DNA is made up of a nitrogenous base, deoxyribose, and a phosphate group.

The phosphate group is negatively charged with PO_4^{2-} so it will be attracted to the positive end.

AP BIO INSTA-REVIEW

TOPIC

6.8

Which fragments travel farther?

A. Small

B. Large

AP BIO INSTA-REVIEW

TOPIC 6.8

Which fragments travel farther?

A. Small

Smaller fragments are able to pass through the pores quicker.

Another teacher describes it visually as comparing an adult to a kid in the ballpit of the playground. The child will be able to get out of the ballpit easier than the adult.

AP BIO INSTA-REVIEW

TOPIC 6.8

What cuts the DNA prior to running gel electrophoresis?

A. DNA polymerase

B. Helicase

C. Ligase

D. Restriction enzyme

AP BIO INSTA-REVIEW

TOPIC 6.8

What cuts the DNA prior to running gel electrophoresis?

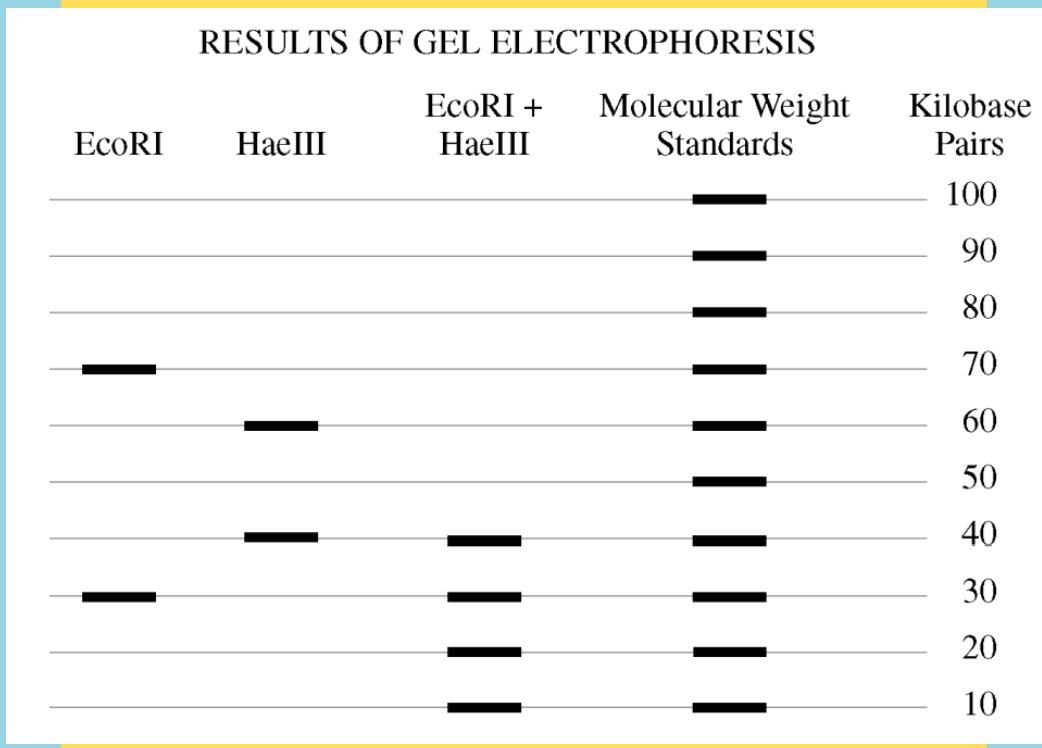
D. Restriction enzyme

Restriction enzymes will cut the DNA at specific restriction sites. This will form fragments that are run on a gel electrtophoresis. When comparing two strands of DNA, researchers will use the same restriction enzymes.

AP BIO INSTA-REVIEW

TOPIC

6.8



Minimum restriction sites for ECO on plasmid to get this?

A. 1

B. 2

C. 3

D. 4

AP BIO INSTA-REVIEW

TOPIC

6.8

Minimum restriction sites for ECO on plasmid to get this?

