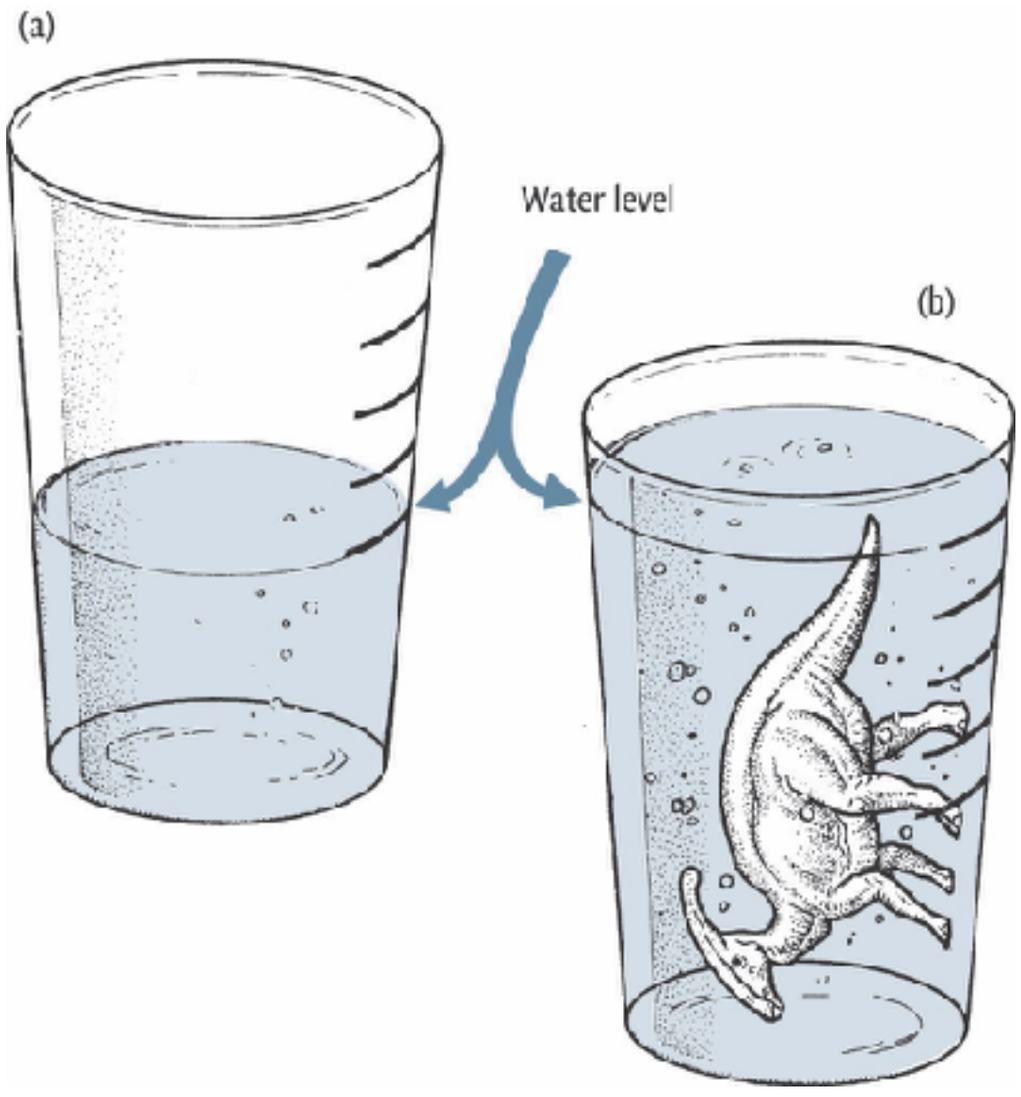
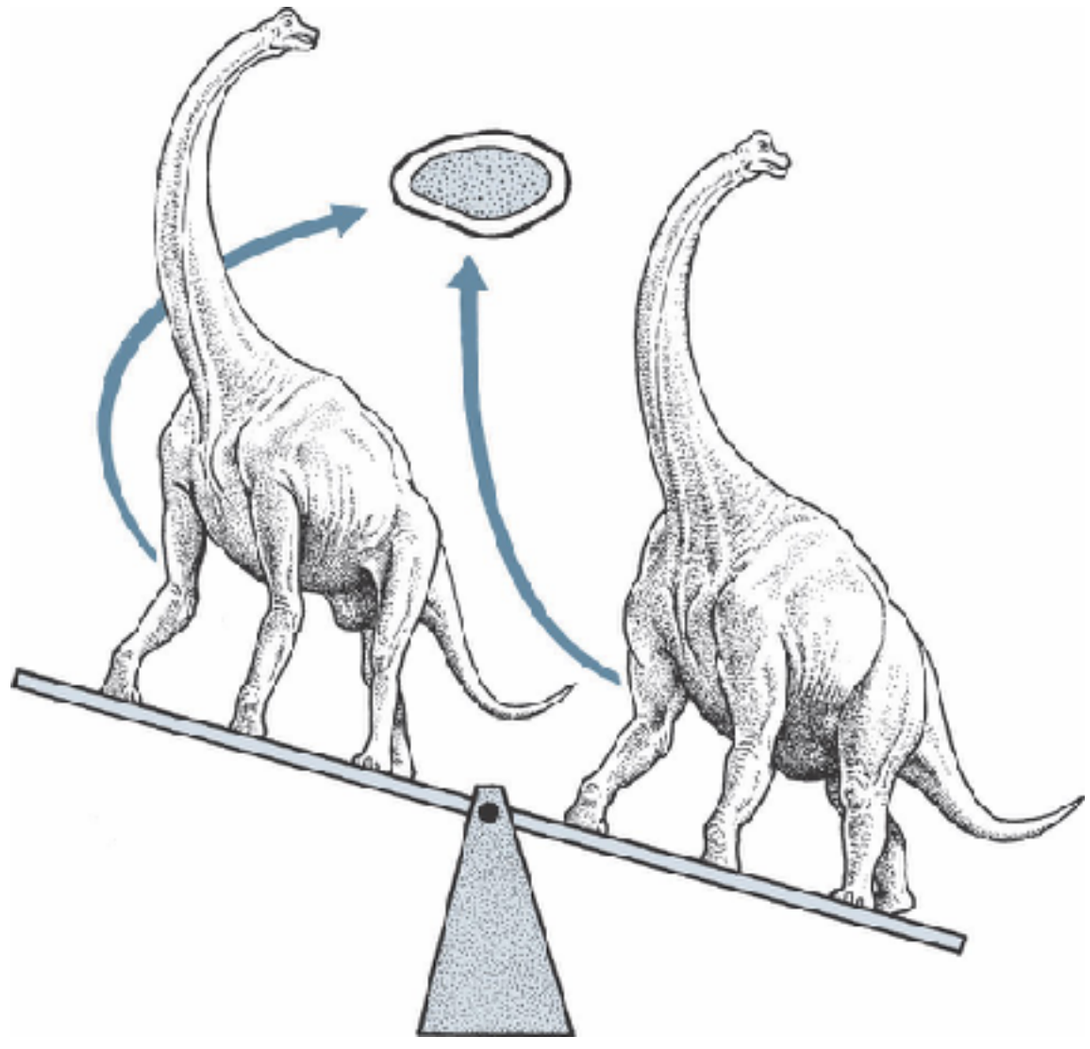
Dinosaurs and Body size

