**Prokaryotic**

**Gene Regulation**

**Why Regulate Genes?**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

- gene expression is affected by changes in the external environment

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* All cells have the full set of genes, but not all genes are needed in each cell (some are turned off)

**Bacteria need to respond quickly to changes in their environment**

**Bacterial metabolism**

If they have enough of a product, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why?

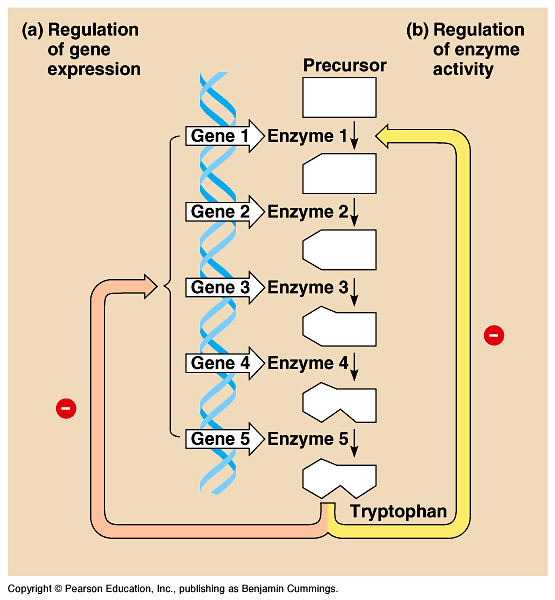
How?

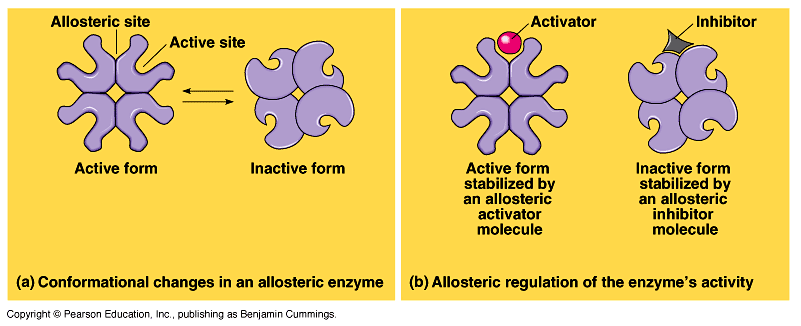
If they find a new food/energy source… \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why?

How?

**🡪Natural selection favors cells that can do this well because it’s COST EFFECTIVE**



**Enzyme Review**

**Feedback Inhibition 🡪**

* ***but this is wasteful production of enzymes***

**Different way to Regulate Metabolism 🡪 Gene Regulation!!!**

* Why is this good?

**Overview of Gene Regulation in Prokaryotes:**

**On and Off. Off and On. On and Off.**

 **Turn genes OFF example**



**Turn genes ON example**

**Operon Structure**

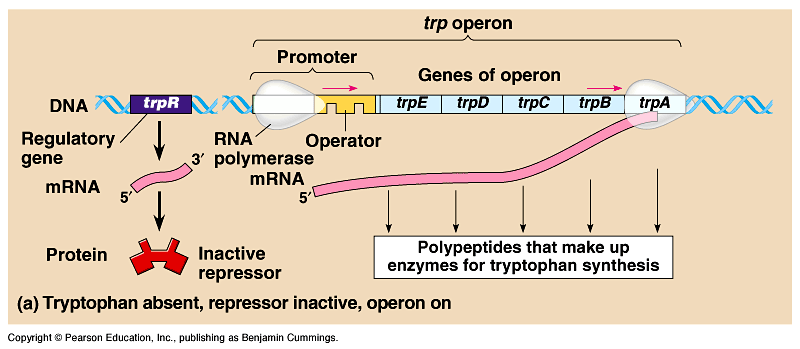
**1.**

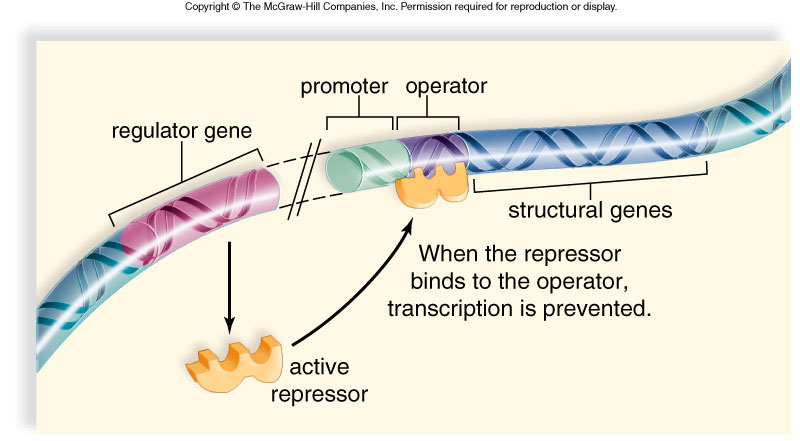
* example: all enzymes in a metabolic pathway