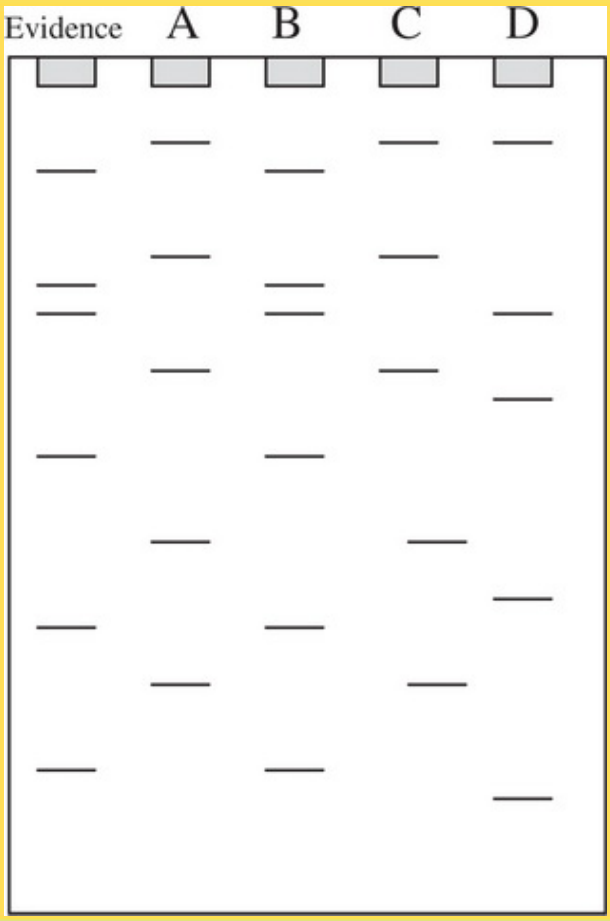
B. 2

Plasmids are circular DNA. If you look at the gel electrophoresis, you would observe that ECO has 2 fragments which means it was cut 2 times. If it was cut 2 times, there must be 2 restriction enzymes

AP BIO INSTA-REVIEW

TOPIC

6.8



Which suspect was at crime scene?

A. A

B. B

C. C

D. D

AP BIO INSTA-REVIEW

TOPIC 6.8

Which suspect was at crime scene?

B. B

When comparing the banding pattern between the crime scene and the suspects, it is observable that section B has the same bands as the restaurant.

AP BIO INSTA-REVIEW

TOPIC

6.8

Which DNA tech is responsible for multiple copies of a gene?

A. Gel electrophoresis

B. PCR

C. Sequencing

D. Transformation

AP BIO INSTA-REVIEW

TOPIC
6.8

Which DNA tech is responsible for multiple copies of a gene?

B. PCR

PCR stands for polymerase chain reaction. This procedure will create multiple copies of a certain DNA to compare and run testing on.

AP BIO INSTA-REVIEW

TOPIC

6.8

What does PCR stand for?

AP BIO INSTA-REVIEW

TOPIC 6.8

What does PCR stand for?

Polymerase Chain Reaction

AP BIO INSTA-REVIEW

TOPIC

6.8

PCR uses a specific type of polymerase, why and where does it come from?

AP BIO INSTA-REVIEW

TOPIC 6.8

PCR uses a specific type of polymerase, why and where does it come from?

PCR involves a heating up then cooling cycle. Proteins (polymerase) denature in high temperatures so heat resistant polymerase from thermophile prokaryotes is needed to allow the enzymes to remain functional after heating phase.

AP BIO INSTA-REVIEW

TOPIC

6.8

What is the function of the heating process in PCR?

AP BIO INSTA-REVIEW

TOPIC 6.8

What is the function of the heating process in PCR?

> Break the hydrogen bonds between the two strands

> Allows the strands to be single stranded to allow for the replication to take place in future steps

AP BIO INSTA-REVIEW

TOPIC

6.8

Which DNA tech involves adding plasmid to prokaryote?

A. Gel electrophoresis

B. PCR

C. Sequencing

D. Transformation

AP BIO INSTA-REVIEW

TOPIC 6.8

Which DNA tech involves adding plasmid to prokaryote?