Dinosaurs and Body size

How do we estimate size from fossils?



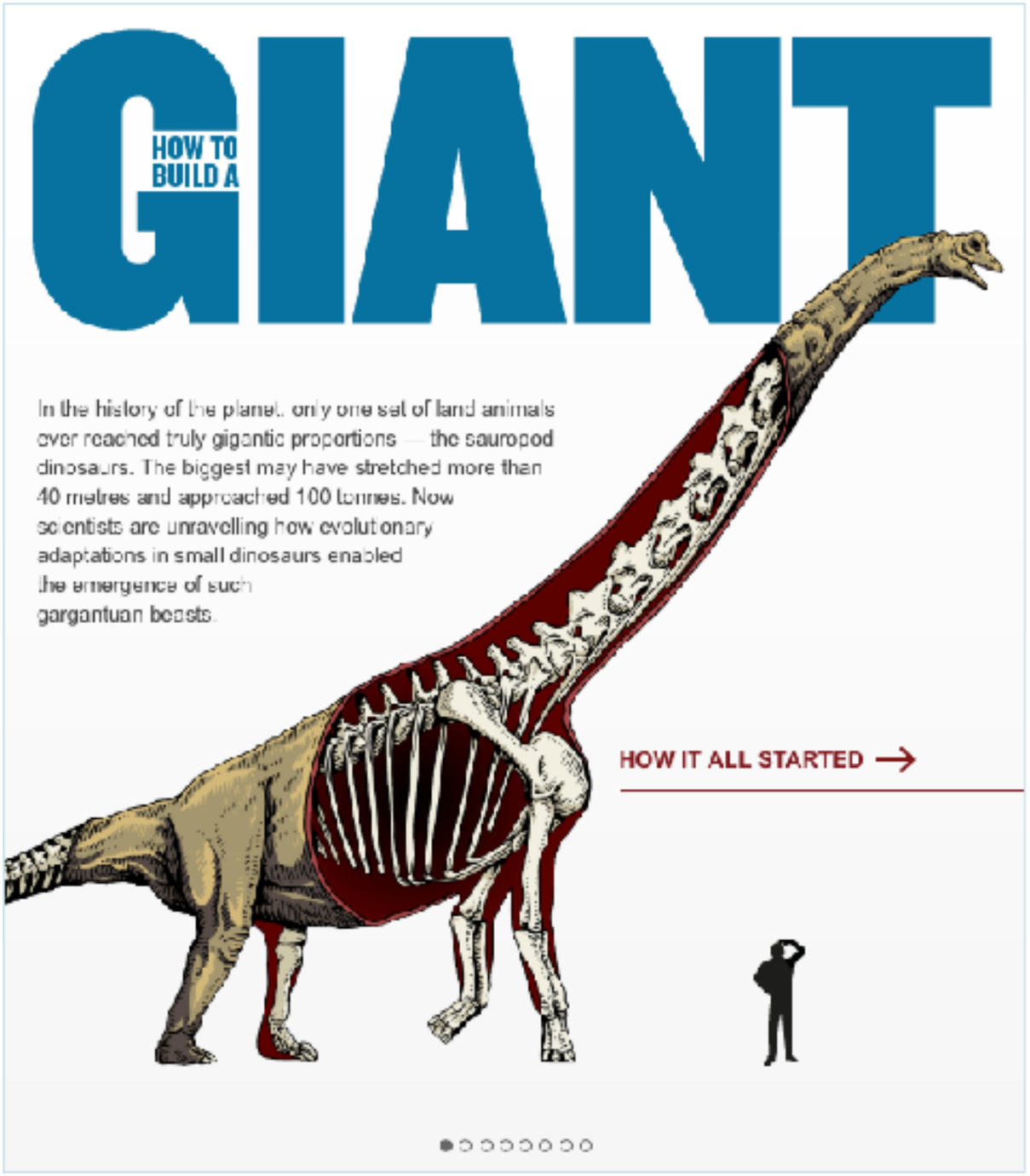
Volumetric reasoning



Cross sections of individual bones

