Notes: (Our Friend) DNA

Questions

Some DNA Basics…

• DNA stands for _____

• DNA functions to _____ & _____ genetic info.

• This information tells an organism's cells what _____ to make and when to make them.

• Proteins form cell structures and control cell chemical processes

DNA Structure…

• DNA is composed of 2 chains of repeating _____.

• A nucleotide = _____ + _____ + _____

DNA Structure…

• Deoxyribose is a _____ molecule.

• Phosphate is a _____ atom surrounded by _____.

• The nitrogen containing base is a base with a _____ atom.

Nitrogen Containing Bases…

• In DNA, the nitrogen containing bases come in 4 varieties.

• _____ (_____)

• _____ (_____)

• _____ (_____)

• _____ (_____)

Purines vs. Pyrimidines

• Adenine and Guanine are _____ (2 carbon rings).

• Cytosine and Thymine are _____ (1 carbon ring).

The Double Helix…

• _____ and _____ are credited with the discovery of the _____ structure of DNA.

The DNA Molecule (Translating All That)

·1. The DNA "_____" consists of alternating _____ and _____ molecules.

·2. Nitrogen containing bases face _____ and are perpendicular to the backbone.

·3. By facing to the center, the bases from one _____ of DNA face bases on a second chain.

·4. The bases on one chain bond to the bases on the second chain by _____.

5. The overall DNA molecule (the one found in most living organisms) is twisted with each turn occurring after 10 _____.

Base Pairing Practice… **Questions**

A	___	T	___	A	___
T	___	T	___	C	___
C	___	C	___	C	___
C	___	C	___	T	___
C	___	C	___	G	___
C	___	C	___	G	___
C	___	A	___	T	___
G	___	T	___	A	___
A	___	G	___	G	___

Complementary Base Pairing…

· DNA bases pair in a standard manner. The 2 _____ are:

· _____ pairs with _____

· _____ pairs with _____

· The bases are connected by _____.

Complementary Base Pairing…(Chargaff's Rules)

· Cytosine and Guanine connect by _____ hydrogen bonds.

· Adenine and Thymine connect by _____ hydrogen bonds.

· The fact that the way bases pair together consistently suggests that DNA has the ability to copy itself. This process is called _____.

SUMMARY:

Notes: DNA Replication

Genetics Standard 5b: *Students know* how to apply base-pairing rules to explain precise copying of DNA during semi-conservative replication and transcription of information from DNA into mRNA.

Questions

Replication…

Replication is the process in a cell where DNA _____ itself. To accomplish this feat, DNA must unwind, split into two chains, and each chain serves as a template for two new strands of DNA. In Eukaryotic cells, replication occurs during the Synthesis (___) phase of _____ during the Cell Cycle.

Structure of the DNA Template…

*DNA chains are labeled with a _____ and a _____ end.
*DNA always copies in the _____ to _____ direction.
*The outside strands are the _____
*The side of new DNA that copies toward the **replication fork** is the _____.
*The side of new DNA that copies away from the **replication fork** is the _____.
*This strand is copied in segments called _____ fragments.

The Replication Process

Step 1.
The two nucleotide chains _____.
*The place where the chains separate is the _____.
*_____ are enzymes that break the _____ between the chains.

Step 2.
Molecules of _____ bind to one strand of the DNA and begin moving along it, using it as a template for assembling a **leading strand** of DNA.

Step 3.
A _____ stitches up the new chains of DNA.

Step 4.
_____ exact copies of the DNA have been created and the cell may now undergo division.

A Semi-Conservative Process…

DNA Replication is a semi-conservative process because half of each new DNA molecule is _____ and half is _____.

