

Scientific Models

What is a scientific model?

A model is a **representation of an object or system**.

Models are used in science to help explain how something works or to describe how something is structured.

Models can also be used to make predictions or explain observations.

Models are never exactly like the real thing.

What are benefits and limitations of scientific models?

Scientific models are useful because they can represent things that are very small, large, complicated, things that no longer exist or that don't actually have a physical representation other than as an idea.

Examples: dinosaurs, a cell, natural selection

Through modeling, scientists may even discover things they haven't thought of before.

Example: recreating dinosaurs through fossils helps scientists better understand them

Models can even be a type of **hypothesis** that can be tested.

Example: "concept" car

Three basic types of models:

Physical: Models that are meant to look like the thing that they are representing.

Examples: toy rocket or plastic skeleton

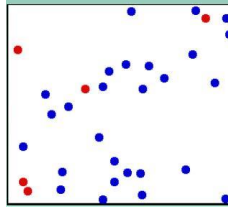
Mathematical: Models that are made up of numbers, equations, or other forms of data.

Example: Punnett Square

Conceptual: Models that represent systems of ideas or compare unfamiliar things with familiar things

Examples: Cell Theory, Evolution.

Models are of central importance in all of science.



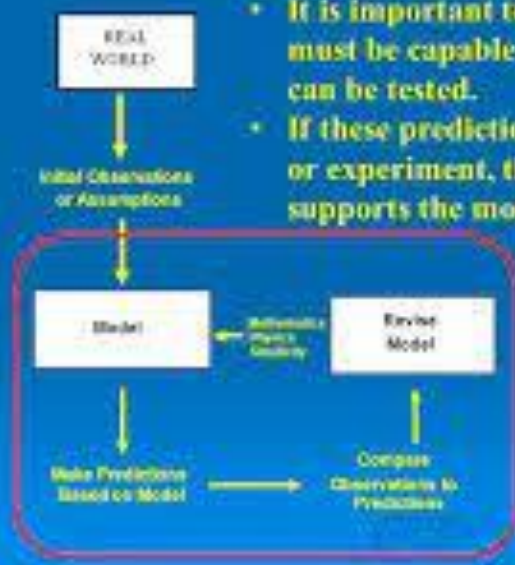
Examples, such as the billiard ball model of a gas (left), the Bohr model of the atom (link below), Quantum Theory, the double helix model of DNA, and the Theory of Evolution are only a small part of the larger group of ideas and presentations that are called "Scientific Modeling".

How to Build an Atom

<http://phet.colorado.edu/en/simulation/build-an-atom>

Developing a Scientific Model

This is where the scientific method comes in!



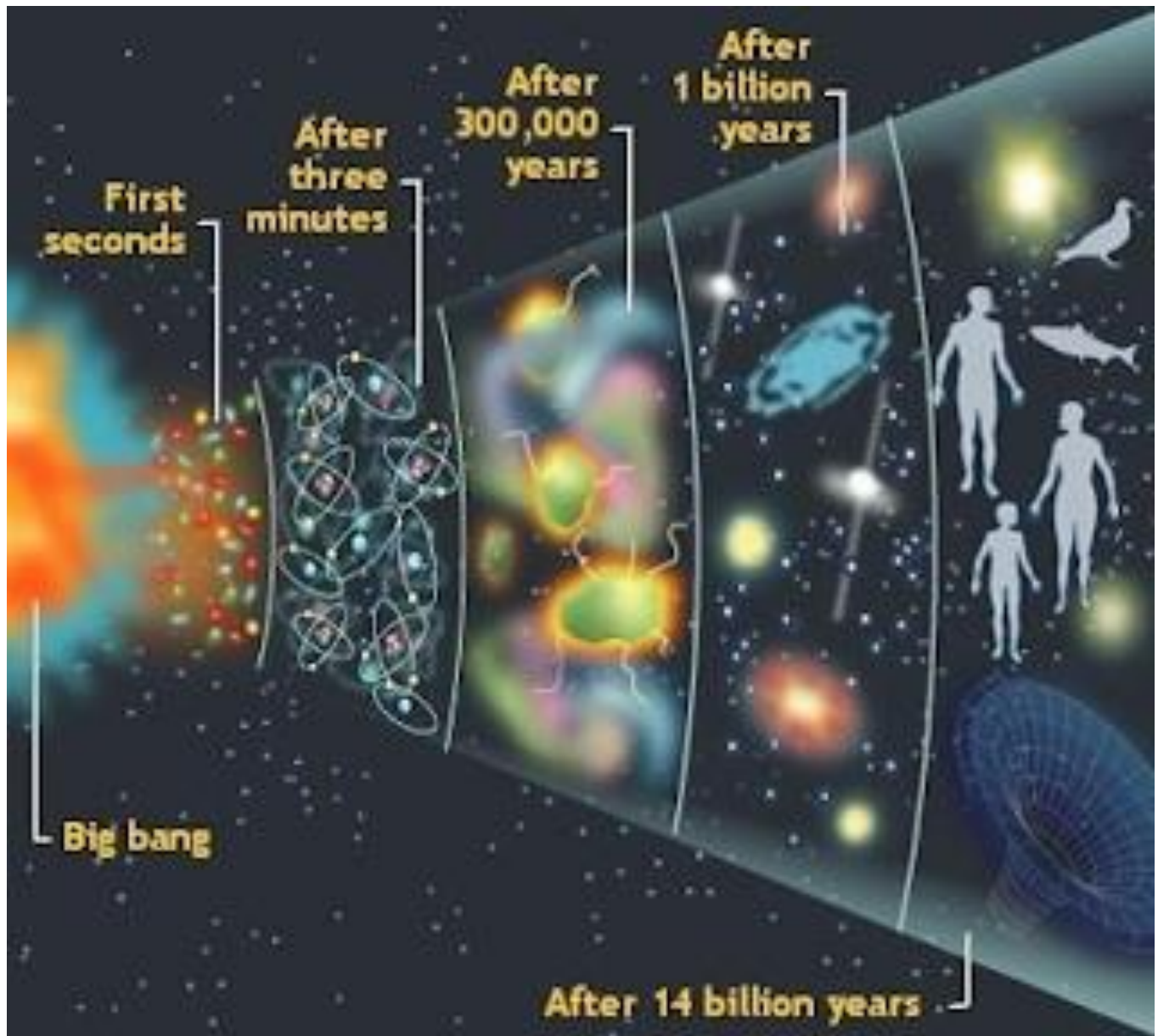
- It is important to understand, that any model must be capable of producing predictions that can be tested.
- If these predictions are verified by observation or experiment, this gives evidence that supports the model.

- If these predictions are shown to be false then the model **MUST** be revised!!!
- If it can't be revised, then it **MUST** be thrown out!!!!

Example

The Big Bang theory describes the evolution of our universe from its very beginning to its fate in the very distant future. It attempts to account for the current behavior of our universe and what we observe.

One conceptual model of the Big Bang is shown below.



Mathematical models of the Big Bang also exist. They are quite involved integrating many concepts of physics and astrophysics intertwined with complex mathematics.