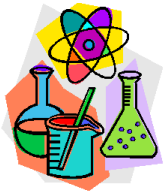
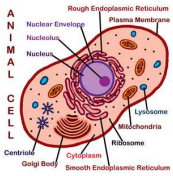
What is a Science?

The word *science* can be used in different ways and contexts such as the following:

Scientific Knowledge: As a body of scientific knowledge or content in disciplines such as





- physics
- chemistry
- metallurgy
- geology
- astronomy
- biology
- medicine
- or psychology.

Scientist: As an occupation, an individual who practices, applies or studies the sciences.

Scientific Process: As a process or method for <u>systematically</u>* investigating and testing claims or beliefs about nature. When scientists make a claim, they go conduct experiments and/or observe the world around them to collect empirical data to support or refute their claim.

Scientific claims need to be <u>falsifiable</u> and empirically <u>testable</u>. Scientific knowledge should be consistent with what is known (unified).

Testing Claims

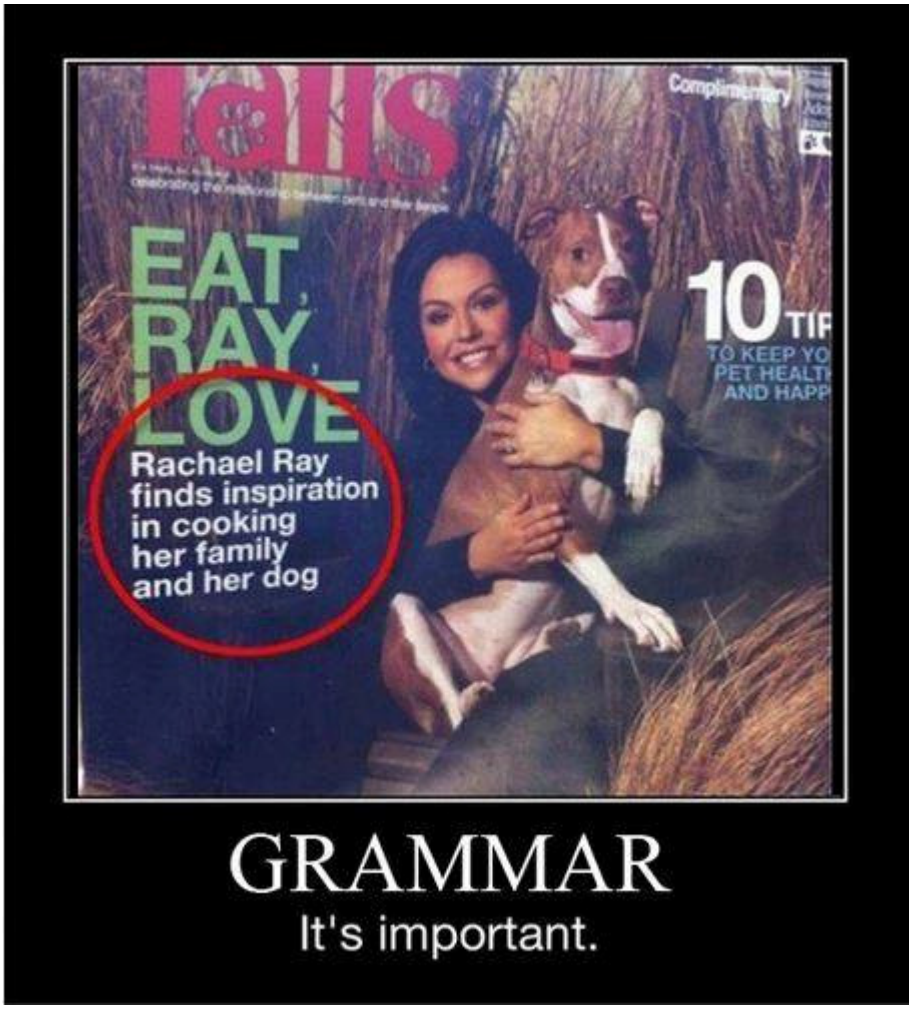
One of the great strengths of science is the collection of data (empirical evidence) to test claims and answer questions. However, several questions may look alike but may be quite different.