Accuracy and Repair… **Questions**

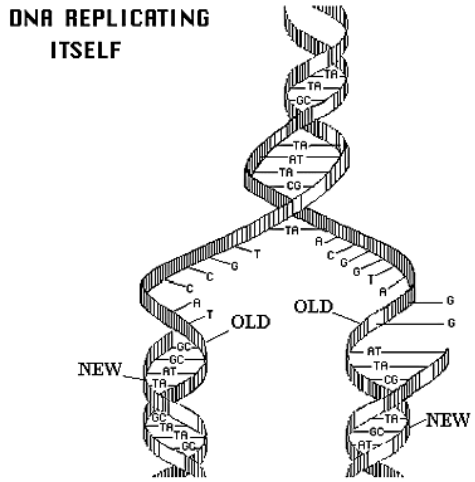
DNA replication is very accurate. In every _____ base pairs there may be one error.

A mismatched, skipped, or changed nucleotide can create problems called _____. There are several types of mutations, and these will be discussed at a later time. _____ _____

Other _____ exist to catch and correct base pairing mistakes. Generally speaking, polymerase's proofreading ability keeps errors down to about one in every _____ base pairs.

Despite proofreading capabilities following replication, mistakes (_____) still occur in base pairing. These mistakes are amplified by environmental factors.

DNA can be damaged by chemicals (called _____) and it can be damaged by the sun. For this reason, a cell is constantly proofreading its DNA, even when it is not replicating.



http://www.accessexcellence.org/AB/GG/dna_replicating.html

SUMMARY: .

Notes: RNA & Transcription

Questions

What is RNA?

•Nucleotides in an organism's DNA are grouped into genes that control the types of _____ an organism needs for survival.

•Proteins are not made in the cell nucleus, but that is where _____ is stored.

•Info stored in DNA must move out of the nucleus to the ribosomes for protein synthesis.

•_____ is the material that carries the instructions for making protein into the cell.

RNA Structure

•RNA is a nucleic acid made up of a sequence of _____.

•The sugar in RNA is _____.

•It's full name is Ribonucleic Acid.

•There is no Thymine in RNA. Instead, RNA contains _____, a pyrimidine.

Types of RNA

•There are ____ types of RNA.

–_____

–_____

–_____

–Wanna read some more? Check out:
http://www.biochem.uwo.ca/meds/medna/default.html

–FYI: Double stranded RNA exists too—one type, RNAi, is being used to possibly interfere with genes that cause problems like sight loss due to macular degeneration ☺

Messenger RNA

•A single uncoiled chain of RNA that carries DNA's message into the cell.

•Made from DNA during _____ (as are all 3 types of RNA)

Transfer RNA

•A single chain of 80 RNA nucleotides folded into a hairpin shape.

•tRNA carries _____ _____ to the ribosomes during protein synthesis.

•tRNA is also made by transcription

Ribosomal RNA

•Globular shaped collection of RNA nucleotides that makes up the _____.

•There's more of this RNA type than any other in a cell (a cell has A LOT of ribosomes)

•Made by transcription

How to Make RNA

•To access genetic information stored in DNA, it must be rewritten as RNA.
The process of rewriting DNA into RNA is called _____.

Questions

•Step 1: Initiation

—_____ binds to a template strand of DNA.

—RNA Polymerase binds to a region of a gene called a _____. In eukaryotes, the promoter signals the start of the single gene to be transcribed.

—The DNA splits where RNA Polymerase binds, and only one side of the DNA is used as a template.

•Step 2: Elongation

—RNA begins forming as RNA Polymerase adds complementary RNA _____ to the DNA template.

—Transcription follows the same base-paring rules except that _____ (____) on the DNA will bond with _____ (____) on the RNA.

•Step 3: Termination

—RNA continues to build until the RNA Polymerase reaches the _____ _____ (or termination signal) on the DNA.

—The termination signal is a series of DNA nucleotides signaling the end of a gene.

—Transcription stops here, the RNA is released from the DNA, and the DNA molecule closes up.

Products of Transcription

•The resulting molecule of RNA is called a _____.

•All three forms of RNA are created via transcription.

