Name: Date:

HANDS-ON ACTIVITY

Modeling Prokaryotic Operons

The ability of a cell to switch certain genes on or off was first discovered by French scientists François Jacob and Jacques Monod. This major advance in our understanding of how genes work began with a study of how genes control lactose metabolism in the bacterium *Escherichia coli*. Jacob and Monod observed that the genes responsible for lactose metabolism were expressed only in the presence of lactose. When lactose was not present, the genes were shut off. In this activity, you will build a model of the *lac* operon. Then you will use your model to show how gene expression is regulated in prokaryotes.

OPTIONAL MATERIALS

- cardboard tubes, various sizes
- colored pencils
- construction paper
- foam pool "noodle"
- pipe cleaners
- table tennis balls
- yarn

PROCEDURE

1. Use materials provided by your teacher or that you have brought to class to build a model of the *lac* operon. Your model should include the following: promoter, operator, *lac*Z, *lac*Y, *lac*A, lactose, inducer, repressor, mRNA, RNA polymerase. Your model should be able to show what happens when lactose is present, and what happens when lactose is absent. Refer to the simple diagram below, the Student Edition, or outside resources to help in the construction of your model.

   ***Lac* operon diagram**

   DNA

	promoter	operator	*lac*Z	*lac*Y	*lac*A

2. Draw an illustration in your Evidence Notebook of your model and label all of its parts.
3. Next, activate your *lac* operon by adding the inducer and removing the repressor.
4. Demonstrate your model to your teacher. Once your teacher approves, draw this new model in your Evidence Notebook and label the parts.

ANALYZE

1. What are the roles of the operator, promoter, and structural genes within an operon?

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2. How does the presence or absence of lactose affect the *lac* operon?

3. Describe in your own words what takes place when an operon is activated and inactivated.

4. How might a mutation in the regulator gene affect the function of an operon?

5. How would the loss of the promoter site affect enzyme production by the operon?