



## 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 "if ....and.... 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?