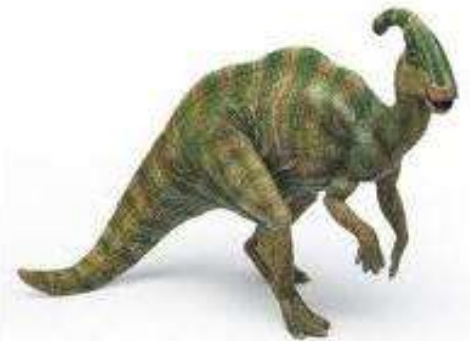# Section 1.3 pg.16-19 Objectives

- **Give** examples of three types of models.

- **Identify** the benefits and limitations of models.

- **Compare** the ways that scientists use hypotheses, theories, and laws.
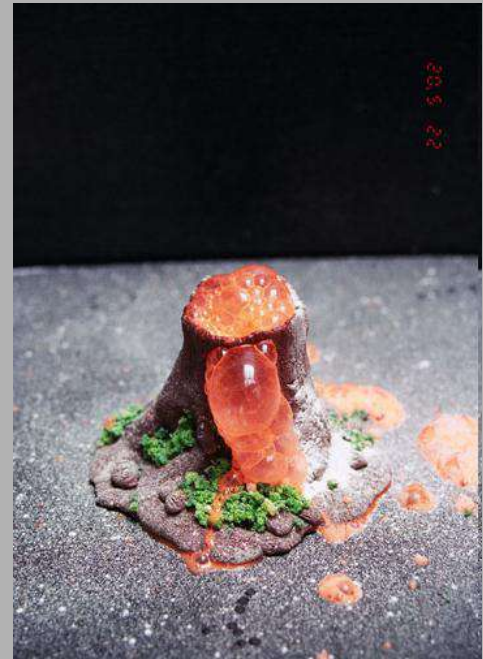
TOYS AS MODELS

HOW ARE THESE TOYS SIMILAR TO THE OBJECTS THEY REPRESENT AND HOW ARE THEY DIFFERENT?

I. Types of Scientific Models

A. Physical Models Physical models, such as miniature volcanoes and steam engines, look like the thing that they model.
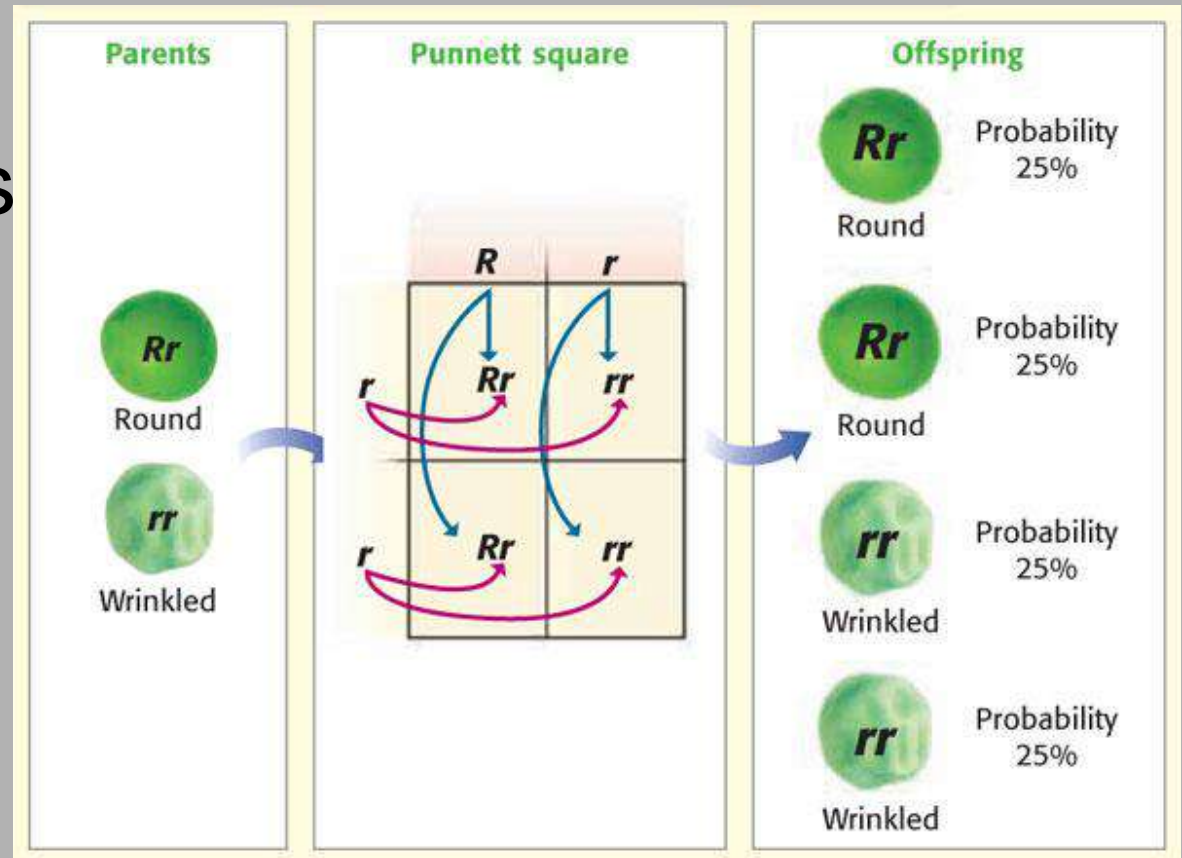

