Lecture 15: Regulating Gene Expression

A. Types of expression

1. Some genes encoding for enzymes are and thus the enzyme is continually synthesized =

2. Some genes encoding for enzymes are but can be turned on ( ) by certain conditions.

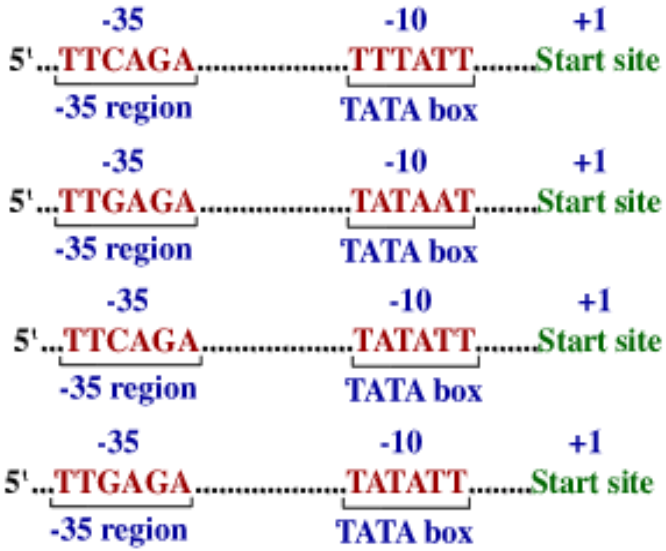
3. Some genes encoding for enzymes are , but they can be turned off ( ) by certain conditions.

On the pGLO plasmid, which gene/s is/are constitutive and which gene is inducible?

B. Mechanisms to control transcription

1. (weak vs. strong promoters)

Which is the strongest prokaryotic promoter?



2. Reversible modulation by transcription factors:

a. - bind to a DNA sequence near the promoter and

DNA binding proteins

( )

- transcription by binding to a region of DNA downstream of the promoter called the

c. Repressors and activators are effector molecules

(Positive control)

- transcription by binding to a region of DNA upstream of the promoter called the

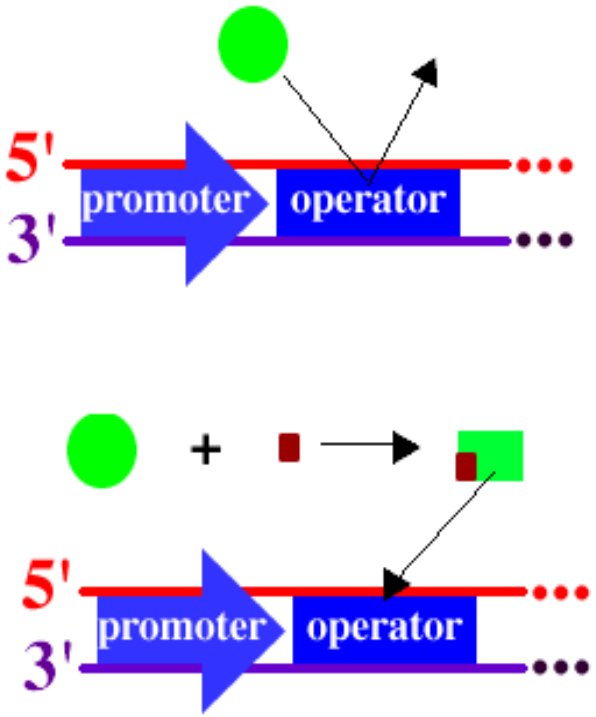
. The binding of

.

