

Lecture Guide: Mutations!

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Name: _____

Period: _____

Instructions:

- 1) On one side of each page, provide the missing terms from the lecture to complete your notes.
- 2) On the opposite side of each page, write your own questions and comments based upon your understanding of the lecture.
- 3) Use the entire page when prompted to make drawings, complete tables, graphs etc. in the indicated boxes.
- 4) Use the completed lecture guide to prepare your own notebook, which should represent your best work!

Mutations occur either during **DNA replication** or during **translation** (when the DNA message is copied into RNA). Draw a picture of either process in this box!

MUTATIONS: WHAT ARE THEY?

MUTATIONS:

- ☐ are _____ in the genetic material of the cell
- ☐ can occur at the level of an individual DNA strand (a _____ mutation) or to an entire chromosome (a _____ mutation)
- ☐ usually lead to a decrease, rather than an increase, in _____
- ☐ A loss of _____ in the cell typically leads to a loss of some _____!

Information is lost Information is lost

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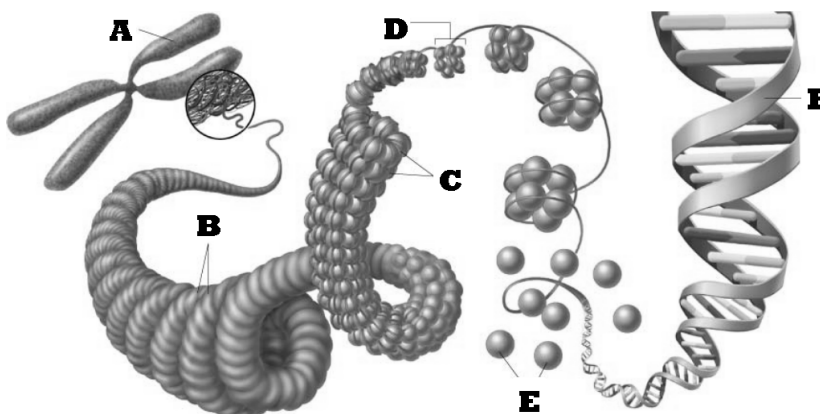
The loss of _____ means that most mutations are either _____ or have _____. Now and then a mutation *will* offer a _____ to an organism. However, the idea that a _____ mutation will lead to a huge, dramatic change in a single _____ (like the _____ characters) is just wrong.

TYPES OF MUTATIONS:

- ☐ _____ mutations are caused by _____ errors in the copying process (during _____)
- ☐ _____ mutations occur when _____ fail to properly separate during _____.

Identify the labeled structures in the diagram at right:

- A: _____
 B: _____
 C: _____
 D: _____
 E: _____
 F: _____



CHROMOSOMAL MUTATIONS:

- ☐ are changes in the _____ or structure of chromosomes
- ☐ typically _____ in humans
- ☐ can occur in four different ways: _____, _____, _____ and _____.

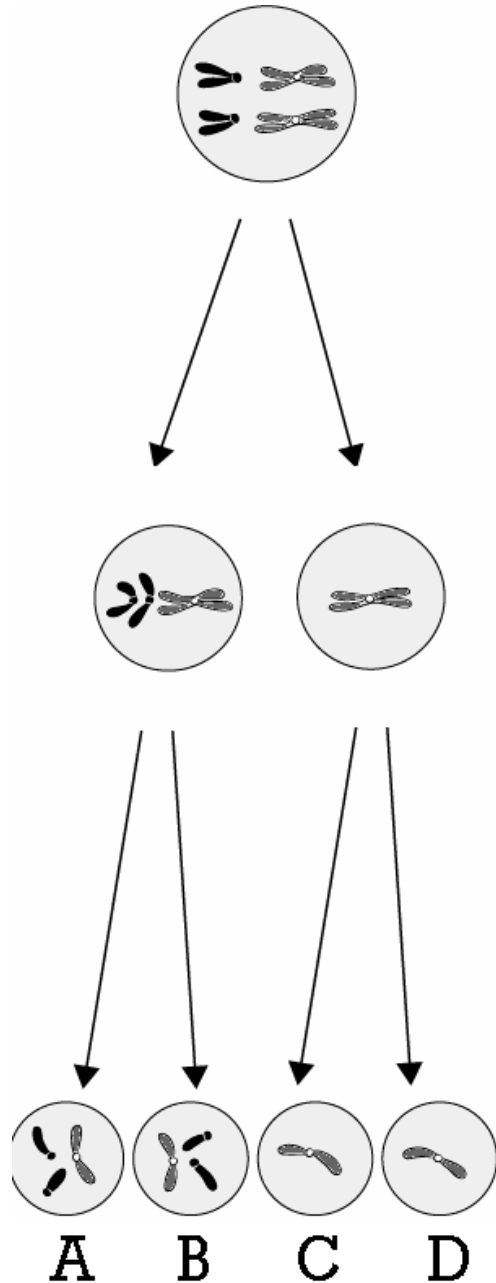
_____ :

_____ :

_____ :

_____ :

Which of the final cells below has too many chromosomes?