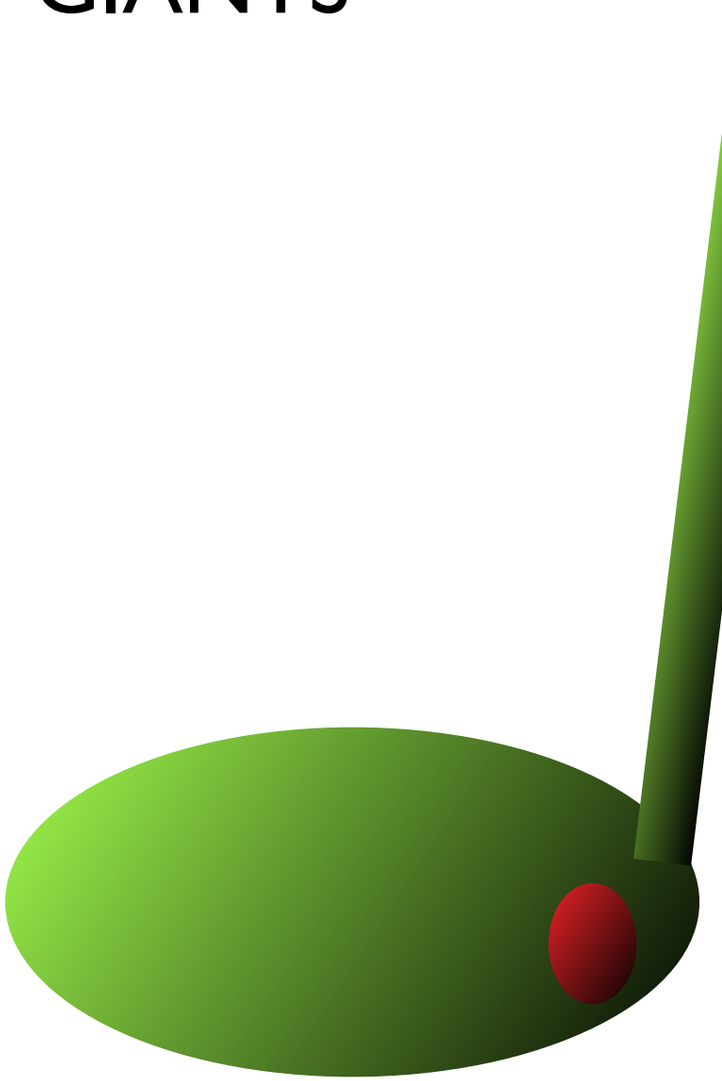
Dinosaurs and Body size

How to build a GIANT



http://www.nature.com/news/2011/110713/fig_tab/475159a.html

GIANTS

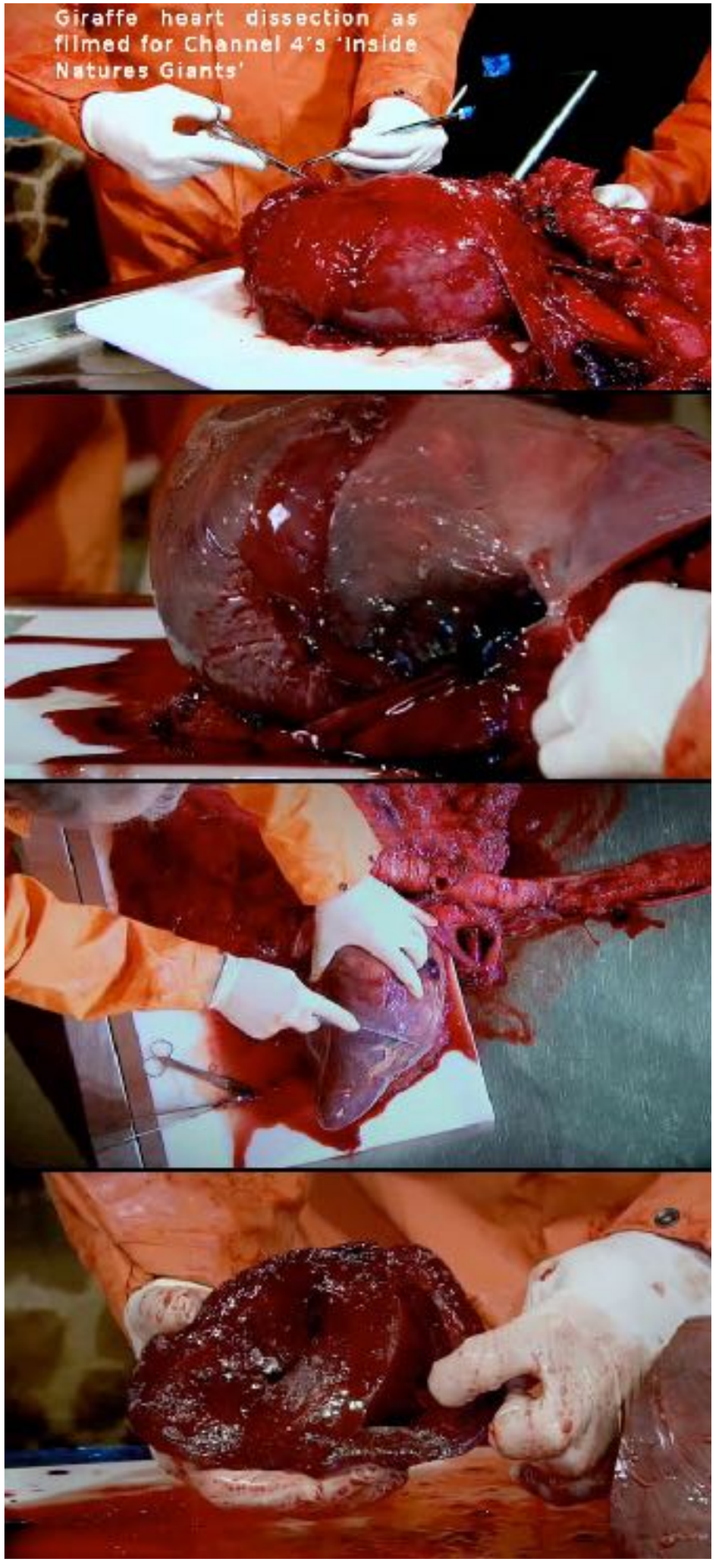