Repressors can function by two mechanisms:

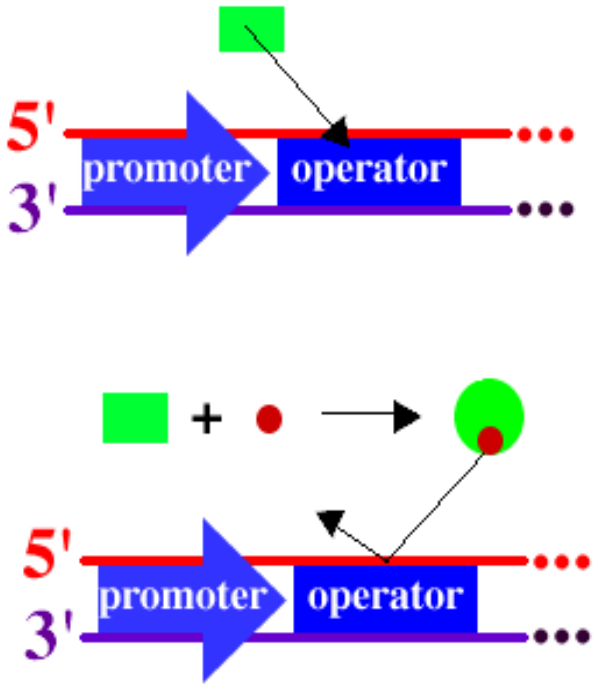
Mechanism #1:

The repressor, alone, to the operator. However, when the effector molecule (called a) binds to the repressor it can bind to the operator and .



Mechanism #2:

The repressor, alone, binds to the operator . The binding of the effector molecule ( ) alters the shape of the repressor and keeps it from binding to the operator.



Examples:

Mechanism #1:

-The encodes for 5 enzymes that catalyze

Tryptophan, itself, serves as a

blocking expression of the trp operon.

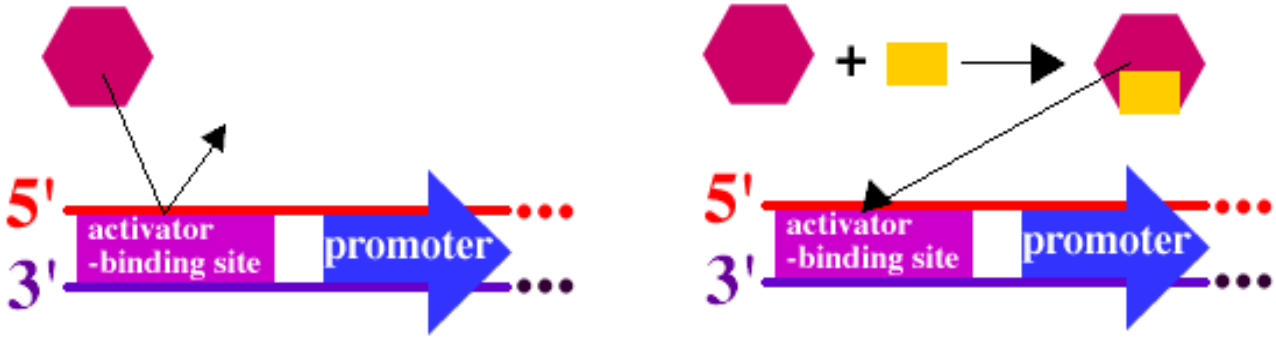
Mechanism #2:

-The encodes for proteins required to

The repressor normally binds to the operator, blocking transcription. However, when lactose is present and a derivative of this disaccharide binds to the repressor; it

The binding of activators can also be modulated by the binding of other molecules.

For example, a molecule that binds to an activator and enhances its ability to bind to the activator site is called an



3. Some that direct RNA polymerase to certain specialized genes are (e.g. during a certain stage of).

Review the mechanisms to control gene expression:

1.

