

# Biotechnology Field Trips & Scientific Inquiry

## *Background*

### Purpose Statement

At the BTC Institute, we are committed to enabling students and teachers to get into the molecular science lab, engaging their hands and minds. To this end, we are offering versions of our Biotechnology Field Trips where the focus of the experience is on using scientific inquiry to explore. Typically, the BTC Institute's Biotechnology Field Trip offerings are well-defined scientific procedures; however, some of them can be executed in such a way so that students can design and run an experiment using the molecular tools that the Field Trip features.

To prepare students to think as experimental scientists, it's important for them to understand a core set of concepts.

### Building & Running an Experiment

- **Procedure:** A **procedure** is a method; a set of instructions that can be followed to obtain a desired outcome.

Note that a **procedure** is not necessarily an **experiment**...

Think of a procedure as a recipe.

When you make a batch of pancakes, you will follow the recipe (the **procedure**). When you follow the recipe (**procedure**) to the letter, you will get a tried-and-true stack of fluffy, delicious pancakes!

... but what if your stomach drives you to explore?

- **Variable:** A variable is a single change that a scientist intentionally makes when running an experiment.

If you decide to put blueberries into the pancake batter, which wasn't in the original recipe (**procedure**), that would be considered a **variable**. Adding a variable to your pancake recipe might make you feel like you're conducting an **experiment**... but you aren't; not yet.



- **Control:** A control is an important part of an experiment where you intentionally perform a procedure and leave your variable unaltered.



Don't forget your mouth-watering 'Original Recipe' (**control**) pancakes!

## Building & Running an Experiment (continued)

- **Experiment:** An experiment is a scientific test.

Making pancakes only becomes an **experiment** if you make the pancakes both WITH and WITHOUT the change.

When a scientist designs an **experiment**, they will create a **procedure**. In our Inquiry field trips, we will use **two procedures** (one **Control** and one **Experimental**). In the **experimental procedure**, the scientist will choose one part of the **procedure** and change it. The part that is changed is called the **variable**.

By doing the **procedure** in two different ways, it allows you to say *scientifically* whether the **variable** had an effect.

For pancakes, you can compare the pancakes with the change (the **experimental** pancakes) directly to the **control** pancakes without the change.

- **Observation:** An **observation** is a detail seen and recorded by a scientist when they run an experiment.

Noticing whether your pancakes look or cook differently, or whether the pancakes taste differently WITH the **variable** compared to the **control** would be considered an **observation**.

In your kitchen, you might make a note of both the **variable** and the **observations** in your cookbook so that you remember the next time you decide to make pancakes.

Scientists record their **observations** in a laboratory notebook as a way of documenting the **experiment**.

Experimental procedures are the basic building blocks of how science is done. The purpose of scientific experiments is to explain how the world works in some way. The way that a scientist records and analyzes their observations throughout an experiment form the evidence that scientists use to explain the world *scientifically*.

## Approaching the Lab

Finally, here are some key ideas to help get into the proper mindset for the activity:

### DO:

- **Understand** the steps that you do before you do them. If you have any questions, ask!
- **Focus** on each step as you do it.
- **Observe** what you do in the lab, what happens when you do it, and WHAT YOU RECORD.

and:

- **DO NOT** pressure yourself to be perfect.
- **DO NOT** try to get the “right” answer.
- **DO NOT** focus on what others are doing or get competitive with your classmates.



*Science can be fun and tasty!*