D. Transformation

Transformation is a process by which foreign DNA is introduced into a cell. During this lab, we added a plasmid to a solution with E. coli then heat shocked to introduce the plasmid into the bacteria. It is then transformed into an antibotic resistant bacteria.

AP BIO INSTA-REVIEW

TOPIC

6.8

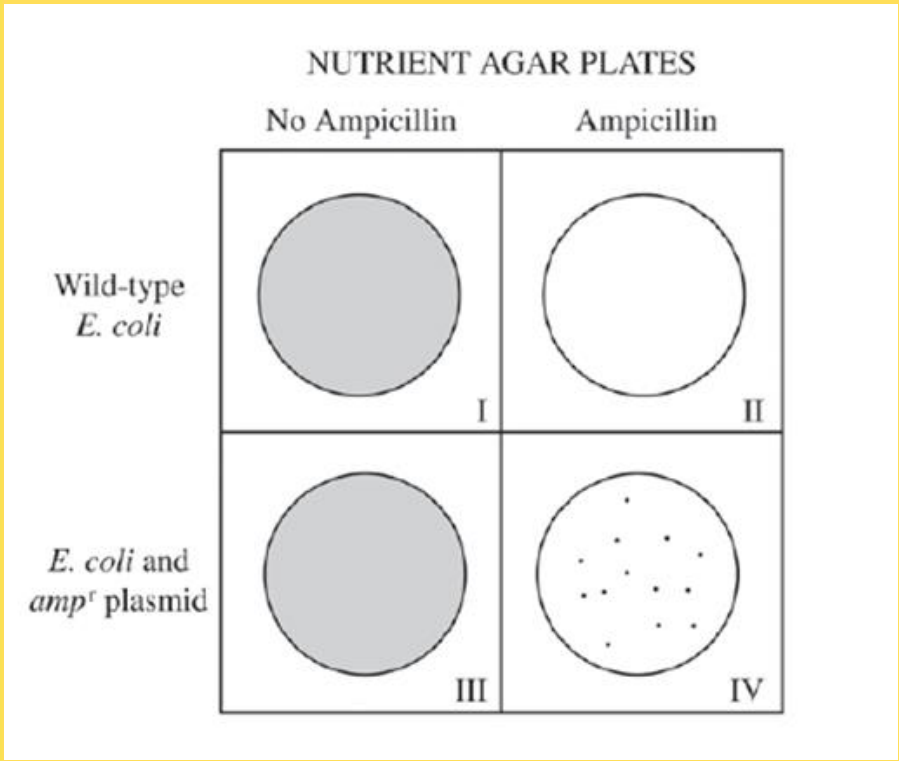


Plate has non transformed bacteria & no antibiotics

A. I

B. II

C. III

D. IV

AP BIO INSTA-REVIEW

TOPIC 6.8

Plate has non transformed bacteria & no antibiotics

A. I

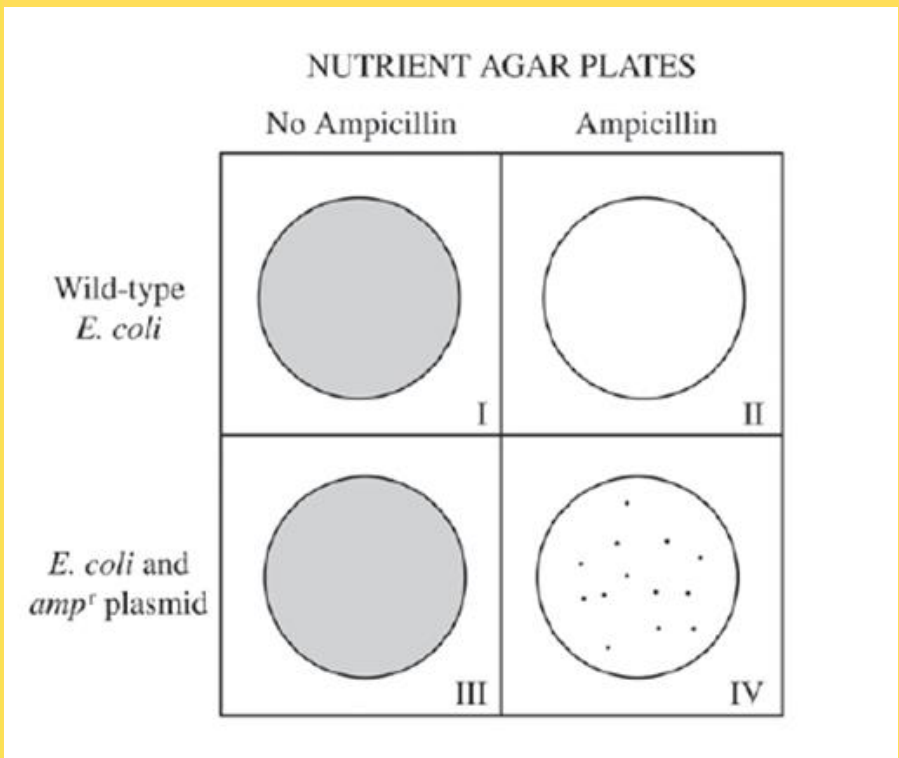
Plate I has the wild-type E. coli (non-transformed bacteria) and no ampicillin (no antibotics)