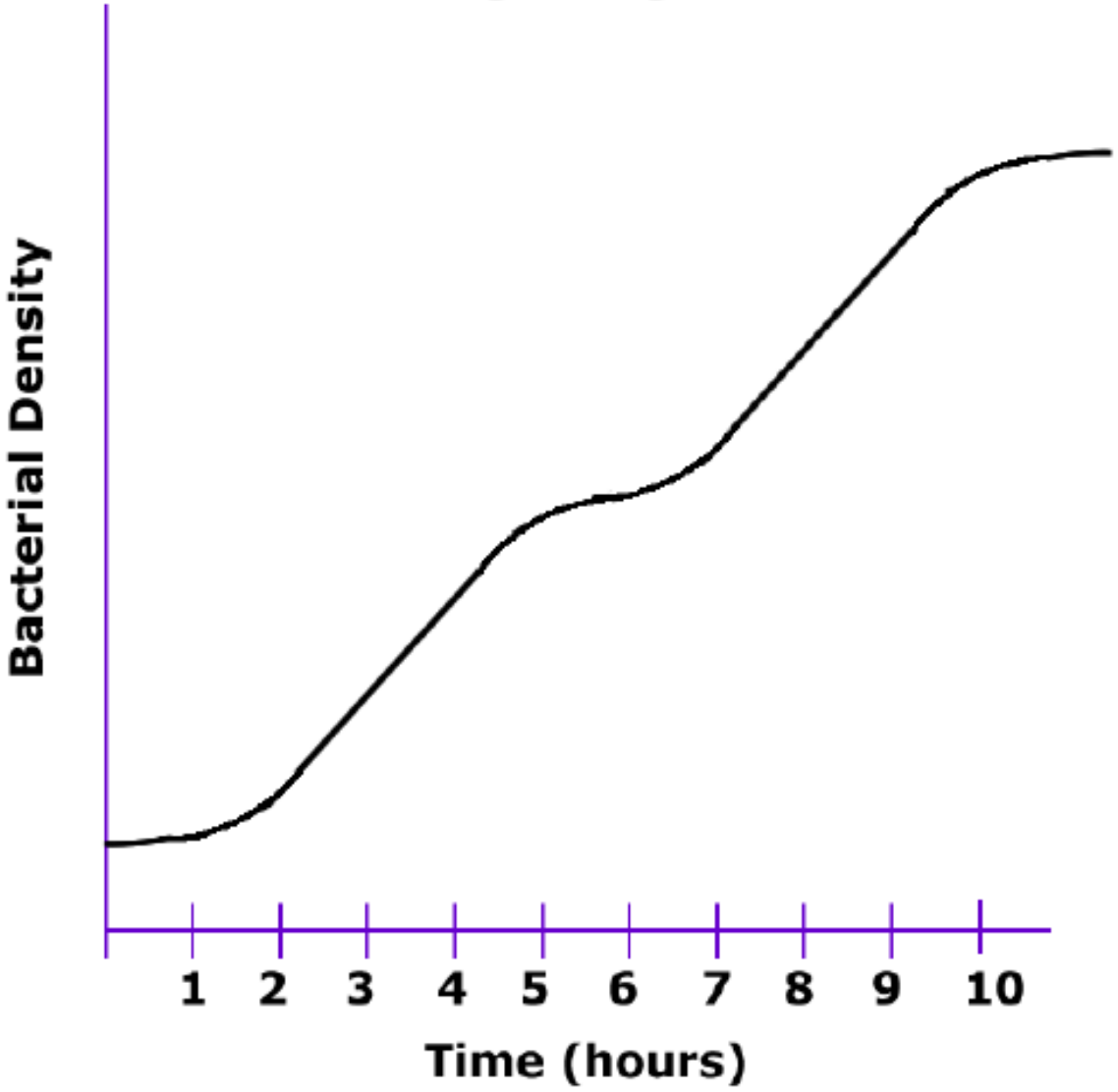
2.

3.

