

# Bellwork

1. On your own, define *allometry* and provide an example
2. Working with a partner, discuss your examples and make sure that you understand the concept
3. Working with your partner, choose your favorite example and prepare to share!

# Allometry: Where Biology Meets Math

1. Work with rational exponents
2. Solve logarithmic equations

# Allometry

- The relationship of organisms' size and shape
- Allometry is studied during the growth of a single organism; as a comparison between different organisms of the same species; and between organisms in different species
- Relates biological functions as they increase as a power of body size

$$Y = Y_0 M^b$$

Where:

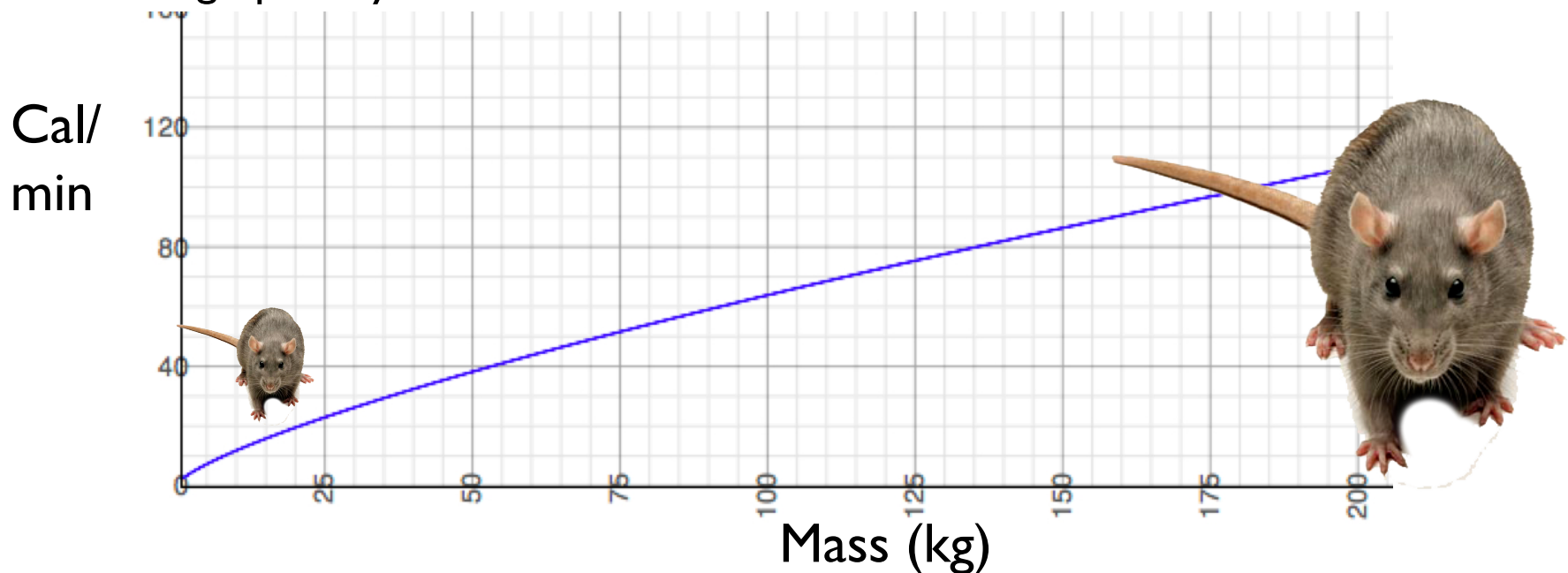
- $Y_0$  is a constant for a given metabolic process of a given species
- And  $M$  is the body mass
- And  $b$  is a rational exponent (typically  $3/4$ )
- And  $Y$  is the resulting metabolic rate as a function of mass

$$Y=2M^{3/4}$$

A packrat burns energy (calories/minute) according to the allometric function above (graphed below).

[1] How many calories does a 1 kg rat expend as he gnaws on the wires of your truck for one minute?

[2] Now assume that his Uncle Willard, a rat visiting from New York, burns 100 calories chewing on the same wire for a minute. How big is Uncle Willard?  
Confirm graphically.