NON-DISJUNCTION:

- ☐ failure of the chromosomes to properly _____ during meiosis
- ☐ leads to organisms with the wrong _____ of chromosomes
- ☐ causes birth defects like _____ (trisomy-21)

POINT MUTATIONS:

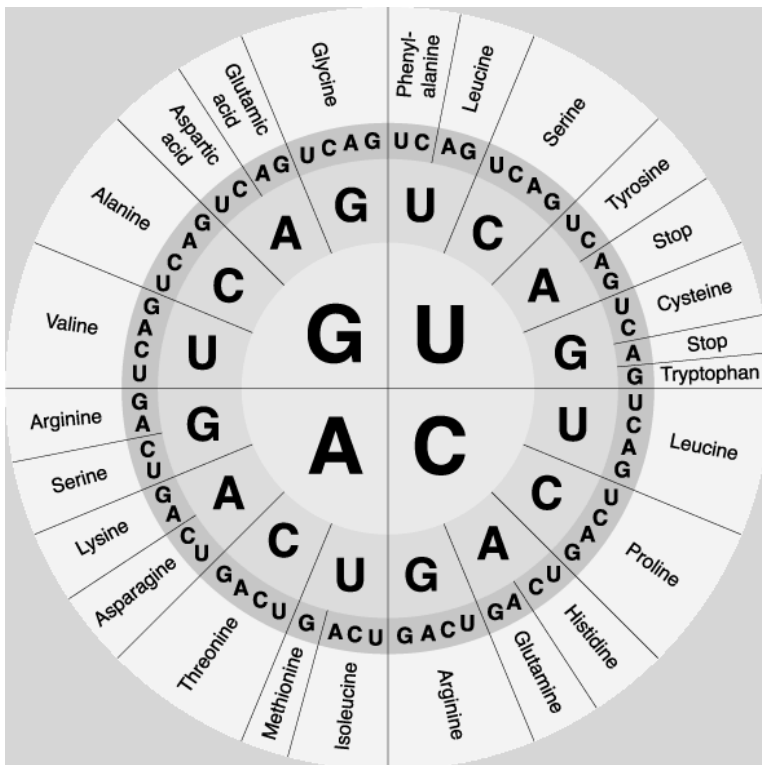
- ☐ are changes in _____ base pairs of DNA
- ☐ can lead to the production of faulty (mishapen) _____, or no _____ at all
- ☐ often have no effect: _____ codes for serine, for example, but so does _____, _____ or _____
- ☐ that change the _____ letter in a DNA _____ may lead to the same _____ acid
- ☐ that do this are called _____, or _____
- ☐ which lead to a _____ amino acid, however, are called _____
- ☐ Depending on the amino acid, these can be good, bad or _____
- ☐ which lead to a _____ codon (UAA, UAG or UGA) are called _____
- ☐ These lead to loss of _____, and are usually bad

☐ Sense, missense and nonsense mutations are typically caused by _____ of one nucleotide for another, changing the meaning of only one _____

☐ _____ or _____ of an entire nucleotide leads to _____!

_____ **MUTATIONS ALTER
EVERYTHING THAT FOLLOWS:**

_____ . . .
 _____ . . .
 _____ . . .
 _____ . . .



The Genetic Code

Using the Genetic Code wheel at the bottom, predict, provide a mRNA codon and DNA triplet for the following amino acid sequence:

AMINO ACID	mRNA	DNA
Methionine	_____	_____
Arginine	_____	_____
Phenylalanine	_____	_____
Serine	_____	_____
Leucine	_____	_____
Serine	_____	_____
Isoleucine	_____	_____
STOP	_____	_____

Now, a deep-thinking question: the genetic code is redundant, so more than one codon can lead to the same amino acid! How many different possible combinations of the eight amino acids listed above can lead to the same polypeptide chain?

Consider the following sequence of letters to represent sections of a chromosome:

SHEUIRCX

Rearrange this sequence to show what might happen in different types of chromosomal mutation!

DELETION:

DUPLICATION:

INVERSION:

TRANSLOCATION:

MUTATIONS: WHERE DO THEY HAPPEN?

MUTATIONS:

- ☐ can occur in ____ cell
- ☐ that occur in _____ (eggs or sperm) are called ____-____ mutations, since they occur during the _____ of new offspring (reproduction)
- ☐ that occur in cells other than _____ are called _____ mutations

SOMATIC MUTATIONS:

- ☐ many are harmless: _____, for example, are often the result of such mutations

Variations in Fruit Fly Wings



Normal



Curly



Short

3 flies are shown above. 2 are _____. Would these be harmless mutations, or not?

- ☐ some are dangerous, because the loss of _____ leads to the loss of _____
- ☐ some are *very dangerous*, because their loss triggers runaway _____, also known as _____!

HOW DOES THIS HAPPEN?