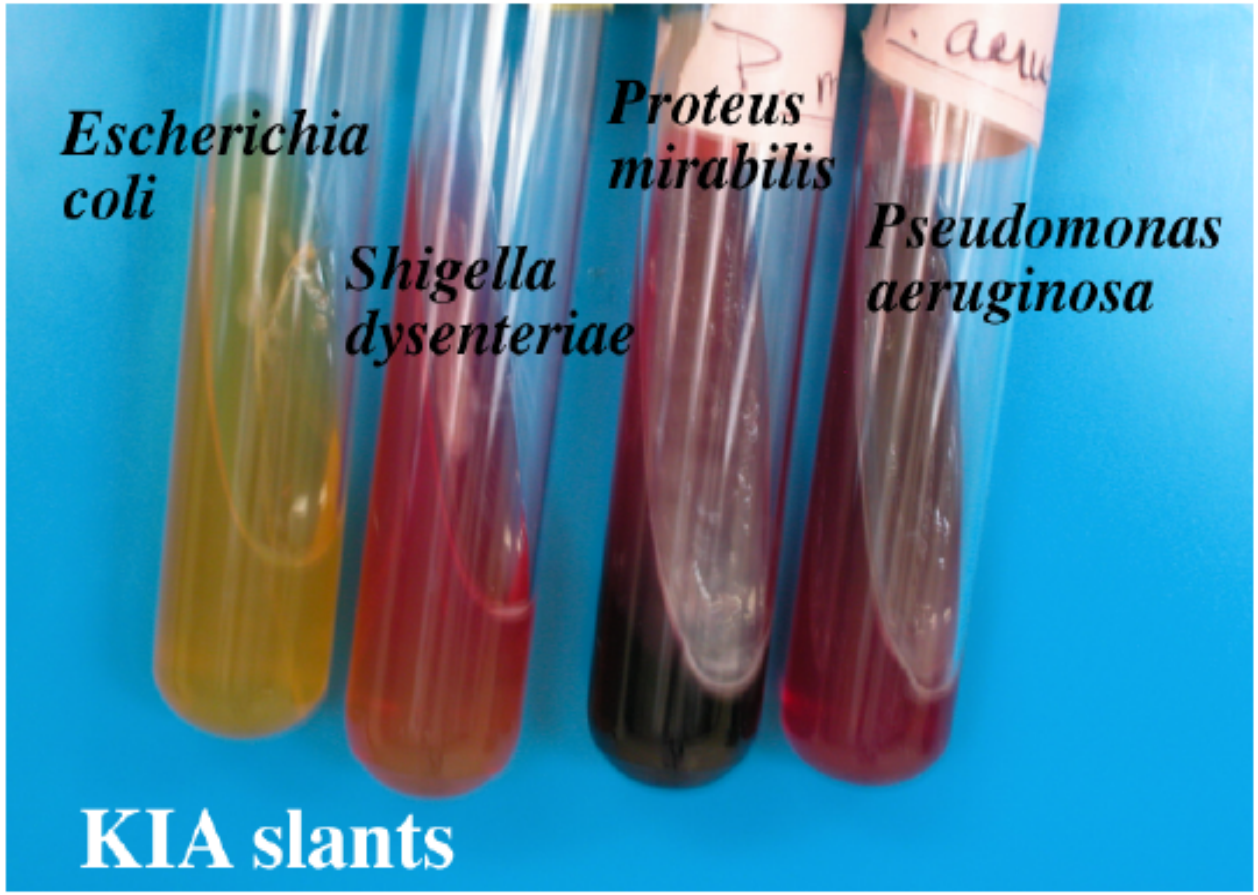
Complex Gene Regulation

A. Catabolite Repression

E. coli uses preferentially. It will exhaust the glucose supply, pause and then use other sugars (e.g. lactose) = .



KIA - contains glucose in a limited supply and lactose in excess.
E. coli **ferments the glucose and then pauses and ferments the lactose - tube is entirely yellow**



This growth pattern represents the ability of glucose to

repression.

1. Glucose is not sensed directly, instead (a secondary messenger whose concentration is low when glucose is present) is sensed.