B. Mathematical Models A mathematical model may be made up of numbers, equations, and other forms of data. Charts and graphs are examples of mathematical models.

USA Ratios of Debt and Money to Base Money
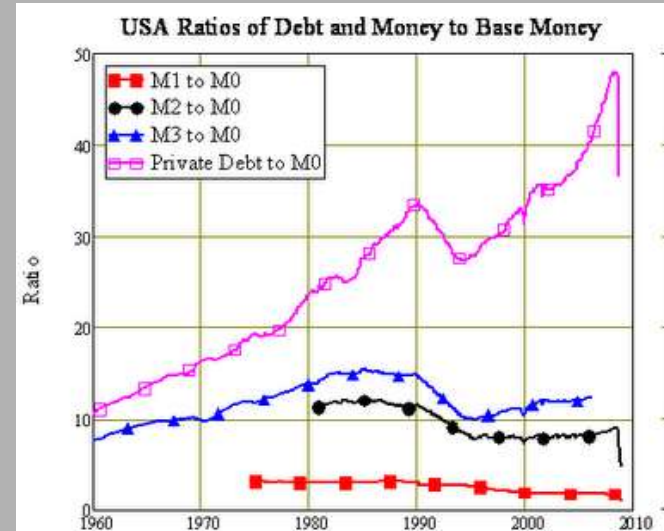
Mathematical Model: A Punnett Square

- The Punnett square helps scientists study the passing of traits from parents to offspring.

Critical Thinking Time!

- Red flowers are dominant to white flowers.

- Create a Punnett square showing a cross between a homozygous white flower and a heterozygous red flower. Use the letter R.

- What is the genotype of the offspring in the lower right hand box.

- What is the ratio of red and white plants?

- What is the probability of the offspring being white? Express in a percentage.

Guess the type of model

LIBOR dollar rate half-yearly
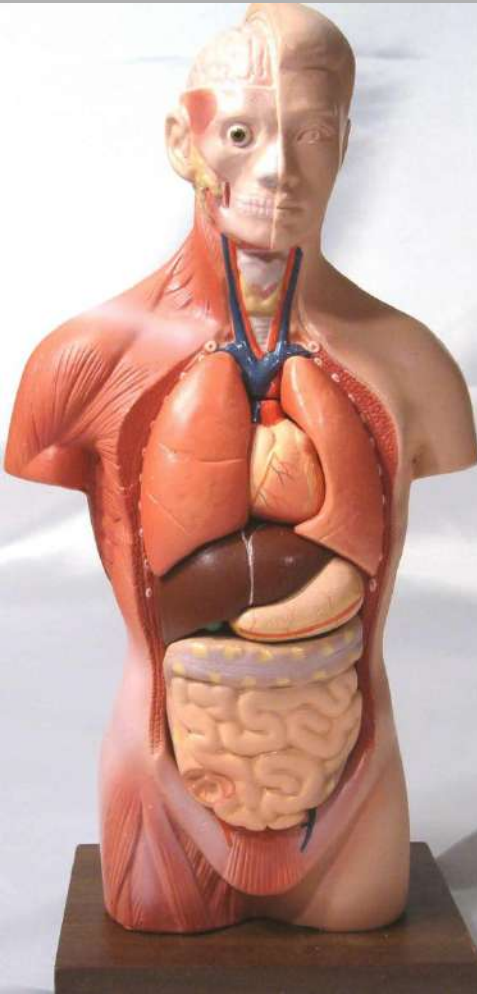
$$\varphi_T = \frac{Id}{4\pi\sigma}\left[\frac{H-h}{r_1^3} + \frac{H-h}{r_1'^3} + \frac{H+h}{r_2^3} \right.$$

$$\left. + \frac{H+h}{r_2'^3} + \frac{H-h}{r_{11}'^3} + \frac{H+h}{r_{22}'^3} \right]$$