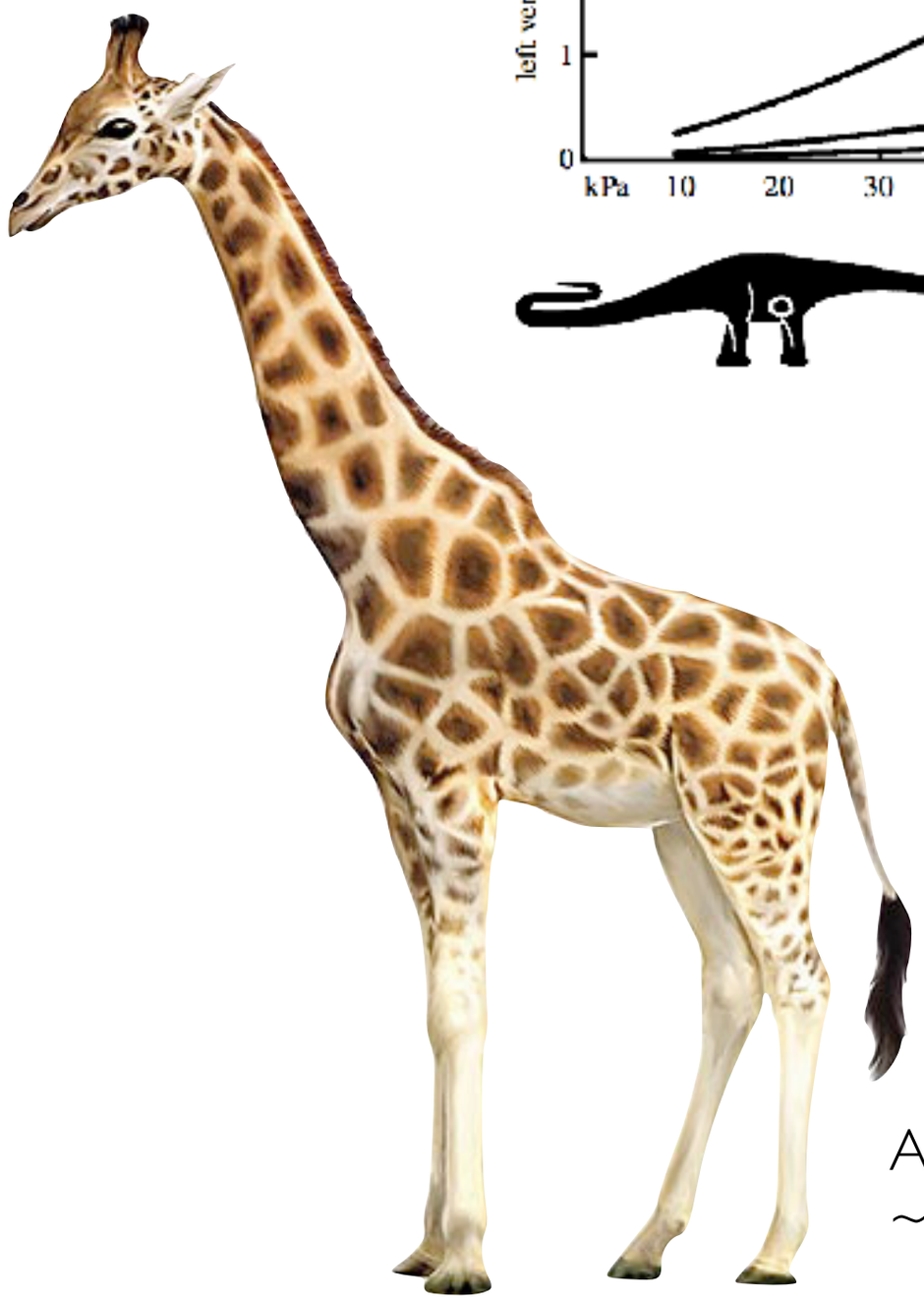
Cooling tower

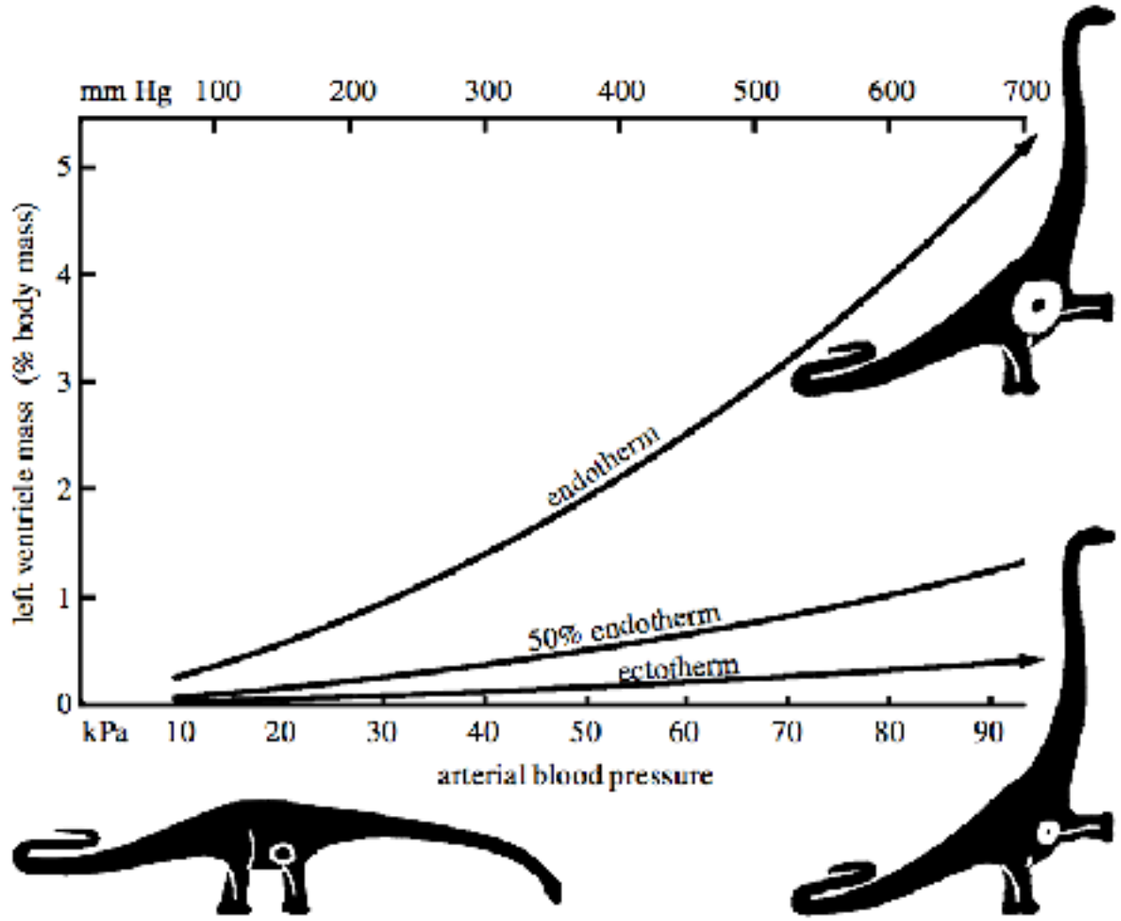
High heat production (digestion)
Low SA:V ratio retained heat