**2.**

* single promoter controls transcription of all genes in operon
* transcribed as one unit & a single mRNA is made

**3.**

****



**So how can these genes be turned off?**

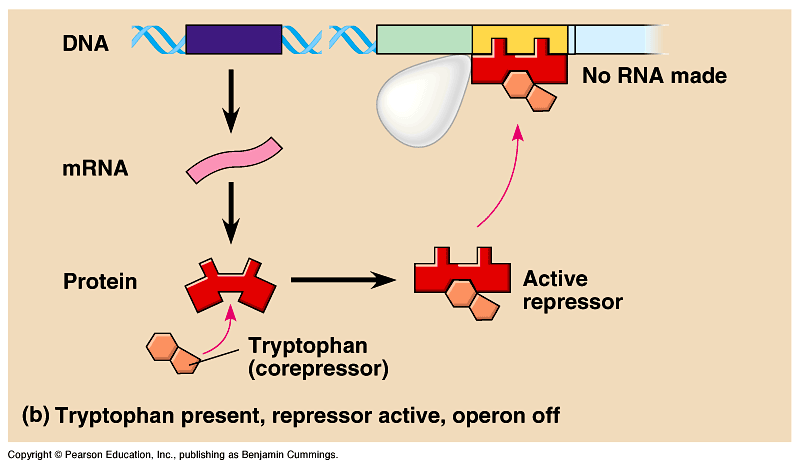
**Operon Model:**

**operator, promoter & genes they control serve as a model for gene regulation**

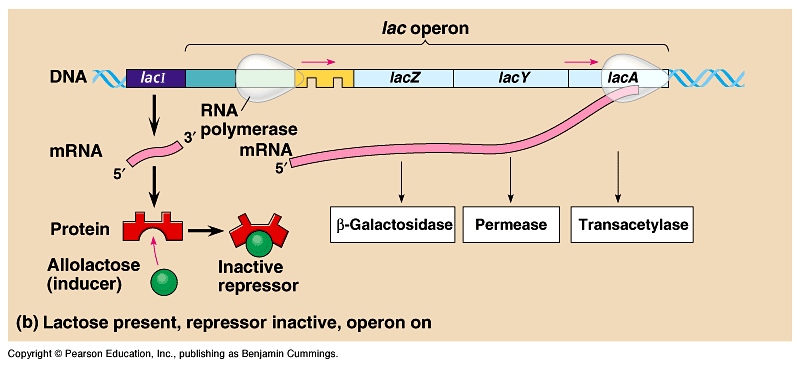
**Two Main Types of Operons:**

Repressible (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) -

Inducible (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) -

**Synthesis Pathway Model (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)**

🡪Tryptophan is allosteric regulator of repressor protein

**Digestive Pathway Model (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)**

🡪Lactose is allosteric regulator of repressor protein

**Operon Summary**

Repressible Operon Inducible Operon

More to the Story… Negative vs. Positive Reg.

