**Regulation of Gene Expression (6.4)**

Gene regulation: Control of the level of gene expression, either active, inactive and its level of activity.

Constitutive genes (*housekeeping genes)*: genes that are always turned on since the proteins they make are required for cell survival.

Prokaryotic Regulation: can occur at three levels:

* During transcription (most common)
* During translation
* After the synthesis of the protein

Operon: a cluster of genes (in prokaryotes ONLY) under the control of a single promoter (region where RNA polymerase complex binds to DNA to begin transcription), the genes will be transcribed together into a continuous mRNA strand (*polycistronic mRNA)*

Two regions:

* Regulatory region: contains the **promoter** (for transcription), an **operator** (binding site for a protein (**repressor)** that will inhibit transcription initiation), and **CAP-binding** site (site that increases the rate of transcription)
* Coding region: location of the genes that will get transcribed

**The *lac* Operon**:

Coding region contains 3 genes that encode for 3 enzymes: Z, Y, A

*E. coli* can adjust gene expression depending on the availability of sugars.

If lactose is available there is an increase in the level of enzymes that are involved in lactose metabolism. If no lactose is available these enzyme levels decrease.

Lac Operon contains the information to build the enzymes needed to break down lactose.

No Lactose present: *lac* **repressor** protein binds to operator which prevents RNA polymerase from binding to promoter therefore NO transcription.

If Lactose is present: “Allolactose” is produced which binds to the repressor so it can’t bind to the operator, thereby allowing transcription to occur. **CAP activator protein** can enhance levels of transcription even more.

*Lac* Operon is considered to be an inducible operon.

**The *trp* Operon:**

Coding region contains 5 genes that encode for synthesis of the amino acid tryptophan.

Regulatory region contains a promoter and an operator region.

Normally, tryptophan must be synthesized and this operon is allowed to be continually transcribed.

However when levels of tryptophan get too high some of the tryptophan binds to a **repressor** protein, which allows the repressor to bind to the operator which decreases the ability of transcription to occur.

**Regulation of Gene Expression in Eukaryotes**

There are 5 levels of regulation of gene expression in eukaryotes:

* Pre-transcriptional
* Transcriptional
* Post-transcriptional
* Translational
* Post-translational

HWK:

Read p269-270: Design & create a table with the following headings to summarize the control of gene expression in eukaryotes: Level of Gene Regulation, Location in the Cell, Description, Example.

Read p271 #1,2,3

P272 #2,,3,4,6,7, 8, 13, 14