

## RQ and Power Problems

### Animal Physiology

1. Calculate the RQ for the aerobic metabolism of ethanol,  $\text{CH}_3\text{CH}_2\text{OH}$ .
2. Suppose that a migrating Monarch butterfly has a mass-specific oxygen consumption of  $10 \text{ mlO}_2 \text{ g}^{-1} \text{ h}^{-1}$  and it is using stores of fat as fuel since there are no flowers.

(a) Calculate its  $\dot{V}_{\text{CO}_2}$ .

(b) Calculate its mass-specific power (watts  $\text{g}^{-1}$ ) (see table of RQ energy equivalents).

*For the purpose of practice, I urge you to make the calculation using the Kcal equivalent of  $\text{O}_2$ , 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  $\dot{V}_{\text{O}_2}$ ?  $\dot{V}_{\text{CO}_2}$ ? (keep all of these mass specific). *For the purpose of practice, I urge you to make the calculation using the Kcal equivalent of  $\text{O}_2$ , not the KJ equivalent.*

3. A typical value of  $\dot{V}_{\text{O}_2}$  for a resting adult human is  $220 \text{ ml O}_2 \text{ min}^{-1}$ . Calculate her  $\dot{M}_{\text{O}_2}$ .

4. A running tarantula used a total amount of oxygen during its run of  $22.4 \text{ ml O}_2$ . 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  $\sim\text{P}$  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  $\sim\text{P}$  for each process starting with glycogen.