Re: Body Temperature

Source: http://sci.tech−archive.net/Archive/sci.med/2004−07/0122.html

---

From: Steve Harris sbharris_at_ROMAN9.netcom.com (*sbharris_at_ix.netcom.com*)
Date: 07/03/04

Date: 2 Jul 2004 23:05:06 −0700

bae@cs.toronto.no−uce.edu.yyz wrote in message news:<2004Jun30.111210.13021@jarvis.cs.toronto.edu>...

> Still, we seem to routinely live several times longer than other mammals
> of comparable size under comparably good conditions.

COMMENT:

Yes. The number you're really looking WRT aging is specific metabolic rate multiplied by maximum life span. That gives you a "calories/joules per gram per lifetime" number. More than a hundred years ago Perls noticed that this number is (very) roughly the same for all mammals. It's pretty close to the same for mice and elephants, for example−− mice have 20 times the specific metabolic rate (specific means "per gram") that elephants do, but they live 3 years max instead of 60, so it works out the same number for each. An elephant−load of mice burn an elephant lifetime of food in only 3 years. Mice run very hot, because they need to keep warm and have a poor surface volume ratio, like everything small.

Not surprisingly, except in shrews (which have hit the heartrate limit), mammalian heartrate scales according to specific metabolic rate. So mice have 20 times the elephant's 30 bpm heart rate, and that gives both species the same number of heartbeats per lifetime.

A few species are way off this heartbeat calorie burned per life span curve. Humans get up to 3 times the number of calories per gram and heartbeats that elephants and mice do. Capuchin monkeys do nearly as well has humans.

Clearly, metabolic rate itself in placental mammals is a surface/volume thing, so it scales roughly as the 2/3 power of body weight (actually more like 3/4 for some reason−− probably having to do with nature economizing on calories by fooling around with hair length). So the max calorie per lifetime limit generally makes large mammals live longer. [Specific metabolic rate is divided by weight, so it generally scales as 3/4 −1 = −1/4 power of size. A mouse weighs 30 g and a human 60 kg, with the ratio 1/2000. Raise that to the −.25 power and you get 6.7, which is about the right ratio of specific

metabolic rates].

Big exceptions to the rule are primates like capuchins and humans, and we both have very large brain/body wt ratios. So evidentally large brains are such a good evolutionary trick against predation that it's worth it for evolution to spend time repairing us, and thus we age more slowly metabolically and get 3 billion heartbeats in a lifetime, instead of the standard billion for mice, cats, cows, etc.

An