"Molecular Genetics"

Class MG 3

Warm-up

What Will the Future Hold

How do we sequence the human genome?

Warm-up

Complete WS QC 94

Review

1. The DNA helicase enzyme unwinds the double helix. Single-stranded binding proteins keep the strand separated, and as the helix unwinds, RNA primase adds an RNA primer on each DNA strand.
2. Okazaki fragments are small, discontinuous segments of DNA made by DNA polymerase on the lagging strand of DNA that is being replicated.

Warm-up

3. When the DNA polymerase comes to the next RNA primer, it removes the primer and fills in the place with a DNA nucleotide. DNA ligase links the end DNA nucleotides together.
4. Student answers will vary. Eukaryotic DNA is longer than prokaryotic DNA, and replicating in multiple areas allows the DNA to be replicated more quickly.

http://www.hhmi.org/biointeractive/intracellular-infection-salmonella

http://www.muschealth.com/video/Default.aspx?videoId=10125&cId=15&type=rel

Food Poisoning

What Exactly is Food Poisoning??

http://www.fsis.usda.gov/Oa/foodsafetymobile/mobilegame.swf

Endotoxins

http://www.teachingtreasures.com.au/Danger%20zone/food-poison-activity.htm

http://www.nlm.nih.gov/medlineplus/foodborneillness.html

http://study.com/academy/lesson/food-poisoning-from-staphylococcus-aureus-bacteria.html

http://www.youtube.com/watch?v=EKLAZfCSf3g

http://enviromysteries.thinkport.org/insidestories/home.html?load=frankie1

The good bad an deadly

http://www.ncbi.nlm.nih.gov/pubmed/12887855

Amanita Poisioning

Looking for deadly mushroom

http://www.youtube.com/watch?v=6m4QQ_n6bq0

DNA, Rna, and protein Objectives

- Explain how messenger RNA, ribosomal RNA, and transfer RNA are involved in the transcription and translation of genes.
- Summarize the role of RNA polymerase in the synthesis of messenger RNA.
- Describe how the code of DNA is translated into messenger RNA and utilized to synthesis a particular protein.

Dna,Rna, and protein

MAIN IDEA

DNA codes for RNA, which guides protein synthesis.

http://www.youtube.com/watch?v=NJxobgkPEAo

Central Dogma

Proteins function as structural building blocks for the cells and as enzymes.

The basic mechanism of reading and expressing genes is from DNA to RNA to protein.

This chain of events occurs in all living things.

This mechanism is referred to as the central dogma of biology:

DNA codes for RNA, which guides the synthesis of proteins.

RNA

RNA is a nucleic acid that is similar to DNA.

RNA contains the sugar ribose, the base uracil replaces thymine, and usually is single stranded.

There are three major types of RNA found in living cells.

RNA

1. **Messenger RNA (mRNA)** – long strands of RNA nucleotides that are formed complementary to one strand of DNA.

   They travel from the nucleus to the ribosome to direct the synthesis of a specific protein.
2. **Ribosomal RNA (rRNA)** – associates with proteins to form ribosomes in the cytoplasm.
3. **Transfer RNA (tRNA)** – are smaller segments of RNA nucleotides that transport amino acids to the ribosome.

Transcription

Transcription is the synthesis of mRNA from DNA.

Through transcription, the DNA code is transferred to mRNA in the nucleus.

The mRNA then can take the code into the cytoplasm for protein synthesis.

DNA is unzipped in the nucleus and RNA polymerase binds to a specific section where an mRNA will be synthesized.

Transcription

The RNA polymerase moves along one of the DNA strands in a 3'to 5' direction.

Template strand - the strand of DNA that is read

- The mRNA is synthesized as a complement to the DNA nucleotides.

Non-template - The DNA strand not used

Transcription

The mRNA transcript is manufactured in a 5'to 3' direction, adding each new RNA nucleotide to the 3' end.

Uracil is incorporated instead of thymine as the mRNA is made.

