Metabolism, RQ, and Power Problems[i]

Biology 390 -- Physiology

1. Calculate the RQ for the aerobic metabolism of ethanol, CH_3CH_2OH.

2. Suppose that a migrating Monarch butterfly has a mass-specific oxygen consumption of 10 $ml O_2\ g^{-1}\ h^{-1}$ and it is using stores of fat as fuel since there are no flowers.

(a) Calculate its $\dot{V}_{CO_2}$.

(b) Calculate its mass-specific power (watts g^{-1}) (see table of RQ energy equivalents). *For the purpose of practice, I urge you to make the calculation using the Kcal equivalent of O_2, not the KJ equivalent.*

(c) Suppose that the costs of flight are always constant but that now the Monarch is able to feed on flowers and its RQ shifts to 1.0. What is its $\dot{V}_{O_2}$? $\dot{V}_{CO_2}$? (keep all of these mass specific). *For the purpose of practice, I urge you to make the calculation using the Kcal equivalent of O_2, not the KJ equivalent.*

3. A typical value of $\dot{V}_{O_2}$ for a resting adult human is 220 ml O_2 min^{-1}. Calculate her $\dot{M}_{O_2}$.

4. A running tarantula used a total amount of oxygen during its run of 22.4 ml O_2.
At the start of the exercise, it had a total body d-lactic acid concentration of 1 millimols; at the finish of exercise the total body lactate was 11 millimols.

> How many total mols of ~P were synthesized during the exercise?
> What proportion of this animal's exercise was fueled by anaerobic metabolism?
> How many mols of glucose were converted to lactate during the exercise?
> How many mols of glucose were burned aerobically?

To do this problem, assume that all hexose comes from glycogen. Look in packet #3 to find the net energetic yields of ~P for each process starting with glycogen.