Some Irreverent Thoughts about Dinosaur Metabolic Physiology: Jurisphagous Food Consumption Rates of *Tyrannosaurus rex*

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It is agreed by all living humans that the highlight of the movie *Jurassic Park* (Universal Studios, 1993) was the consumption of the lawyer by the true hero of the movie, *Tyrannosaurus rex*. This brings up an obvious question: How many lawyers would it take to properly feed a captive *T. rex?* Fortunately science has now progressed to the point where this important question can be answered—and plans made accordingly.

Two pieces of information are needed:

(A) The food requirements of a *T. rex* for one year

(B) The food value of one lawyer

Following the way that it was portrayed in *Jurassic Park*, let us first assume that our *T. rex* is endothermic. Let us also assume that our tyrannosaur weighs 10,000 pounds (4540 kg)—perhaps a bit on the light side (Farlow et al. 1995), but close enough.

Farlow (1990; see Farlow 1976 for details about the data used) published an equation relating the food consumption rate (in watts, or joules/second; that is, the amount of food energy needed per unit time) to body mass (in kilograms) in living endotherms (mammals and birds):

$$\text{consumption rate} = 10.96 \times \text{body mass}^{0.70}$$

For a 4540-kilogram *T. rex*, the equation predicts an average food consumption rate of 3978.8 joules/second. Because we are interested in the time span of one year, we must now multiply this result by 3.1536×10^7, which is the number of seconds in one year (that is, 60 seconds/minute $\times$ 60 minutes/hour $\times$ 24 hours/day $\times$ 365 days/year—unless you are watching golf on TV, in which case this number is much higher), to give us the tyrannosaur's energy needs in joules/year. This results in a big number: 1.2547×10^{11} joules/year.

This gives us the first part of what we need to know in order to begin rounding up enough lawyers to keep our dinosaur content. We must now calculate the energy value of one lawyer.

There are three components of the food value, in joules, of one lawyer: (1) the energy value (in joules) of 1 kilogram of lawyer flesh; (2) the number of kilograms (mass) in our sacrificial lawyer; (3) the digestive percentage, or assimilation efficiency, of a carnivore digesting meat—in the present case, this is the percentage of the lawyer that actually has food value. (We assume that clothing, briefcase, cellular phone, and pocket organizer have no energy value, and so these components of an operational lawyer will be ignored in our calculations.)

We assume that the energy value of lawyer meat, like that of other animals, is 7×10^6 joules/kilogram (Peters 1983). We further assume that our lawyer weighs 150 pounds, or 68.1 kilograms.

The assimilation efficiency of carnivores eating meat is about 90 percent (Golley 1960; this is much higher than for herbivores feeding on high-fiber forage—as presumably was the case for most herbivorous dinosaurs; see Tiffney, chap. 25 of this volume).

The energy value of a single lawyer can now be calculated as

$$68.1 \text{ kg} \times (7 \times 10^6 \text{ joules/kg}) \times 0.9 = 4.2903 \times 10^8 \text{ joules}$$

By dividing the yearly energy requirements of our *T. rex* by the energy value of a single lawyer, we get the yearly lawyer consumption that our dinosaur would need:

$$(1.2547 \times 10^{11} \text{ joules/year})/(4.2903 \times 10^8 \text{ joules/lawyer}) = 292 \text{ lawyers/year}$$

The calculations are the same if we assume that our tyrannosaur was an ectotherm, except that we must use an equation relating food consumption rate to body mass in reptiles and amphibians (Farlow 1990; same units as for endotherms):

$$\text{consumption rate} = 0.84 \times \text{mass}^{0.84}$$

For a 4540-kilogram *T. rex*, this equation predicts a feeding rate of 991.3 watts, which works out to 73 lawyers per year.

We can see, then, that genetically resurrected tyrannosaurs would have a far greater predatory impact on the lawyer population if they were endotherms than if they were ectotherms. This is perhaps a good reason for hoping that dinosaurs will turn out to have been endotherms.

References

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