For example,

Question 1:
You have flipped a coin and gotten 5 heads. What are the odds the 6th flip of the coin is heads?

Question 2:
What are the odds of flipping a coin and getting 6 heads in a row?

Attention and Being Precise



Attention and Being Precise

Movie Theater Plays Wrong Guardians Movie Three Times In a Row

Fans eager to see Guardians of the Galaxy got a disappointing surprise at a Regal Cinemas this week. The debut-seeking crowd watched in horror as the screen before them played the open scene not of the badass comic-based movie, but of 2012's Dreamworks kids flick, Rise of the Guardians. Not the same!

Newspaper celebrates MLB's first amphibious pitcher
By Bill Hanstock □ @sundownmotel on Jun 8, 2015, 6:49p

Testing Claims: Hypotheses

To discover information about the natural world, scientists make a specific prediction about some phenomena—they generate a hypothesis.

- Hypothesis: A testable prediction, often implied by a theory (page 26). Often it is a specific and tentative statement about the relationship between two variables.

Usually, a hypothesis is a specific prediction about some phenomena. A hypothesis often takes the form of an "if-then" statement.

Hypotheses can be generated from theories—our understanding of the world around us. People often use the word "theory", when they mean hypothesis

- Theory: An explanation using an integrated sense of principles that organizes observations and predicts behaviors or events (page 26).

Examples of hypotheses:

1. If we make cars more fuel efficient, then it will make them less safe.
2. If we have our employees wear backbelts, then we can reduce the number of workplace injuries
3. Driving while using a hands-free cell phone increases the risk of accidents
4. Drug testing reduces workplace accident.
5. Negative emotions (anxiety, fear, and anger) decreases creativity and critical thinking while increasing selfishness.

Examples of non-hypotheses:

6. If you go to the bar, I will divorce you

There are no variables that vary naturally. This is more of a contingency statement, not a prediction. If it were, the hypothesis would be people who go to bars are more likely to get divorced.

Testing claims: Data (Empirical Evidence)

Once a scientist has a hypothesis and operationally defined their variables, the hypothesis must be tested, and data (empirical evidence) collected.

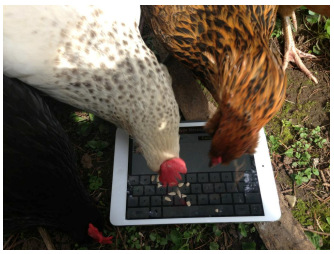
A testable hypothesis is one that can be assessed. When assessing a hypothesis, scientists rely on the collection of data (empirical evidence) to assess claims (think mythbusters).

Data (Empirical evidence):
Measurable outcomes of research studies (page 34).

The belief that dogs dream, but can't tell the difference between dreams and reality isn't testable and empirical evidence cannot be collect to support or dispute the claim.

