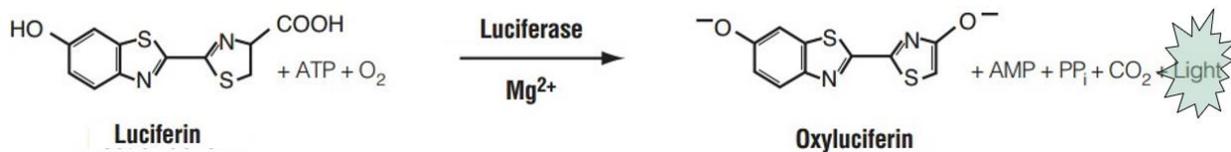


## Bioluminescence II – Serial Dilution of Luciferase

### Field Trip Background

#### Background Information

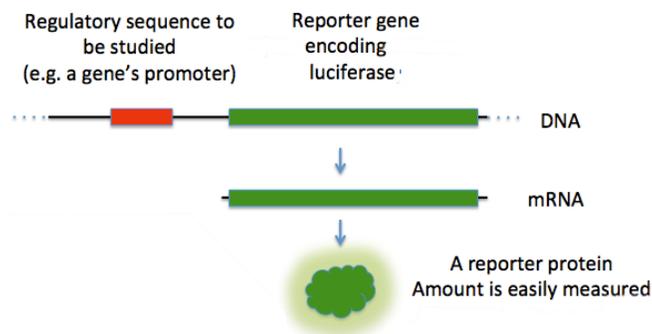
**Bioluminescence** is the term used to describe the way in which a living organism can convert its own life energy to light energy. Many kinds of living things have developed this adaptation, and the light that they make can be used for a variety of purposes. These purposes could include attracting a mate (the firefly), self-defense (various squids), mimicry (angler fish), or simply lighting a dark area (certain deep-sea fish). To make light, these organisms use a special enzyme called **luciferase** to help them produce light under specific conditions.



*Note: **Luciferase** does not glow on its own. Luciferase is an **enzyme**, so it must have other chemicals (glow reagents) around it, so that it can do the chemical work necessary to make light.*

#### Using Luciferase in Research

Laboratory scientists have learned how to repurpose the luciferase enzymes from different creatures and use them as molecular detectors that are called **reporters**. The light that luciferase makes can be detected and measured either inside or outside of a cell. Scientists use that light to track whether a particular gene in a cell is turned on or off.



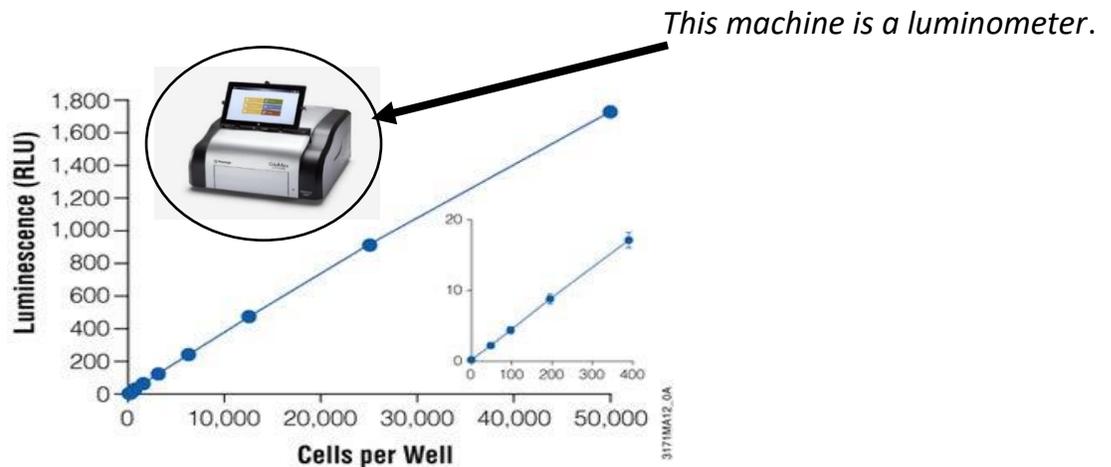
Adapted from a diagram by: TransControl at en.wikipedia  
CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=15534188>

When scientists use luciferase to track whether light is made, they use an instrument called a **luminometer**. Luminometers detect and report how much light is being produced in a small sample.

## Measuring Light to Track What Happens Inside of Cells

Here's an example:

One way that scientists use luminescence is to look at how healthy a group of cells is. When a scientist is investigating something like a new cancer drug, they want to know how much of that drug is required to kill certain cancer cells without killing other types of human cells. Light from luciferase is used to estimate the number of cells that are still alive in their experiment.



The figure above shows both a luminometer and the sort of data generated by measuring light. The data shows that the more living cells that are present in the sample, the greater amount of luminescence, measured in **Relative Light Units (RLUs)**, that is produced by those cells. The light produced in this experiment is not bright enough to see with the naked eye, so it must be measured using a luminometer.

### Luciferase Serial Dilution

For the Bioluminescence II field trip, students will make dilutions of luciferase using micropipettes. By making a gradual series of dilutions, the amount of luciferase will steadily decrease with each **serial** dilution. Students will then add **BrightGlo®** (a glow reagent) to the luciferase using a multichannel pipette. Next, students will use a luminometer to measure light output of their luciferase dilutions.

The data generated in this way will be used as a standard curve. A standard curve is a tool that researchers use to analyze their results. In the example above, a scientist could tell precisely how many cells are alive in their experiment by measuring how much light the cells are making and comparing them to the standard curve.

If you have any questions or would like more information before you bring your students to the BTC Institute, please give us a call. Alternatively, bring your questions along and we can discuss them during the lab. We look forward to seeing you and your group on your scheduled field trip day. Thank you for your interest in the BTC Institute's Biotechnology Field Trips program!