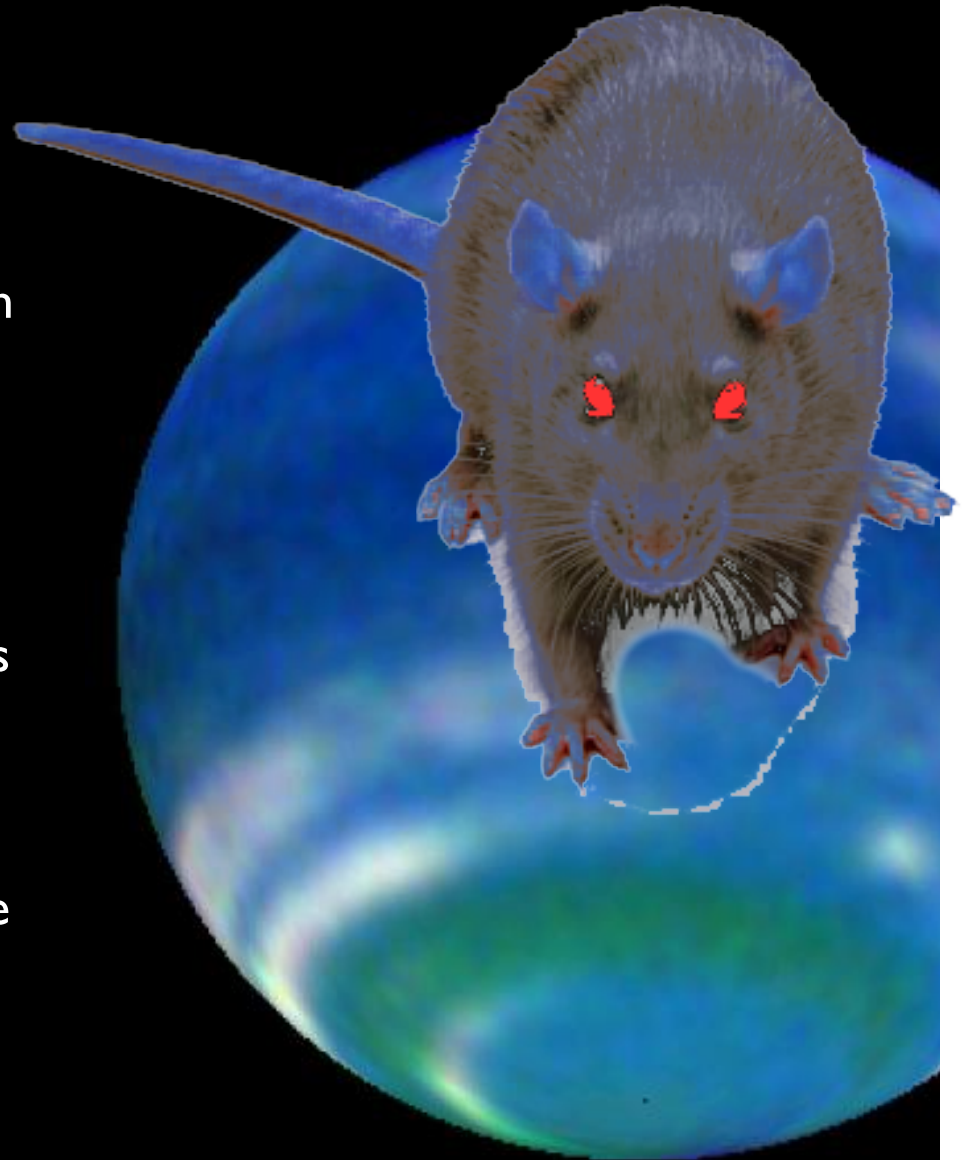


# Killer Alien Rats of Xod

As one might expect, on the distant planet Xod, the allometric equation is different. The exponent  $b$  is not  $3/4$  as on Planet Earth. In fact, the killer Xodian rats' mass-metabolism relationship is governed by:

$$Y_0 = eM^b$$

If a 100 kg Xodian rat burns 500 calories in the 5 minutes that it takes her to chew the wires of your spaceship, what is the exponential constant  $b$  of Xodian allometry? (Assume a constant burn rate as she gnaws your wires into oblivion).



# Closure

Think silently and be ready to discuss:

[1] How do you recognize an equation that must be solved using logarithms?

[2] Express the following in radical form:

$$A^{(m/n)}$$

# Assignment

Devise and solve two allometric word problems, and be ready to present to the class:

[1] Includes an equation that must be solved using logarithms

[2] Can be solved without logs

Graph the allometric relationship of both scenarios, and confirm your solutions graphically.