700 mmHg (typical animals: 100 mmHg)
Heart wall muscle scales with arterial blood pressure

How did sauropods pump blood to their heads?





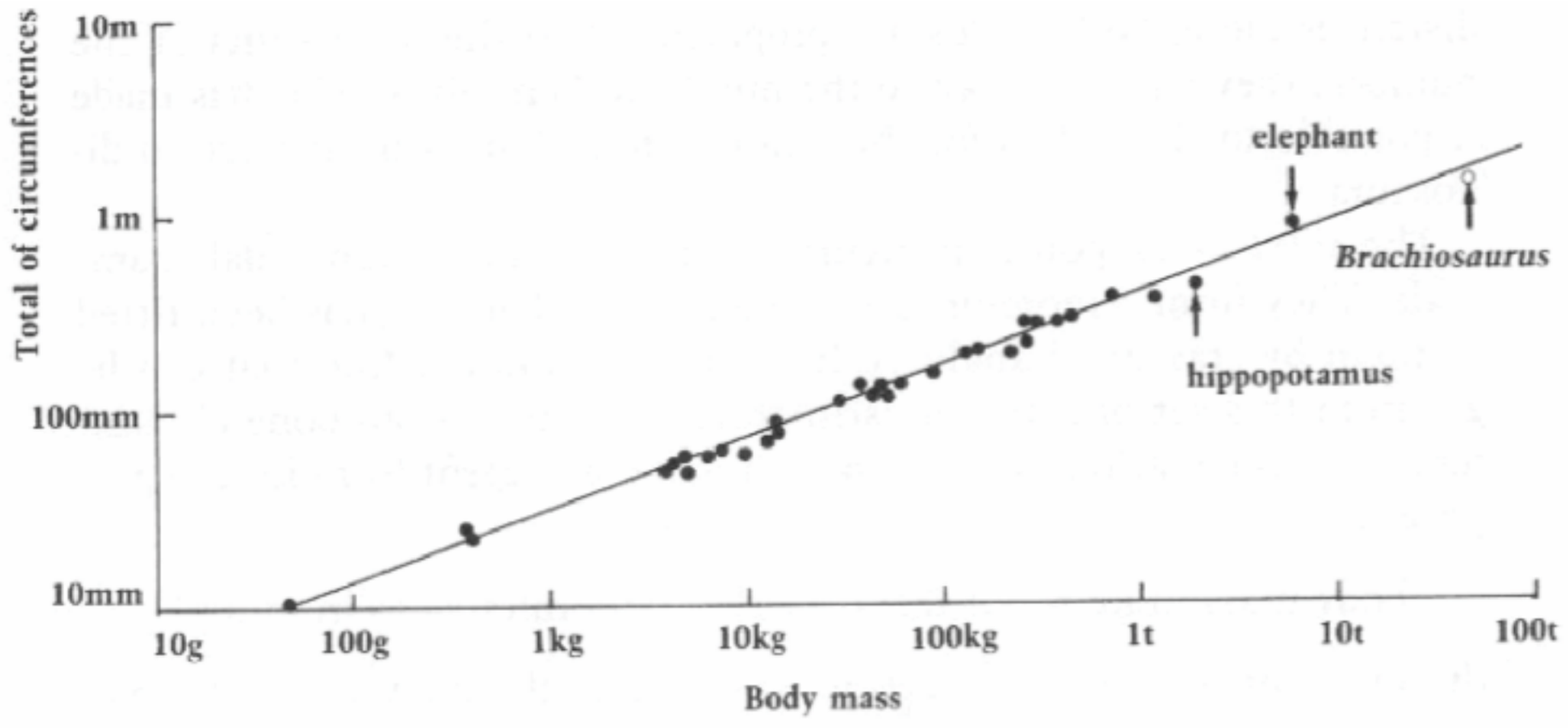


Arterial blood pressure:
~200 mmHg (2x norm)

Dinosaurs and Body size

How do we estimate size from fossils?