Eventually, the mRNA is released, the RNA polymerase detaches from the DNA, and the new mRNA moves out of the nucleus through the nuclear pores into the cytoplasm.

THE CODE

The only way DNA varies among organisms is in the sequence of the bases.

There are **20 amino acids** that are used to make proteins.

The DNA code is a three-base code called a codon.

Each of the three bases of a codon in the DNA is transcribed into the mRNA code.

THE CODE

All but three codons are specific for an amino acid, those are stop codons.

Codon AUG codes for the amino acid methionine and also functions as a start codon.

Translation

Once the mRNA is synthesized and processed, it moves to the ribosome.

Once in the cytoplasm, the 5’ end of the mRNA connects to the ribosome.

This is where the code is read and translated to make a protein through a process called translation.

In translation, tRNA acts as the interpreter of the mRNA codon sequence.

Translation

The tRNA is folded into a cloverleaf shape and is activated by an enzyme that attaches a specific amino acid to the 3’ end.

At the middle of the folded strand, there is a three-base coding sequence called the anticodon.

Each anticodon is complementary to a codon on the mRNA.

The role of the ribosome

The ribosome consists of two subunits, which are not associated when they are not involved in protein translation.

1. When the mRNA leaves the nucleus, the two parts of the ribosome come together and attach the mRNA to complete the ribosome.
2. A tRNA carrying a methionine will bind to the mRNA start codon, AUG, on the 5' end of the mRNA.

   The ribosome structure has a groove, called the P site, where the tRNA that is complementary to the mRNA moves in.

The Role of the Ribosome

3. A second tRNA moves into a second groove in the ribosome called the A site and corresponds to the next codon of the mRNA.

   Part of the rRNA in the ribosome acts as an enzyme catalyzing the formation of a bond between the new amino acid in the A site and the amino acid in the P site.

4. As the two amino acids join, the tRNA in the P site is released to the third site called the E site, where it exits the ribosome.

The Role of the Ribosome

This process will continue adding and linking amino acids in the sequence determined by the mRNA.

The ribosome continues to move along until the A site contains a stop codon.

The stop codon signals the end of protein synthesis and does not complement any tRNA.

Proteins called release factors cause the mRNA to be released from the last tRNA and the ribosome subunits to disassemble, ending protein synthesis.

Comparison of the three types of RNA

http://glencoe.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::550::400::/sites/dl/free/0078695104/383936/table12_2.swf::Comparison of Three Types of RNA

Visualizing Transcription & Translation

http://glencoe.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::550::400::/sites/dl/free/0078695104/383936/Vis_transcription_translation.swf::Visualizing Transcription and Translation

Modeling Transcription & Translation

http://www.hippocampus.org/Biology;jsessionid=1344FD047D45201EE245771496D1470C

Self-Check Quiz

http://glencoe.mcgraw-hill.com/sites/0078695104/student_view0/unit3/chapter12/section2/self-check_quizzes-english.html

http://glencoe.mcgraw-hill.com/sites/0078695104/student_view0/unit3/chapter12/section3/self-check_quizzes-english.html

DNA Workshop Activity

http://www.pbs.org/wgbh/aso/tryit/dna/shockwave.html

Class Work

Complete QC 95

Review

1. DNA codes for RNA, which guides the synthesis of proteins.
2. Transcription is the synthesis of mRNA from DNA. Translation is the synthesis of a protein from mRNA.
3. The introns are removed, a protective cap is added to the 5’ end, and a poly-A tail is added to the 3’ end.

Class Work

4. The DNA unzipped, and RNA polymerase binds to the template strand of the DNA and moves in the 3’ to 5’ direction. The mRNA transcript is manufactured in the 5’ to 3’ direction, and uracil is incorporated instead of thymine.
5. The sequence would be serine, leucine, alanine, isoleucine, serine.

Steroid effects

http://steroideffects.wordpress.com/2008/09/15/steroid-effects/

HW

Complete WS “Protein Synthesis” 37.