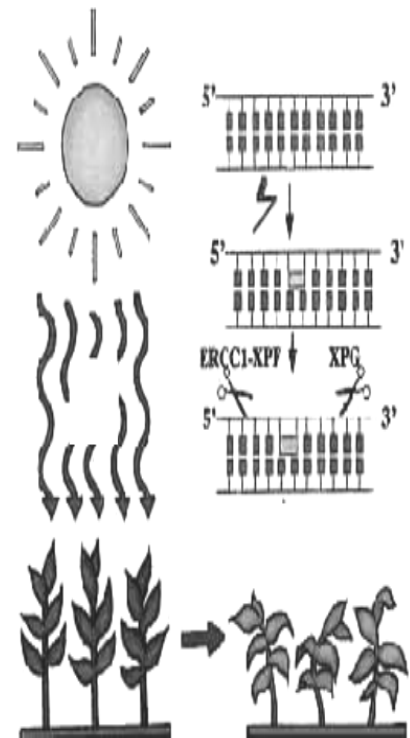
- ☐ Skin cancer on a person's cheek is a _____ mutation, probably triggered by _____ radiation.
- ☐ Substances which tend to cause mutations are called _____. . . high frequencies of _____ light, for example, can cause mutations that lead to skin cancer. Let's see how this can happen . . .

ULTRAVIOLET LIGHT AND MUTATION:

- ☐ Sunlight contains many _____ of radiation, but most are filtered out by the _____
- ☐ _____ does get through, however, triggering a chemical change in DNA, a _____ mutation
- ☐ UV-B radiation provides energy that drives two _____ together
- ☐ These _____ pull in, effectively eliminating a single nucleotide
- ☐ This single _____ also destroys _____, leading to loss of _____

MUTATION:

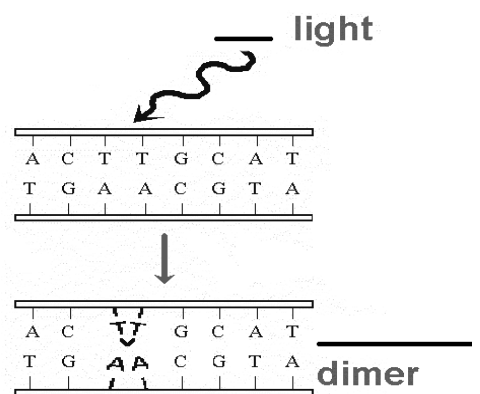
- ☐ Loss of function may disrupt the regular _____ (G₁, S, G₂, mitosis and cytokinesis)
- ☐ If this happens, the cell may _____ more often than is should!
- ☐ Uncontrolled cell growth goes by many names, but the generic term is _____.



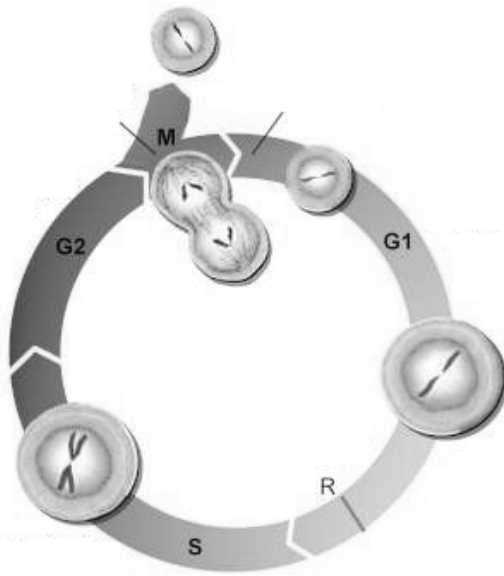
What kind of radiation is shown in the picture above? _____

Circle the place in the picture where the mutation is occurring.

What kind of mutation is it _____



Provide the missing words in the above picture



Let's review! Compare the above picture with the illustration on page 245 of your text, then label the different divisions of the cell cycle in the picture above.

In which part of the cell cycle are point mutations likely to occur?

In which part of the cell cycle is non-disjunction likely to occur?

What is the term for the actual act of cell division?

- ☐ When these mutations lead to cancer, they are classified as _____
- ☐ _____ products contain many ingredients known to cause cancer and other forms of _____ disease

Don't let mutation freak you out!

It's _____ for humans to have a certain number of somatic mutations during their life.

It's also _____ for all of us to avoid _____ whenever possible!

We should avoid _____ because most mutations are highly unlikely to offer _____, but (interestingly enough) scientists have found the _____ of mutations very helpful!

ALLELES:

- ☐ are _____ versions of the _____ gene
- ☐ come in _____ (one from each _____)
- ☐ can be either _____ (always expressed) or _____ (hidden, and only expressed when there are no _____ alleles present)
- ☐ whatever you have, whether dominant or recessive, make up the organism's _____
- ☐ the traits that are actually shown are the _____.
- ☐ different combinations lead to different _____ which may still have the same _____.

ALLELES:

- ☐ As an example, a fly with ____ dominant alleles and a fly with ____ dominant and ____ recessive will both have the same _____!
- ☐ Another complication is that not all alleles are expressed all the time, in ____ part of the organism's body. Their expression may be _____.

In figuring these things out, scientists have found mutations helpful, because the _____ in development reveal the _____ (actual physical location) of the normal allele.

So research on organisms like _____ flies often involves deliberately using _____ to cause mutations that reveal the normal allele and, eventually, that allele's _____.