It has a lawn of growth because there is no antibotic to inhibit the bacterial growth.

AP BIO INSTA-REVIEW

TOPIC

6.8



Why is there no growth on plate II?

AP BIO INSTA-REVIEW

TOPIC 6.8

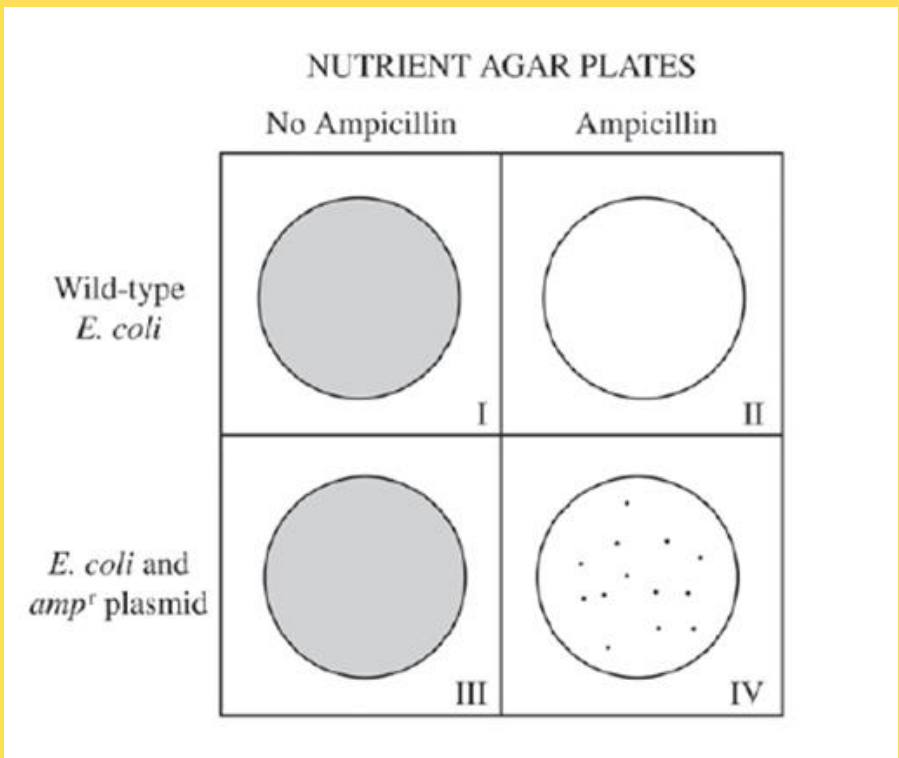
Why is there no growth on plate II?

Bacteria is not transformed and there is antibiotic in the agar which restricts growth.

AP BIO INSTA-REVIEW

TOPIC

6.8



What is function of plates I and III?

AP BIO INSTA-REVIEW

TOPIC 6.8

What is function of plates I and III?