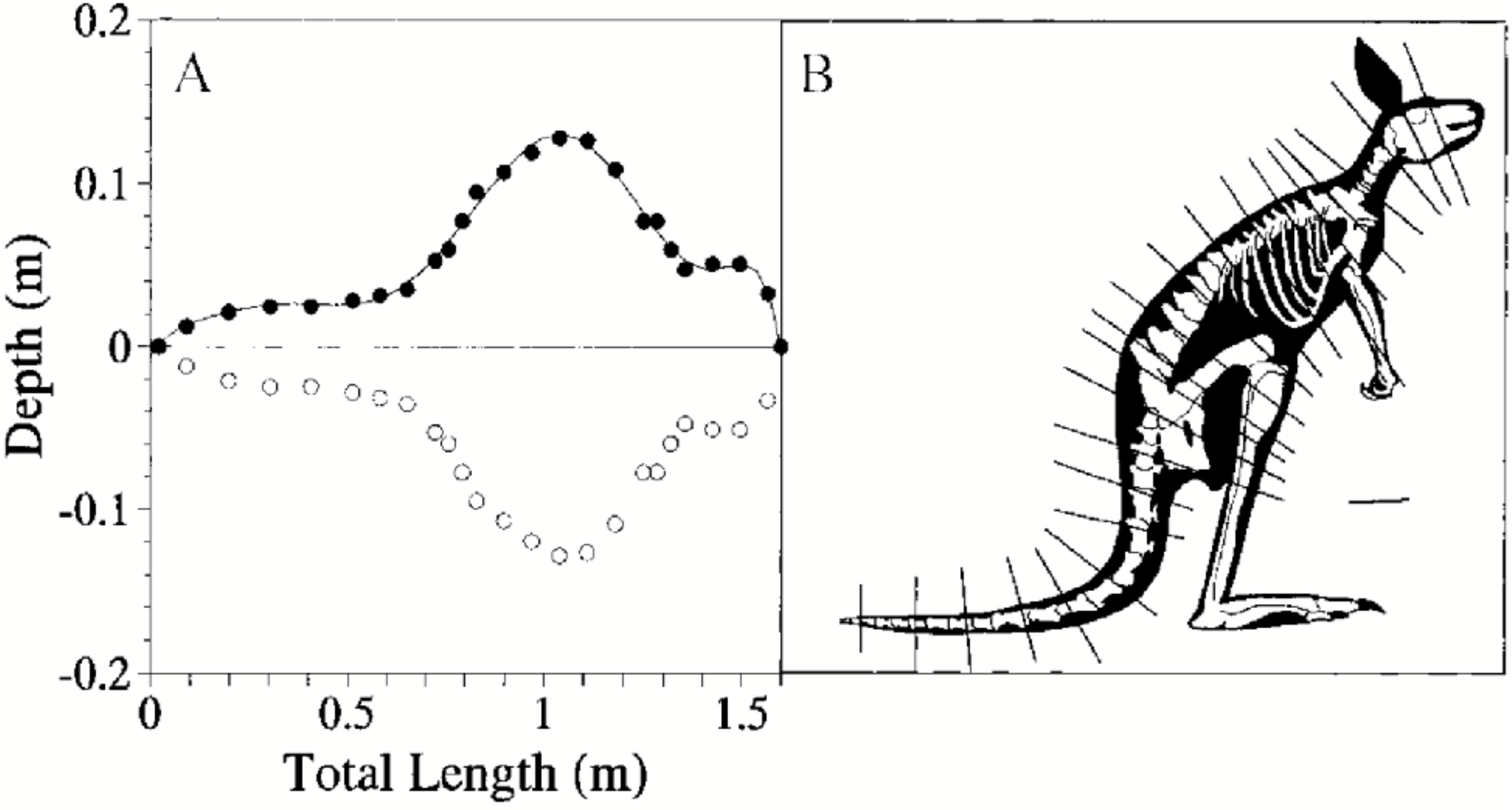
Weighing Dinosaurs with Leg Bone Measurement (cont.)



Log-log plot of data (quadrupedal mammals) obtained by Anderson et al.

Dinosaurs and Body size

How do we estimate size from fossils?



Dinosaurs and Body size

What can body size tell us about the life of the animal?

