**CH8.6-8.7: Gene Regulation, Structure, & Mutations**

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| Objectives | Vocabulary |
| * **Describe** how the *lac* operon is turned on or off.
* **Summarize** the role of transcription factors in regulating eukaryotic gene expression.
* **Describe** how eukaryotic genes are organized.
* **Evaluate** three ways that gene alterations can alter genetic material.
 | * Lac operon
* Repressor protein
* Operator
* Operon
* Transcription factor
 | * Intron
* Exon
* Point mutation
* Frameshift mutation
* Transposon
 |

**Regulation of Gene Expression in Prokaryotes**

* Both prokaryotic and eukaryotic cells are able to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which genes are expressed and which are not, depending on the cell’s \_\_\_\_\_\_\_\_\_.
	+ If specific proteins are not needed all of the time, it would be a \_\_\_\_\_\_\_\_\_\_\_ of energy for the cell to continually make them
	+ Review…
	+ What did we call the sequence of DNA that signals for the start of transcription?
* In prokaryotes, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ protein may bind to DNA in order to \_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_ RNA polymerase from binding to the promoter site and beginning transcription



* The three genes on the prokaryotic DNA strand below are involved with \_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ down lactose
* The entire set of bacterial DNA that controls the consumption of lactose is called the *lac* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Recall that lactose is a disaccharide \_\_\_\_\_\_\_\_\_\_\_ found in milk
* When you consume dairy products, the lactose eventually makes its way into your \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, where prokaryotic bacteria must break it down
* When you are \_\_\_\_\_ consuming dairy, the repressor protein binds to DNA and the series of gene are \_\_\_\_\_\_\_\_\_
* When lactose is present, it binds to the repressor protein, changing its \_\_\_\_\_\_\_\_\_\_\_\_, which causes it to \_\_\_\_\_\_\_\_\_ off of the DNA strand
* Now it is no longer blocking \_\_\_\_\_\_ polymerase from binding with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ site, so transcription may occur and the genes are \_\_\_\_\_\_\_
* The regulation of gene expression in eukaryotes is more \_\_\_\_\_\_\_\_\_\_\_\_\_ than in prokaryotes for several reasons…
	+ Eukaryotes have many more \_\_\_\_\_\_\_\_ than prokaryotes
		- Typical prokaryote = \_\_\_\_\_\_\_\_\_\_ genes
		- Humans = \_\_\_\_\_\_\_\_\_\_\_\_ genes
	+ Similar genes in eukaryotes are not \_\_\_\_\_\_\_\_ together like in prokaryotes…they are often found on different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Additionally, a nuclear \_\_\_\_\_\_\_\_\_\_\_\_\_ separates transcription and translation in eukaryotes, so there are many more opportunities for gene regulation
		- Regulation may occur \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_\_\_\_\_\_\_ transcription,…but most often occurs at the \_\_\_\_\_\_\_\_\_\_\_\_\_

**Regulation of Gene Expression in Eukaryotes**

Special proteins, called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 factors and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ help to

arrange RNA polymerase on the promoter site properly



Intervening DNA Sequences in Eukaryotes

* In eukaryotes, many genes are interrupted by **\_\_\_\_\_\_\_\_\_\_\_\_** —long segments of nucleotides that have no \_\_\_\_\_\_\_\_\_\_ information.
	+ These portions are said to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with protein synthesis
* The portions of a gene that are translated or expressed into proteins are called \_\_\_\_\_\_\_\_\_\_
* After a eukaryotic gene is transcribed, the introns in the resulting mRNA are \_\_\_\_\_\_\_ out by proteins called \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Spliceosomes also \_\_\_\_\_\_\_\_\_\_ or “stitch” the remaining \_\_\_\_\_\_\_\_\_\_ together
* The new mRNA containing only \_\_\_\_\_\_\_\_\_\_, exits the nucleus



* This arrangement of exons and introns in genes may have an evolutionary advantage…
	+ Sometimes the exons get \_\_\_\_\_\_\_\_\_\_\_ between different gene segments, allowing several different \_\_\_\_\_\_\_\_\_\_\_\_\_ of a gene to exist
	+ For example, our cells have \_\_\_\_\_ different hemoglobin genes that are all capable of producing the protein hemoglobin

**Mutations**

* Errors in DNA \_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_ may cause mutations that code for \_\_\_\_\_\_\_\_\_\_\_\_ amino acids
* Mutations may…
	+ have \_\_\_\_ effect on an organism
	+ be \_\_\_\_\_\_\_\_\_\_\_\_
	+ Be \_\_\_\_\_\_\_\_\_\_\_\_
* The two main types of mutations are gene \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and gene \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Gene Rearrangements

* Gene rearrangements are mutations that move an \_\_\_\_\_\_\_\_\_\_ gene to a new location on a chromosome
	+ This may affect a gene’s expression because it is exposed to different \_\_\_\_\_\_\_\_\_\_\_\_\_ proteins
	+ It could be comparable to moving to France but not being able to \_\_\_\_\_\_\_\_\_\_ French
* Sometimes gene rearrangements occur when DNA does not \_\_\_\_\_\_\_\_\_\_\_ properly during cell division
* Other gene rearrangements are the result of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, special genes that can actually \_\_\_\_\_\_\_\_ and change positions along a DNA strand



* Before a transposition, a gene sequence may read A B C, but after it may read \_\_\_\_\_\_\_\_\_\_\_
* Transposons are responsible for the streaked \_\_\_\_\_\_\_\_ pattern seen on Indian corn… their positions prevent \_\_\_\_\_\_\_\_\_ proteins from being produced, causing portions of the cob to lack color
* Scientists think that transposons may play a significant role in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and may help researchers pinpoint the causes of \_\_\_\_\_\_\_\_\_\_\_
* They were actually first discovered by Barbara \_\_\_\_\_\_\_\_\_\_\_\_\_ in the 1950s, but her work was not recognized or honored for more than 20 years

Gene Alterations

* Gene alterations are mutations that change a portion of a \_\_\_\_\_\_\_\_\_\_ gene
* Two types of gene alterations are…
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutations
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutations

Point Mutations

* In a **point mutation,** a single nucleotide \_\_\_\_\_\_\_\_\_\_\_\_\_
* So, if a codon reads GGG, after a point mutation it may read \_\_\_\_\_\_\_
* Since several codons code for the same amino acid, sometimes point mutations do \_\_\_\_\_ alter the protein being made…but sometimes they do
* Point mutations may also be called\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Frameshift Mutations

* In a **frameshift mutation,** nucleotides are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Because the genetic code is read in \_\_\_\_\_\_\_\_\_\_\_, insertions and deletions often upset the triplet grouping
* These mutations may cause a gene’s nucleotides to \_\_\_\_\_\_\_\_\_\_, causing the \_\_\_\_\_\_\_\_\_ three nucleotide sequences to be read
* Sometimes scientists compare proteins to sentences…
	+ Imagine deleting the letter C from the sentence…

 THE CAT ATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* The remaining triplet sequences would be altered and rendered \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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3. Describe how eukaryotic genes are organized.
4. Evaluate three ways that gene alterations can alter genetic material.