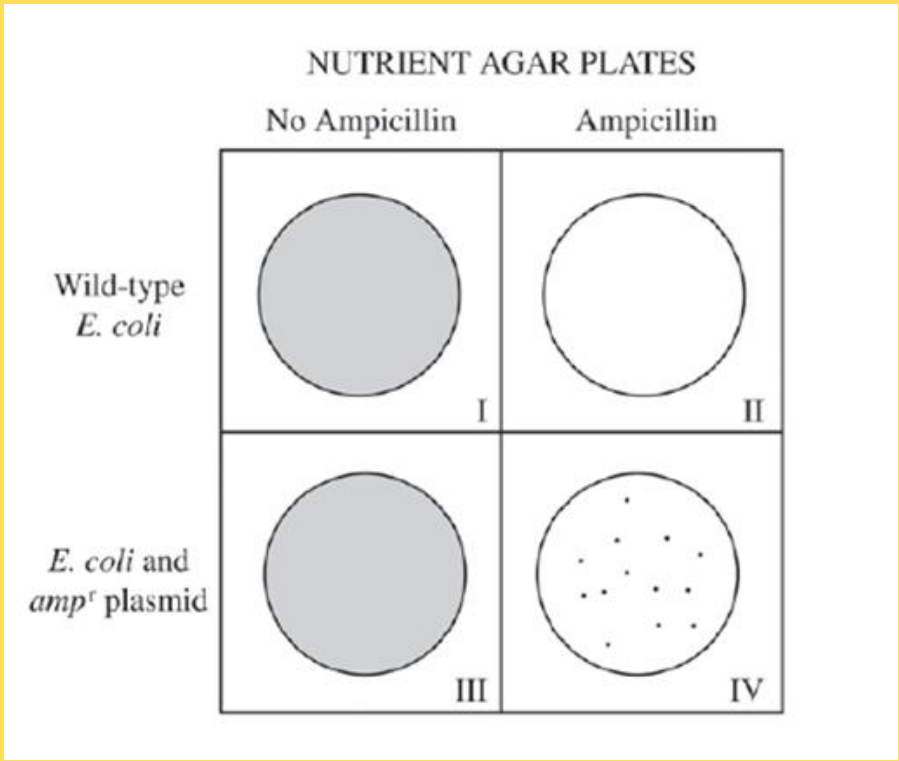
Control:

Positive control- you are verifying that the bacteria is viable. You need to be sure that the bacteria would grow in the absence of the antibiotic to know that the antibiotic killed non-resistant bacteria (explains plates II and IV)

AP BIO INSTA-REVIEW

TOPIC

6.8



If plasmid also had the gene to synthesize insulin...

Which plate has the highest % of insulin producing bacteria?

A. I

B. II

C. III

D. IV

AP BIO INSTA-REVIEW

TOPIC 6.8

If plasmid also had the gene to synthesize insulin...
Which plate has the highest % of insulin producing bacteria?
D. IV

Plate IV has E. coli/*amp* plasmid and ampicillin. The ampicillin will restrict the growth of the non-transformed bacteria. The only bacteria that will grow on this plate is the bacteria with the plasmid containing the gene to synthesize insulin, so 100% of the bacteria are insulin producing bacteria.

AP BIO INSTA-REVIEW

TOPIC

6.8

DNA is ___ because of the ____.

A. Negatively charged; hydroxyl group

B. Negatively charged; phosphate group

C. Positively charged; hydroxyl group

D. Positively charged; phosphate group

AP BIO INSTA-REVIEW

TOPIC 6.8

DNA is ___ because of the ____.

B. Negatively charged; phosphate group

DNA is negatively charged because of the phosphate group. Phosphate is PO_4^{2-} and DNA has an alternating sugar and phosphate backbone.

AP BIO INSTA-REVIEW

TOPIC 6.8

Gel electrophoresis separates molecules based on

A. Charge and Polarity

B. Polarity and Weight

C. Weight and Size

D. Size and Charge

AP BIO INSTA-REVIEW

TOPIC 6.8

Gel electrophoresis separates molecules based on

D. Size and Charge

Gel electrophoresis involves a gel with pores that allow for materials to be separated by size. Electrophoresis involves using an electrical current so the charge of the material will allow for movement through the gel.

AP BIO INSTA-REVIEW

TOPIC

6.8

In a gel electrophoresis...