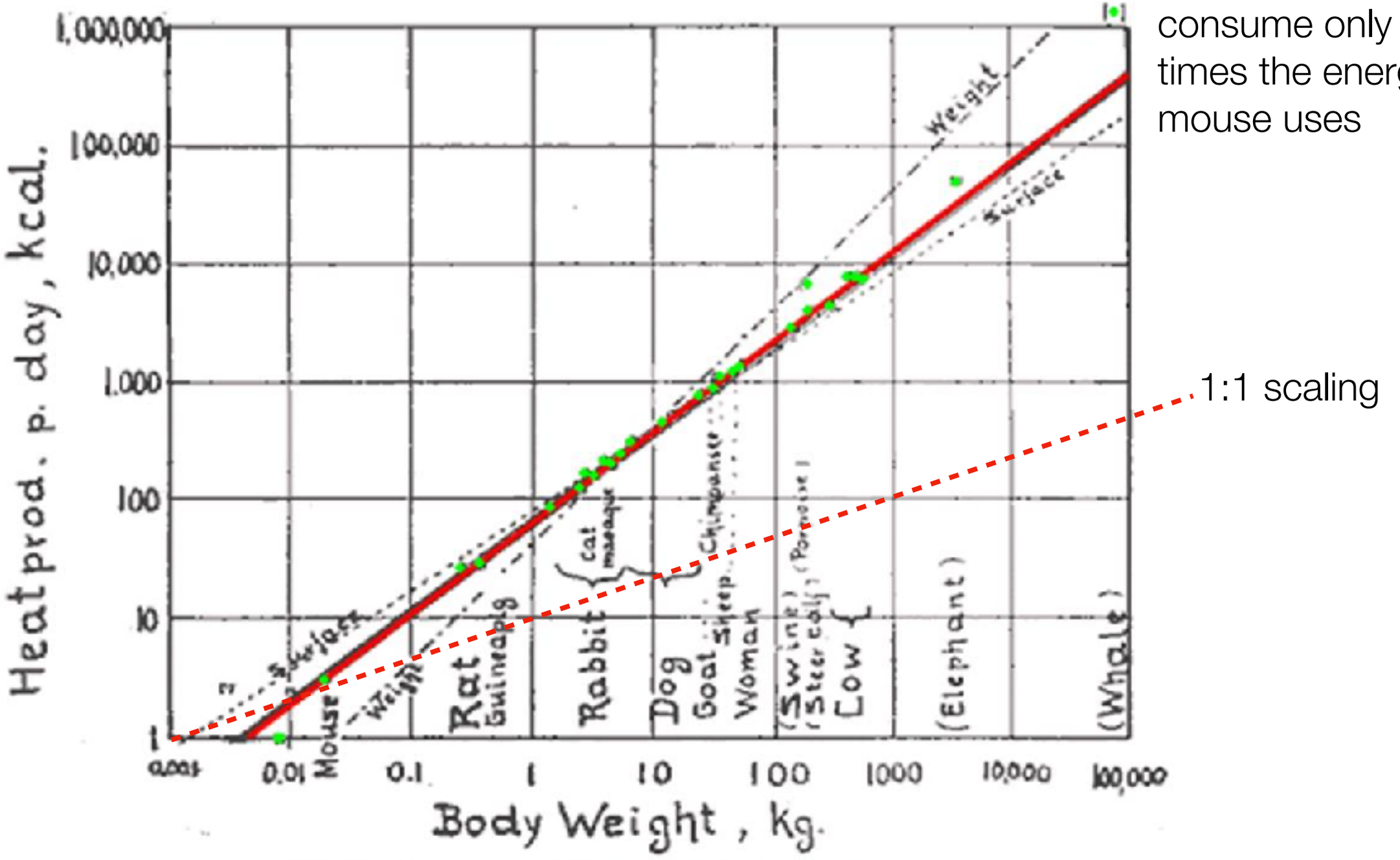


Fig. 1. Log. metabol. rate/log body weight

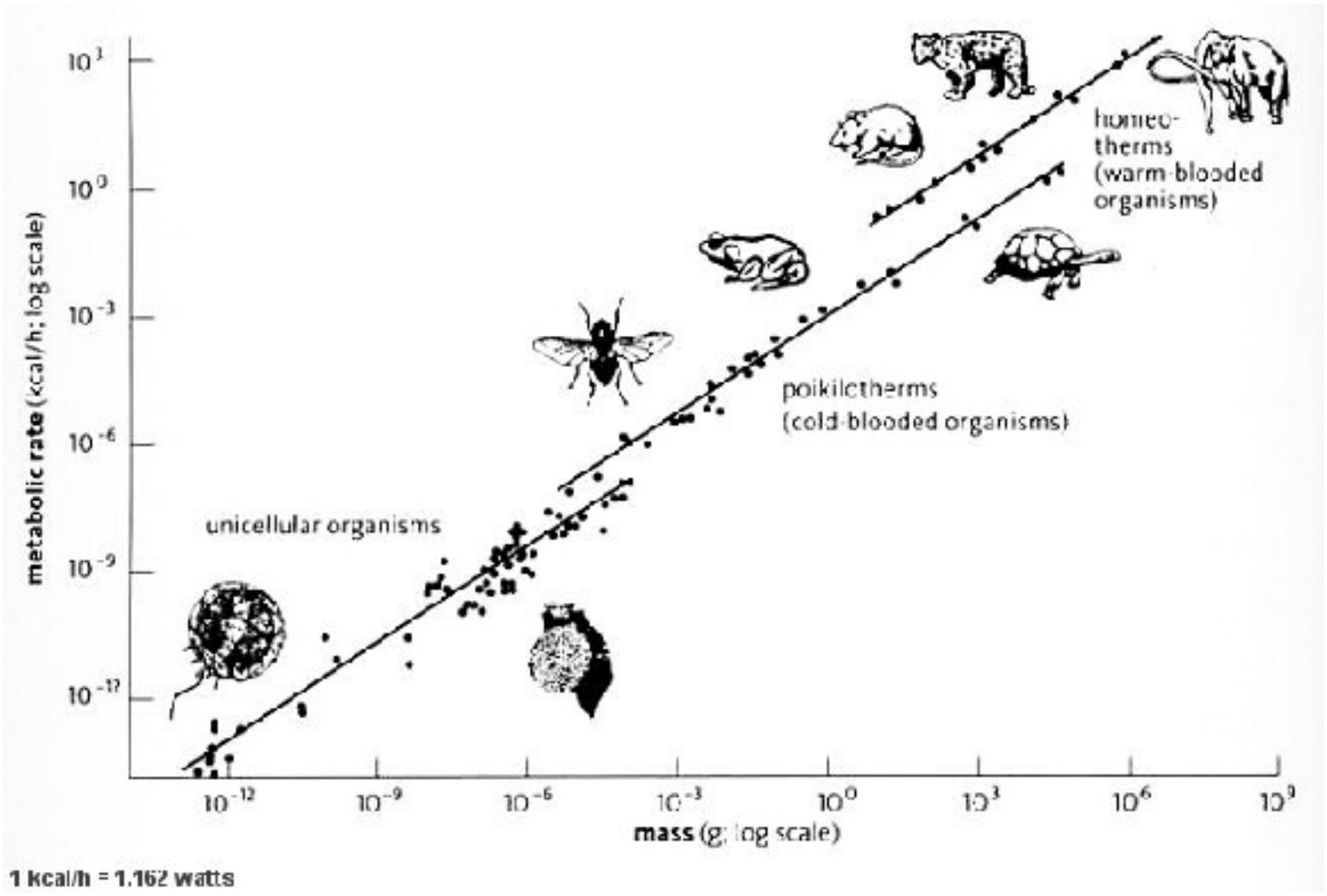
A cat having a mass 100 times that of a mouse will consume only about 32 times the energy the mouse uses

