MAT 0012 and BSC 1086 Module

Topic: Calculating unit conversions, unit rates for metabolic rate and nerve conduction velocity

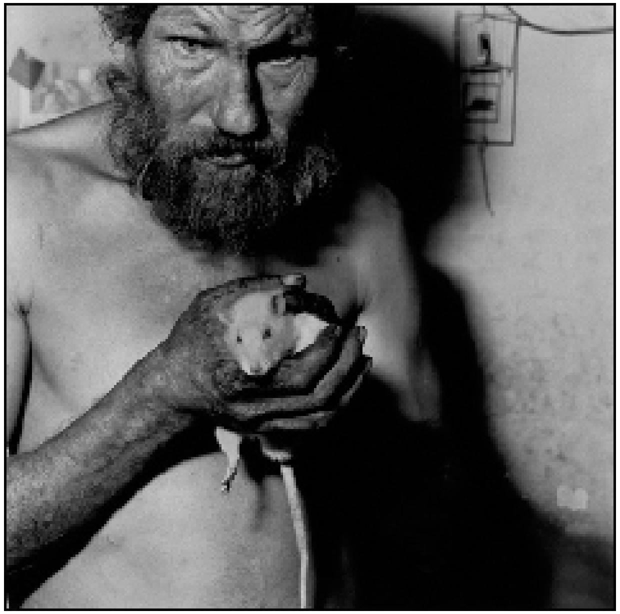
Math lesson – Lesson on units conversion (g → kg) and calculating a unit rate and a normalized unit rate of metabolism of an organism (milliliters (ml) oxygen (O_2) consumed per hr per kilogram (kg) body weight).

Real World Application – Determining normalized basal metabolic rate (BMR) of a laboratory rat (small) vs. a human.

Why - BMR is measure of an animal or human's metabolism. It can be affected by hormones, environmental conditions (hot or cold), nutrition, or illness. It is often monitored in patients.

BMR Definition – O_2 consumed (in ml)/hr /kg body weight. O_2 consumed by an animal is a measure of its metabolism.

Goal - teach students to convert units and calculate a unit rate that applies to biology and physiology of humans.



Problem 1– Which has a higher Basal Metabolic Rate (BMR) in ml/hr/kg: a rat or a human? First change each unit to match (minutes to hours, for example), then find the "unit rate" or BMR.

If a rat consumes 6 ml O_2 in one minute and weighs 243 g, what is its BMR?

If a human consumes 80 ml O_2/breath and breathes 15 breaths/min and weighs 70 kg, what is his BMR?

What does converting each to the unit rate allow us to do?

Which animal has the higher BMR? In general as a creature gets larger its BMR gets _______________.

For fun, which do you suppose would get cold faster if it jumped into a vat of cold milk? (Which would lose heat faster?) In general we can say then that, the more quickly an animal loses heat the _________ the BMR needs to be. (Now remember this when you have Anatomy and Physiology!)

Follow up problem – comparing nerve velocity (how fast a nerve signal travels) in different nerves.
Definition - time of conduction - time for a nerve signal to traverse the length of the nerve.

One has 3 nerves of different lengths – 10 millimeters, 20 millimeters, and 30 millimeters (mm). You measure the time of conduction for these 3 nerves and get 0.14 milliseconds (ms), 1 ms, and 6 ms, respectively. Calculate the nerve conduction velocity of these three nerves in meters per sec (m/s).