A. More numerous sizes are near the wells

B. Less numerous sizes are near the wells

C. Larger molecules are near the wells

D. Shorter molecules are near the wells

AP BIO INSTA-REVIEW

TOPIC 6.8

In a gel electrophoresis...

C. Larger molecules are near the wells

The large molecules will be unable to pass through the pores as quickly and will be located near the wells (where the DNA was added to the gel). Smaller molecules will travel faster and thus farther.

AP BIO INSTA-REVIEW

TOPIC 6.8

What does a thicker band represent in a gel?

A. There's more DNA material present in that band

B. There's more glucose available in that band

C. There's more mutation in the DNA fragment present

D. There's more radioactive material present in that band

AP BIO INSTA-REVIEW

TOPIC 6.8

What does a thicker band represent in a gel?

A. There's more DNA material present in that band

The DNA that is the same length will travel the same distance. If multiple fragments travel the same distance, it will cause the band in the gel to be thicker.

AP BIO INSTA-REVIEW

TOPIC

6.8

What is used to cut the DNA into fragments for the gel?

A. Ligase from eukaryotes

B. Ligase from prokaryotes

C. Restriction enzymes from eukaryotes

D. Restriction enzymes from prokaryotes

AP BIO INSTA-REVIEW

TOPIC 6.8

What is used to cut the DNA into fragments for the gel?

D. Restriction enzymes from prokaryotes

Restriction enzymes will cut the DNA at restriction sites. The prokaryotes use restriction enzymes to cleave foreign DNA.

AP BIO INSTA-REVIEW

TOPIC

6.8

What does PCR stand for?

A. Place for cellular respiration

B. Primase cytosine reactants

C. Polymerase chain reaction

D. Preferred chemical reaction

AP BIO INSTA-REVIEW

TOPIC 6.8

What does PCR stand for?

C. Polymerase chain reaction

PCR stands for Polymerase Chain Reaction. This is a process that will amplify a segment of DNA using a thermocycler, DNA polymerase, a primer and DNA nucleotides.

