# Applied Learning Activity: Regulation of Gene Expression

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## Purpose:

* To reinforce students’ understanding of gene expression.
* To emphasize that gene expression involves DNA transcription to mRNA, and mRNA translation to protein.
* To understand how the biological activity encoded by a gene is regulated.

**References:** [***Genetics, Agriculture, and Biotechnology***](https://iastate.pressbooks.pub/genagbiotech/)**, Chapter 9**

## Background

The term **expression** can be used in different ways that are sometimes confusing. Typically, if a gene product is produced, the gene is considered “expressed.” However, it sometimes occurs that mRNA might be produced but not a protein, or that a protein is produced but it is in an inactive state. In such cases, although a gene product is produced, the biological activity encoded by that gene is not present.

## Scenario

You are using tomato to study plant response to insect feeding. You are interested in understanding the role of 5 candidate genes that might make tomato tolerant to the tobacco hornworm. You know that understanding how the genes are regulated is important in developing tomatoes that are tolerant to insects. You grow two sets of plants. One set of plants is treated with insects and the other not treated with insects. After insects have been on the plants for 12 hours, you measure the amounts of mRNA and protein from each candidate gene.

Explain the type of regulation from your data below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Candidate gene** | **Not treated with insects** | | **Treated with insects** | |
|  | **mRNA** | **Protein** | **mRNA** | **Protein** |
| 1 | Absent | Absent | Present | Present |
| 2 | Present | Absent | Present | Present |
| 3 | Present | Present | Absent | Absent |
| 4 | Present | Present | Present | Absent |
| 5 | Present | Present | Present | Present |