$$\text{where} \quad r_1 = \left((H-h)^2 + s^2 + (x)^2 \right)^{1/2};$$

$$r_1' = \left((H-h)^2 + s^2 + (x-m)^2 \right)^{1/2};$$

$$r_2 = \left((H+h)^2 + s^2 + (x)^2 \right)^{1/2};$$

$$r_2' = \left((H+h)^2 + s^2 + (x)^2 \right)^{1/2};$$

$$r_{11}' = \left((H-h)^2 + s^2 + (x-(m)^2)^2 \right)^{1/2};$$

$$r_{22}' = \left((H+h)^2 + s^2 + (x-(m+m))^2 \right)^{1/2};$$

Tacoma Narrows Bridge

On November 7, 1940, at approximately 11:00 AM, the first Tacoma Narrows suspension bridge collapsed due to wind-induced vibrations. The bridge was across the Tacoma Narrows in Puget Sound near the city of Tacoma, Washington. It had only been open for traffic a few months. As the wind began to increase the bridge began to sway and this slowly became worse until the middle span of the bridge fell apart.

This photograph shows the twisting motion of the centre span just before the structure failed..

Note: the only death as a result of this bridge collapsing was a dog left in the car in the middle of the bridge. The dog was abandoned by its owner who fled to safety.

Scientists had to use mathematical models and scale models of the bridge to determine the cause of the accident. Their work led to better construction guidelines and safer bridges.
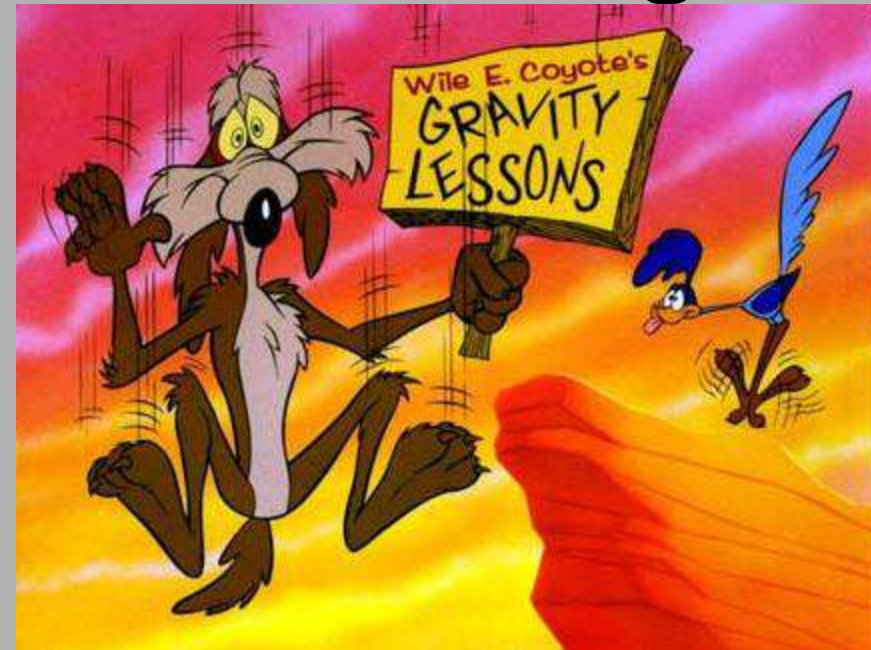
Types of Scientific Models

C. Conceptual Models Conceptual models are systems of ideas or comparisons of unfamiliar things with familiar things to help explain unfamiliar ideas.
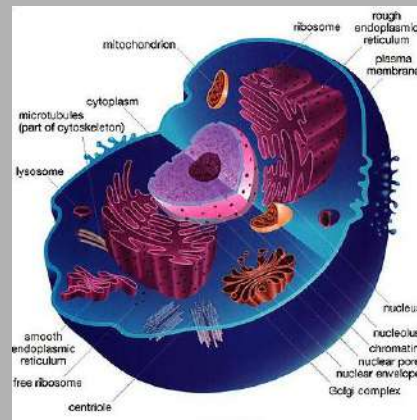
II. Building Scientific Knowledge

A. Scientific Theories An explanation that ties together many related observations, facts, and tested hypotheses is called a theory.

B. Scientific Laws A scientific law is a statement of what *will* happen in a specific situation. A law tells you how things work.

C. Scientific Change If new evidence challenges an accepted idea, scientists must reexamine the old evidence and reevaluate old idea.

Wile E. Coyote's GRAVITY LESSONS

Puds didn't CARE what the law of gravity said

He wasn't getting his paws wet

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rough endoplasmic reticulum
ribosome
mitochondrion
plasma membrane
cytoplasm
microtubules (part of cytoskeleton)
lysosome
nucleus
nucleolus
chromatin
nuclear pore
nuclear envelope
Golgi complex
smooth endoplasmic reticulum
free ribosome
centriole

Critical Thinking Time!

- Classify Shoes.

Classify Sports

Create a visual organizer to classify the following sports.

1. Basketball
2. Football
3. Soccer
4. Golf
5. Cheerleading
6. Baseball
7. Swimming

Then write a paragraph explaining how you separated them into groups.