AP BIO INSTA-REVIEW

TOPIC

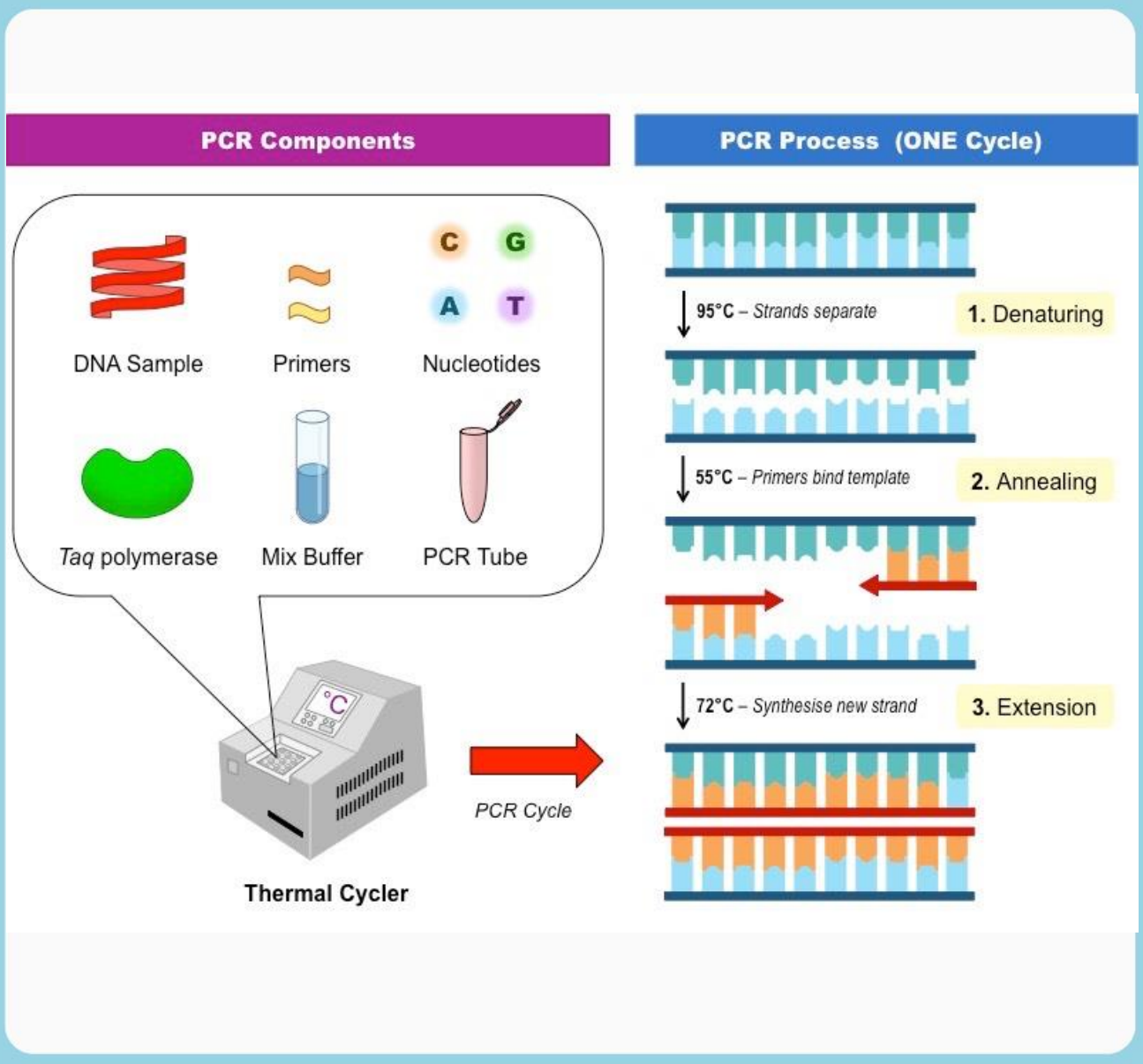
6.8

What are the steps involved in PCR?

AP BIO INSTA-REVIEW

TOPIC 6.8

What are the steps involved in PCR?



AP BIO INSTA-REVIEW

TOPIC

6.8

Where does the heat resistant polymerase come from?

A. Fire-resistant plants

B. Monkeys

C. Nucleus

D. Thermophiles

AP BIO INSTA-REVIEW

TOPIC 6.8

Where does the heat resistant polymerase come from?

D. Thermophiles

DNA polymerase is an enzyme (and a protein). Recall, heat will denature proteins. The process of PCR has repeated heating and cooling which would denature the enzyme. The thermophiles are bacteria that thrive at extremely high temperatures.

AP BIO INSTA-REVIEW

TOPIC

6.8

Plasmid makes bacteria resistant to ampicillin and able to synthesize the green glow protein. Which plate will have highest percent of growth?

A. Plate with nutrients and no ampicillin present

B. Plate with ampicillin and nutrient present

AP BIO INSTA-REVIEW

TOPIC 6.8

Plasmid makes bacteria resistant to ampicillin and able to synthesize the green glow protein. Which plate will have highest percent of growth?

A. Plate with nutrients and no ampicillin present

Not all bacteria will be transformed, so the plate with nutrient only would have a lawn of growth while the plate with ampicillin would have colonies. Read the question carefully, it said highest percent of growth.

AP BIO INSTA-REVIEW

TOPIC

6.8

Plasmid makes bacteria resistant to ampicillin and able to synthesize the green glow protein. Which plate will have higher amount of glowing bacteria?

A. Plate with nutrients and no ampicillin present

B. Plate with ampicillin and nutrient present

AP BIO INSTA-REVIEW

TOPIC 6.8

Plasmid makes bacteria resistant to ampicillin and able to synthesize the green glow protein. Which plate will have higher amount of glowing bacteria?

B. Plate with ampicillin and nutrient present

The plate with the ampicillin will restrict the growth to the transformed bacteria only. All of the bacteria on this plate will be transformed, thus will glow.

AP BIO INSTA-REVIEW

TOPIC

6.8

What happens during DNA sequencing?

AP BIO INSTA-REVIEW

TOPIC 6.8

What happens during DNA sequencing?