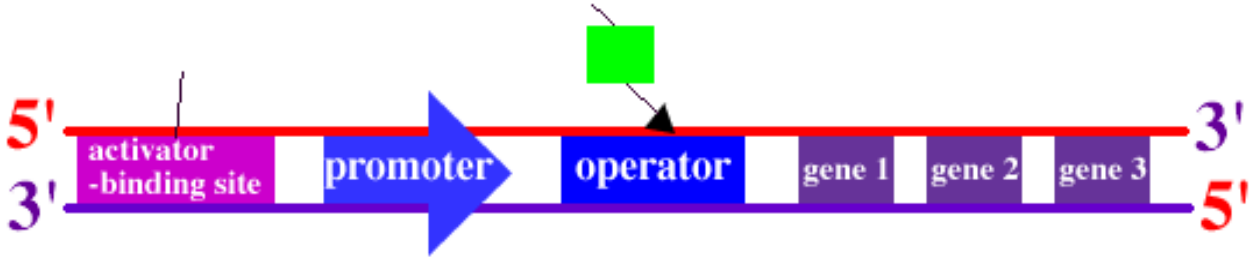
a. If then degradation of sugars other than glucose is

b. If and the metabolite (e.g. lactose) is present then the enzymes to digest that sugar are

2. Enzymes subject to catabolite repression are under control of the

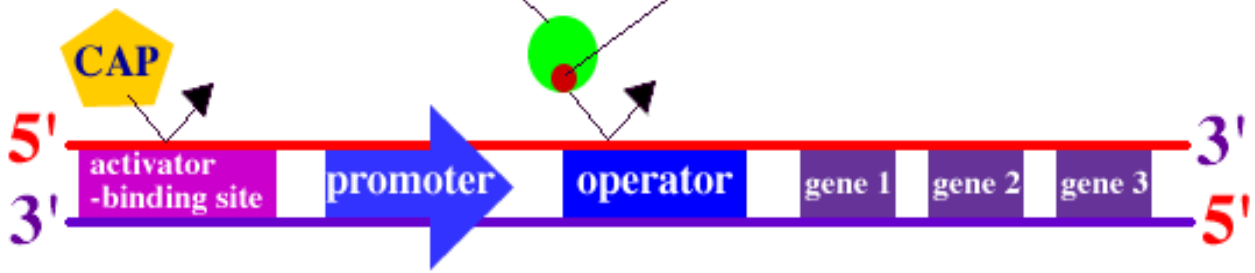
The *lac* operon is under control of both an :

The *lac* operon

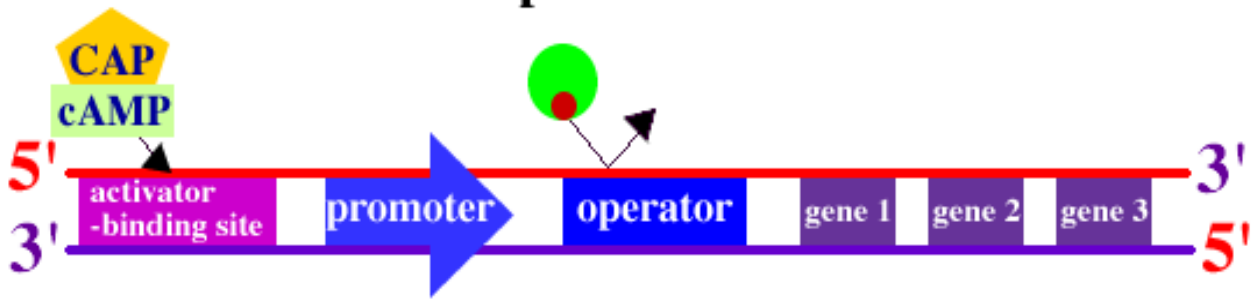


When are both present:

Repressor



When lactose is present but :



What is the appearance of the *lac* operon when *E. coli* is growing on GSA?

Recipe:

$(NH4)_2SO_4$, K_2HPO_4, KH_2PO_4, $MgSO_4$, Glucose and Agar