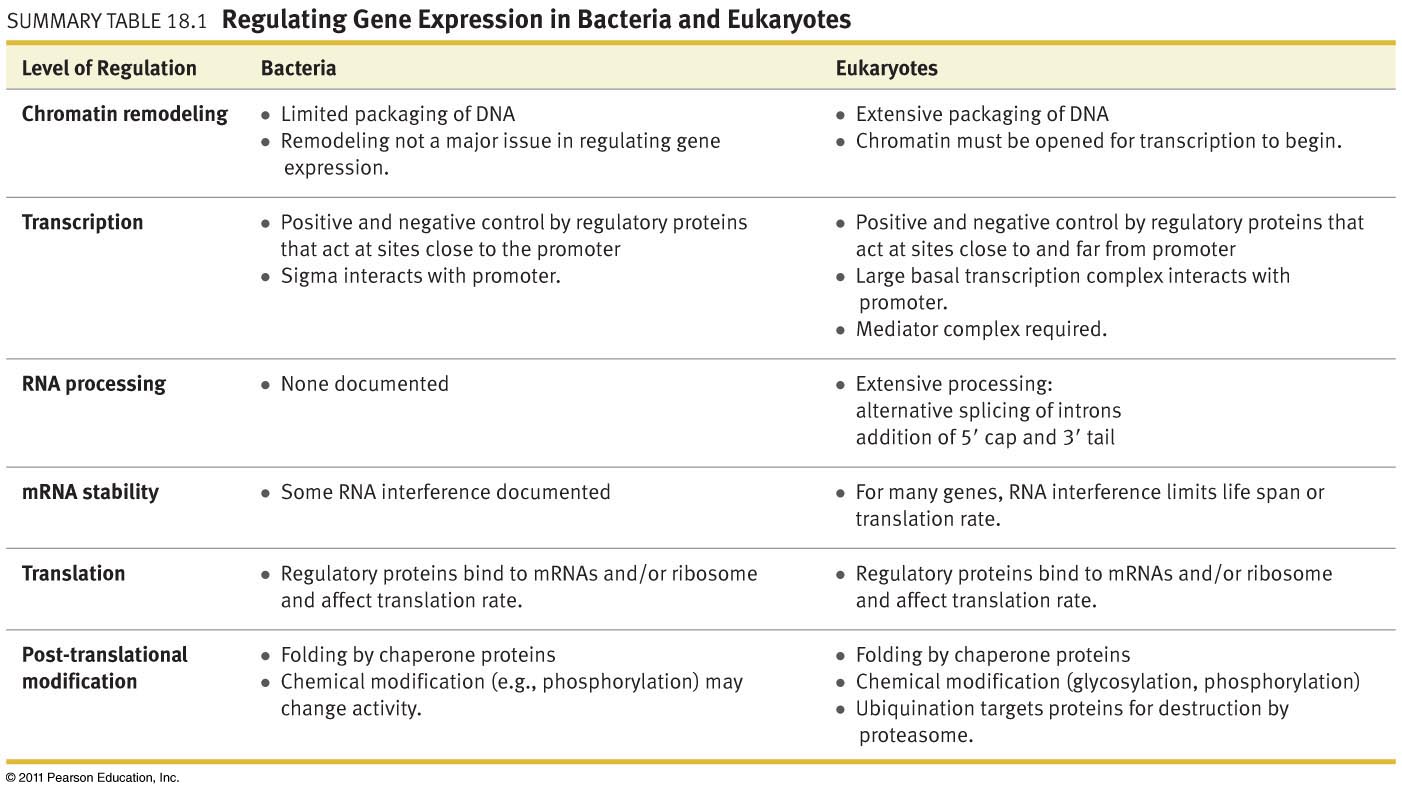
**negative regulation**

* + repressor protein binds to the operator, turns off transcription

**positive regulation**

* + ***activator*** binds to the promoter, turns transcription up (amplifies expression)

**Prokaryotic vs Eukaryotic Transcriptional Control**



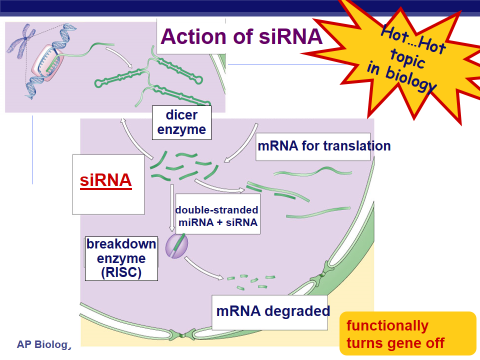
**RNA**

an amazing little thing

Coding RNA =

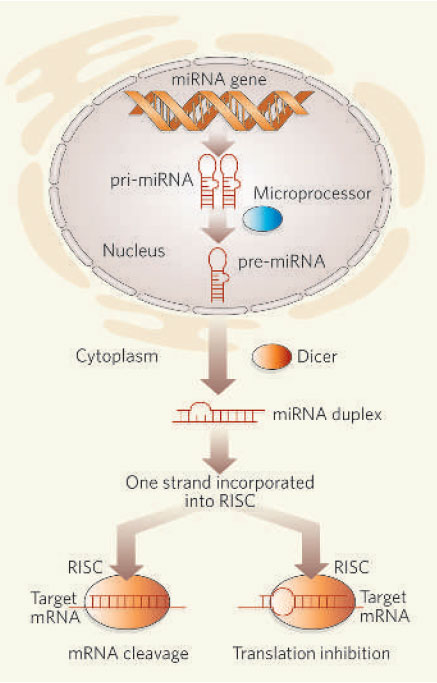
Non-coding RNA =

**RNA Interference involves siRNA and microRNA**



**siRNA = Small Interfering RNA**

**microRNA**



**Applications of microRNAs**