

Discussion Week 7a

Animal Physiology

Discussion Questions and Reading Assignments

Practice Problem for Gut Design: A predator consumes food with the following composition: 1% carbs, 20% protein, 5% fat, 67% water, and 7% indigestibles (bones, fur, etc.). If it has a DMR of 1200kJ/day, will it gain weight if it eats 200g of food? (assume a 90% assimilation efficiency)

Write out the answers properly, with all equations, units, parameter values, and assumptions

First calculate the Energy Density of the food (how many kJ/g — see info in Supplement 4-1):

How many g of food does it need to *assimilate* to support DMR?

How many g of food does it need to *consume* to support DMR?

Will it gain weight?

How many moles of each nutrient type needs to be transported?

Which nutrient type is going to limit the absorption rate?

The average density of carbohydrate and protein transporters in the gut is given in Supplement 18-1. Using this info, calculate the nominal surface area of the gut required to absorb the daily food requirement.

Make an assumption about gut diameter and calculate the gut length:

Maximal attainable body size

Read the article Clauss et al 2003 - find under "Supplemental Readings" tab on website.

1. What is the central argument of the paper? How do herbivores get larger in size? (i.e., how do they eat more food or increase digestive efficiency?) Why would there be different limits on maximal body size for foregut versus hindgut fermentors? (food quality, rate of passage, intake, limits on digestion)

 2. What is the Jarman-Bell Principle? What is a reason to doubt it? If not true, what would it imply?

 3. How do elephants deviate from the expected pattern discussed in (1)? Why is it so weird?

 4. What is the evidence for limits on digestion (hindgut ingesta passage rate, ruminant capacity, passage rate, intake rate, etc)

 5. What is so interesting about the examples at the end of the article (discuss as many as you can)? For example, why are macropod marsupials an interesting exception? What significance does the fact that they are independently evolved have to do with it?
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