



Process of Science

Using the experiments on the effect of bee predators on bee feeding behavior as a model

There is no single one way that scientists study the natural world, but **there is a general process that most scientists use.**

Key Elements in the Process of Science Are:

1. **Observations**
2. **Questions**
3. **Hypotheses**
4. **Predictions**
5. **Tests/ Experiments**
6. **Communicating**

Most people get **hypotheses** and **predictions** confused.

- ▶ **Hypothesis: A tentative explanation for a natural phenomenon.**
- ▶ **Prediction: A forecasted outcome of an event based on evidence or a hypothesis.**

Using Our Bee Experiment As a Model

- ▶ Jesse **observes** that bees as a group will avoid areas where there are predators.
- ▶ So, she **questions**: Why do bees avoid areas with predators?
- ▶ She **hypothesizes**:
 1. Maybe because bees can smell when a bee dies, and avoid these areas.
 2. Maybe because bees can see large predators, and avoid these areas.
 3. Maybe bees can smell the odors of predators

Making Predictions

Scientists use **deductive reasoning** to predict the results of new observations and experiments.

Deductive reasoning follows:
an "ifand.... then" logic.

- ▶ **If our hypothesis is correct, and we test it, then we can expect a particular outcome.**

Let's Use Our First Hypothesis

- ▶ Jesse **observes** that bees as a group will avoid areas where there are predators.
- ▶ So, she **questions**: Why do bees avoid areas with predators?
- ▶ She **hypothesizes**:
 ▶ Maybe because bees can smell when a bee dies, and avoid these areas.
- 2. Maybe because bees can see large predators, and avoid these areas.
- 3. Maybe bees can smell the pheromones of the predators

Making Our Own "If...and...then" Statement

- ▶ **If** the bees avoid predators because bees can smell when a bee dies, and avoid these areas,
 ▶ **question and hypothesis** ↑
- ▶ **And** we have two feeding dishes and put a smashed bee on a filter paper next to one feeding dish,
 ▶ **experiment** ↑
- ▶ **Then** the bees should avoid the feeding dish with the smashed bee.

prediction ↑

Qualities of a Good Experiment

It is **controlled**.

- ▶ There are two parallel test groups
- ▶ The variable of interest is changed in one group (the test group), but everything else remains the same.
- ▶ **Sample size**

Now you design your own experiment

1. Generate three hypotheses
2. Choose a hypothesis
3. Write an If...and...then statement for your hypothesis.

Review the experiments

- ▶ Does the experiment match the hypothesis?
- ▶ Does the prediction match the experiment?