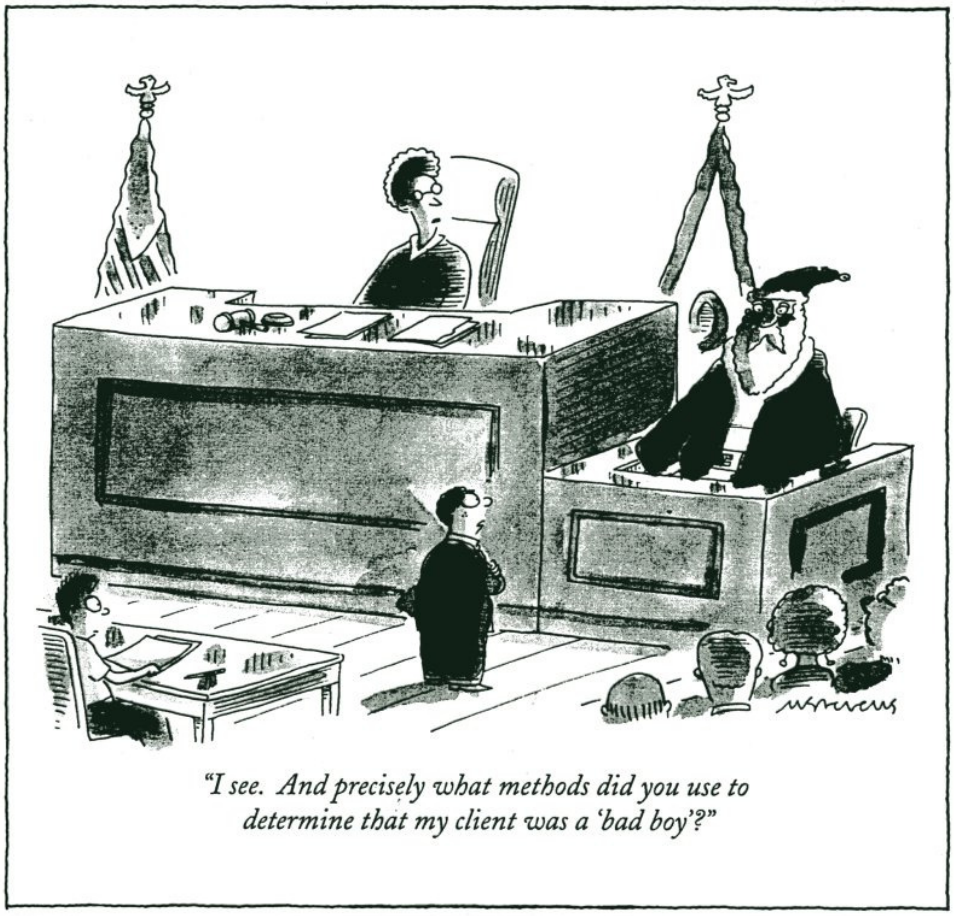
Apply the idea of empirical evidence to these hypotheses:

- If we make cars more fuel efficient, then it will make them less safe.
- If we have our employees wear backbelts, then we can reduce the number of workplace injuries.
- Driving while using a hands-free cell phone increases the risk of accidents
- Drug testing reduces workplace accident.
- Can chicken's activate an iPad?
- Magnets ruin credit cards.
- 3- person samurai sword
- Carts that lock the wheels when leaving the parking lot



Testing claims: Operational Definitions

When the scientist tests the claim or hypothesis, they must operationally define (page 26) the variables. An operational definition is a carefully worded statement of the exact procedures (operations) used in a research study. In other words, a relatively precise description of how the variable or concept in a study will be manipulated, measured or identified. These definitions should be such that they could be assessed by anyone and produce similar results.



"I see. And precisely what methods did you use to determine that my client was a 'bad boy'?"

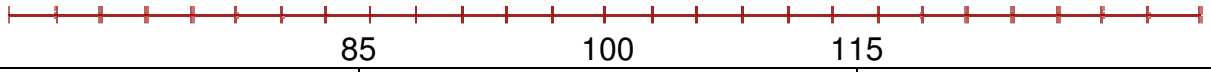
Image source: unknown

A “bad boy” means different things to different people. We need to define it in a way that we are using consistent definitions that allow us to identify “bad boys”.

Testing claims: Operational Definitions

Examples of operational definitions:

- **Intelligence** is operationally defined as a score in the WAIS (Wechsler Adult Intelligence Scale).



Below average intelligence	Normal intelligence	Above average intelligence

- An **unsafe driver** is a driver who has gotten into 3 accidents within a one-year span.
- An **Oregon citizen** is one who has lived in Oregon for 3 months.
- The executive branch of the federal government wants to operationally define "fast food" jobs as "**manufacturing jobs**" (why?).
- Use of **inappropriate language**
- A **serving size** is defined as…
- A person who displays most of the symptoms of major depression (see Chapter 15) for two or more weeks is considered to have a **major depressive disorder** (compared to normal depression)
- **A conformist** is someone who…
- **A team player** is someone who…

If you don't have operational definitions, you run into problems such as the following results:

- 60% of surveyed high school students rated themselves in the top 10%
- 25% rated themselves in the top 1%

They used different operational definitions of what is best, such as math, sports, music, art, glee club, social friends

Testing claims: Operational Definitions

Image source: Classics of Western Literature, Bloom County 1986-1989, (1990), Berke Breathed

Taco Bell: What constitutes beef?
Subways: What is a foot-long sandwich?