•The instructions for making protein are carried by _____, but all three RNA types play a role in protein synthesis.

Editing RNA

●RNA is not perfect the first time—parts of it have to be removed after it has been transcribed from DNA

●DNA contains "junk" sequences called introns.

●Intron sequences are cut out of the RNA, and only the exon portions are used to make proteins.

Tutorials

•Some other helpful sites…

•http://edtech.clas.pdx.edu/gene_expression_tutorial/transcription.html

•http://www-class.unl.edu/biochem/gp2/m_biology/animation/gene/gene_a2.html

SUMMARY:

Notes: Translation and Protein Synthesis

Questions

Some Review…

■RNA is **transcribed** from DNA

■The three types of RNA previously discussed (**mRNA**, **tRNA**, and **rRNA**) are all important for _____, the production of proteins.
–Keep in mind that it is the amount and type of _____ a cell produces that gives that cell its identity and function.

Review Vocabulary…

■_____: compound built of many monomers bonded together

■_____: long chain of amino acids (a protein)

■_____: one of 20 monomers that bond to form proteins

Protein Structure

■A _____ (or polypeptide chain) is a polymer.

■Proteins are made of several _____ attached by peptide bonds.

■There are _____ possible amino acids. A protein is made of many of these.

■The sequence of _____ determines a protein's structure and even function. The amino acid sequence directs how the amino acid chain will twist and fold into the _____ structure of the protein.

■Protein function depends on the _____ of the protein. Shape affects which molecules the protein can interact with and bind with in a cell.

The Genetic Code

■The _____ is determined by the arrangement of bases in DNA.

■During protein synthesis, the sequence of _____ in an mRNA transcript is translated into a sequence of _____.

■The protein message coded for in the mRNA nucleotides is the genetic code.

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

The Codon

–Each amino acid is associated with a series of _____ mRNA nucleotides.

–The 3 nucleotides that code for an amino acid is called a _____.

–There are _____ possible codons.

•These 64 codons provide the information used by nearly every organism on the planet. Because the genetic code is practically universal, it supports the idea that all organisms are related through evolution.

Questions

■Notice that several codons code for the same amino acid.
–For example, Proline has _____ codons.
■_____ is the START codon. This signals the start of a protein.
■_____ are the 3 STOP codons. These signal the end of a protein.

Translation

■_____ is the process where mRNA's message is used to make protein.
■Remember, mRNA is produced by _____ of DNA, and mRNA's job is to travel to the ribosomes for translation and protein synthesis.

tRNA

–Amino acids float freely in the cytoplasm.
–_____ carries amino acids to the ribosomes during protein synthesis.

The Anticodon

■The bottom region of tRNA has a RNA sequence called the _____.
■The anticodon has an mRNA sequence complementary to the codon.
–For example, the codon for Leucine is UUA, so its anticodon is _____.
■The anticodon binds to a codon to hold an amino acid in place for binding to other amino acids.

Role of the Ribosome

■Ribosomes are made of _____ & either float in the cell or stick to the ER.
■Free floating ribosomes produce protein for use _____ the cell.
■ER Ribosomes make proteins that will be _____ to other cells.
■Ribosomes have _____ binding sites; 1 to bind to _____ and 2 to bind to _____s so their anticodons can pair with mRNA codons.

The Translation Process

•A ribosome attaches to the AUG (start) codon on an mRNA chain.
•A tRNA with the anticodon UAC binds to the start codon.
•The ribosome moves down the mRNA and tRNA keeps bringing amino acids.
•When the ribosome reaches a stop codon translation stops.
•mRNA is released from the ribosome and the new protein is sent out for use.

Let's Practice Translation

-AUG: _____
•Anticodon: _____
–GGC: _____
•Anticodon: _____
–ACU: _____
•Anticodon: _____

- UCG: _____
-Anticodon: _____
-UGA: _____
-Anticodon: _____

SUMMARY: