**Regulation of the Lactase Gene Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

*Key Concepts*

*• Eukaryotic gene expression is regulated at the levels of transcription, RNA processing, translation, and post-translation.*

*• Proteins called transcription factors bind to DNA and control transcription. Different types of transcription factors can*

*increase or decrease transcription.*

*• Mutations in DNA regions that control gene expression can alter the way genes are expressed.*

*• Infants have high lactase levels so that they can digest their mothers’ milk, but lactase gene expression is turned off after*

*weaning.*

*• Lactase persistence is the trait that allows adults to continue to digest milk. It results from a mutation in an enhancer region of the lactase gene.*

Go to <http://www.hhmi.org/biointeractive/regulation-of-the-lactase-gene> and open the **Click and Learn**.

Why is lactose tolerance also called lactase persistence?

What normally happens to the levels of lactase produced throughout a person’s lifetime?

In general, why is it important for a cell to regulate protein production?

What are the steps in gene expression that ultimately affect protein levels in a eukaryotic cell?

What is the role of general transcription factors and where do they bind?

How do activators and repressors affect transcription?

Where do activators bind?

What are two ways in which repressors can interfere with transcription?

Multicellular organisms are made up of different types of differentiated cells. Given that all cells in an organism have the same DNA—and thus the same genes—explain how it is that different genes can be expressed only in certain types of cells.

Is RNA processing a common way for regulating gene expression?

What is alternative splicing and why is it important?

What is translation?

RNA interference is a major mechanism of gene regulation in eukaryotes. Explain how RNA interference works.

Which proteins are marked for destruction?

How does a cell know which proteins should be destroyed?

How are these proteins destroyed?

At what level (i.e., transcription, translation, or protein processing) is the lactase gene (LCT) regulated?

Using your knowledge of activators and repressors, hypothesize two ways in which transcription of the LCT gene could be turned off.

In what regions of the world is lactase persistence most prevalent?

How is lactase persistence an example of human evolution?

Explain the effect of the mutation that occurs among northern European people on LCT gene expression.

What are the similarities and differences between the lactase persistence mutations found in African populations and the one found in European populations? (Consider, for example, type of mutation, location, function.)