1:1 scaling

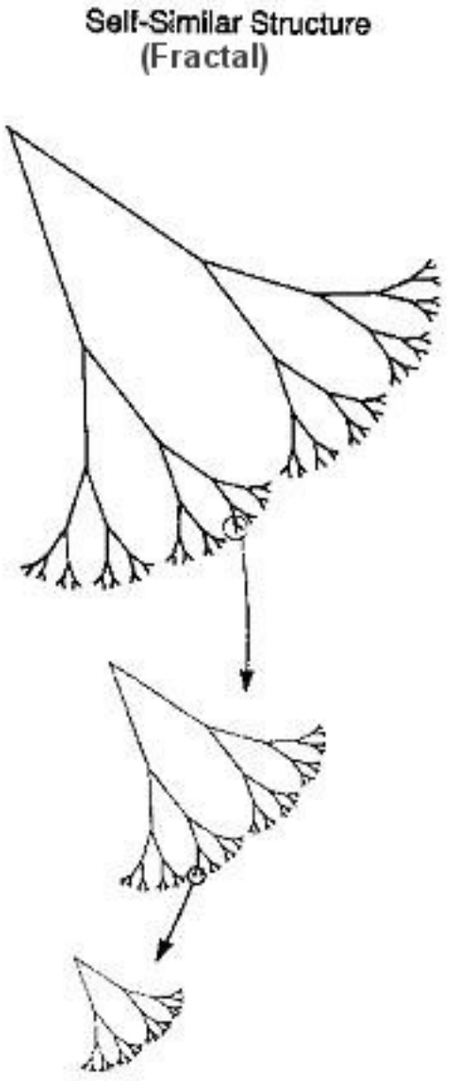
Dinosaurs and Body size

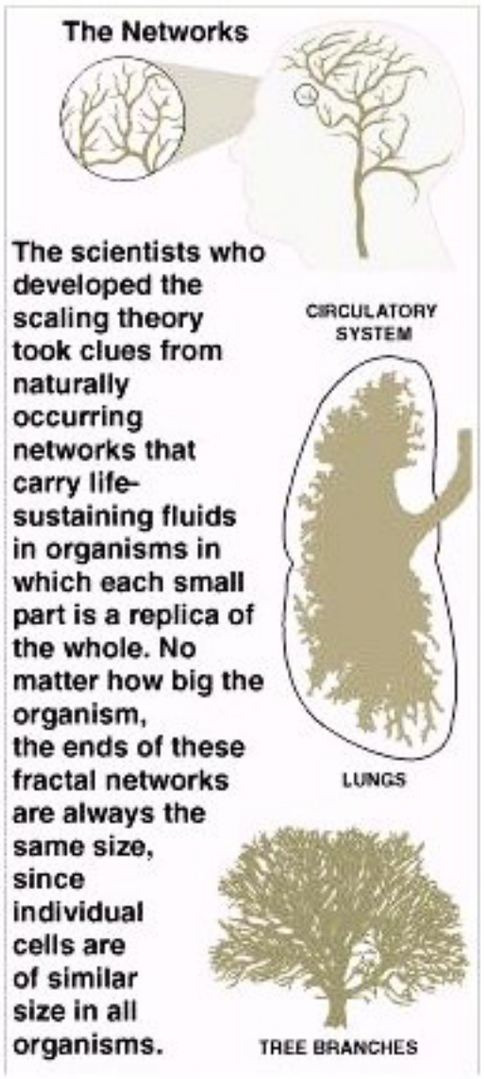
What can body size tell us about the life of the animal?

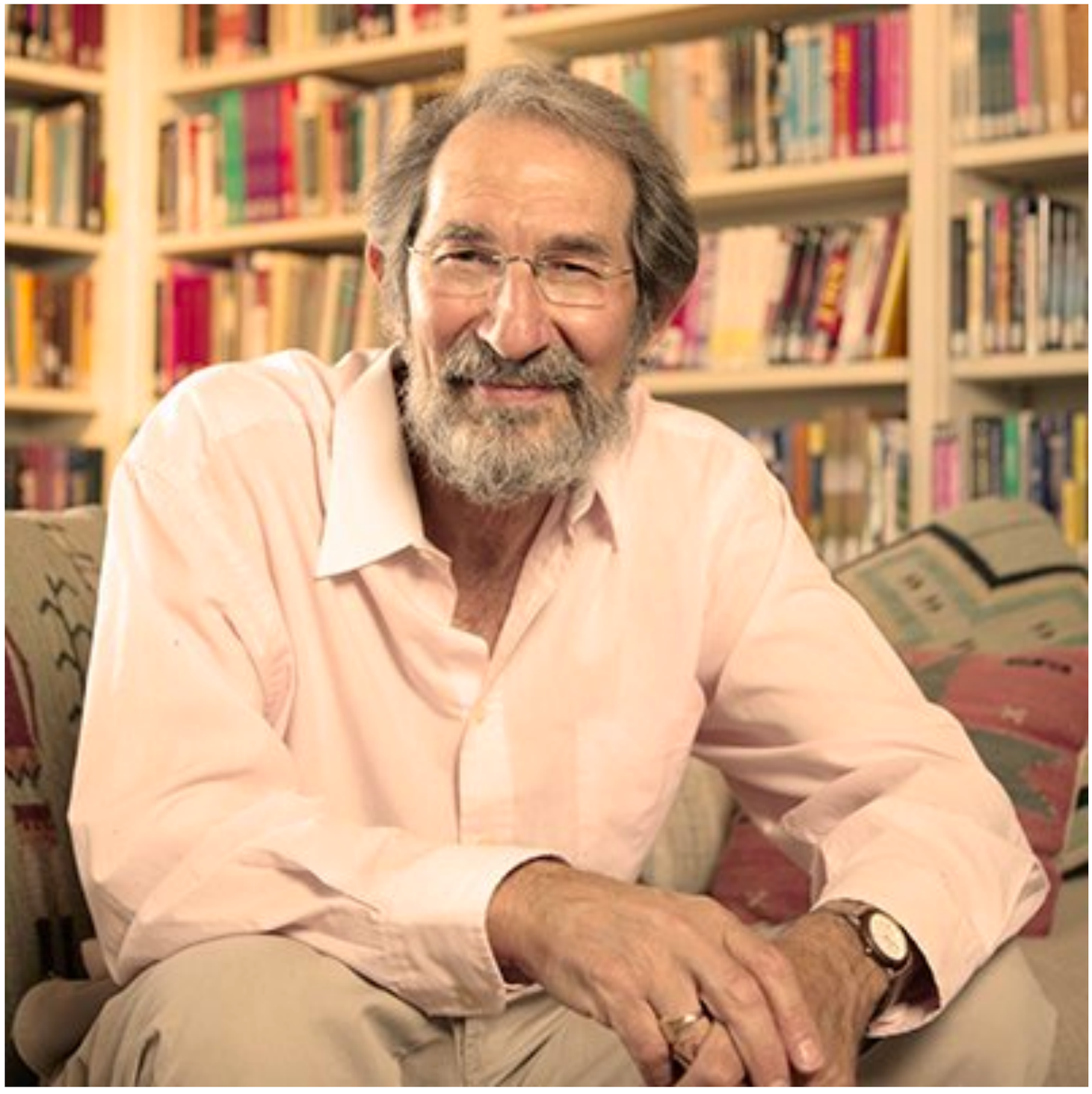
$$\text{Metabolic Rate} = cM^{3/4}$$



1 kcal/h = 1.162 watts





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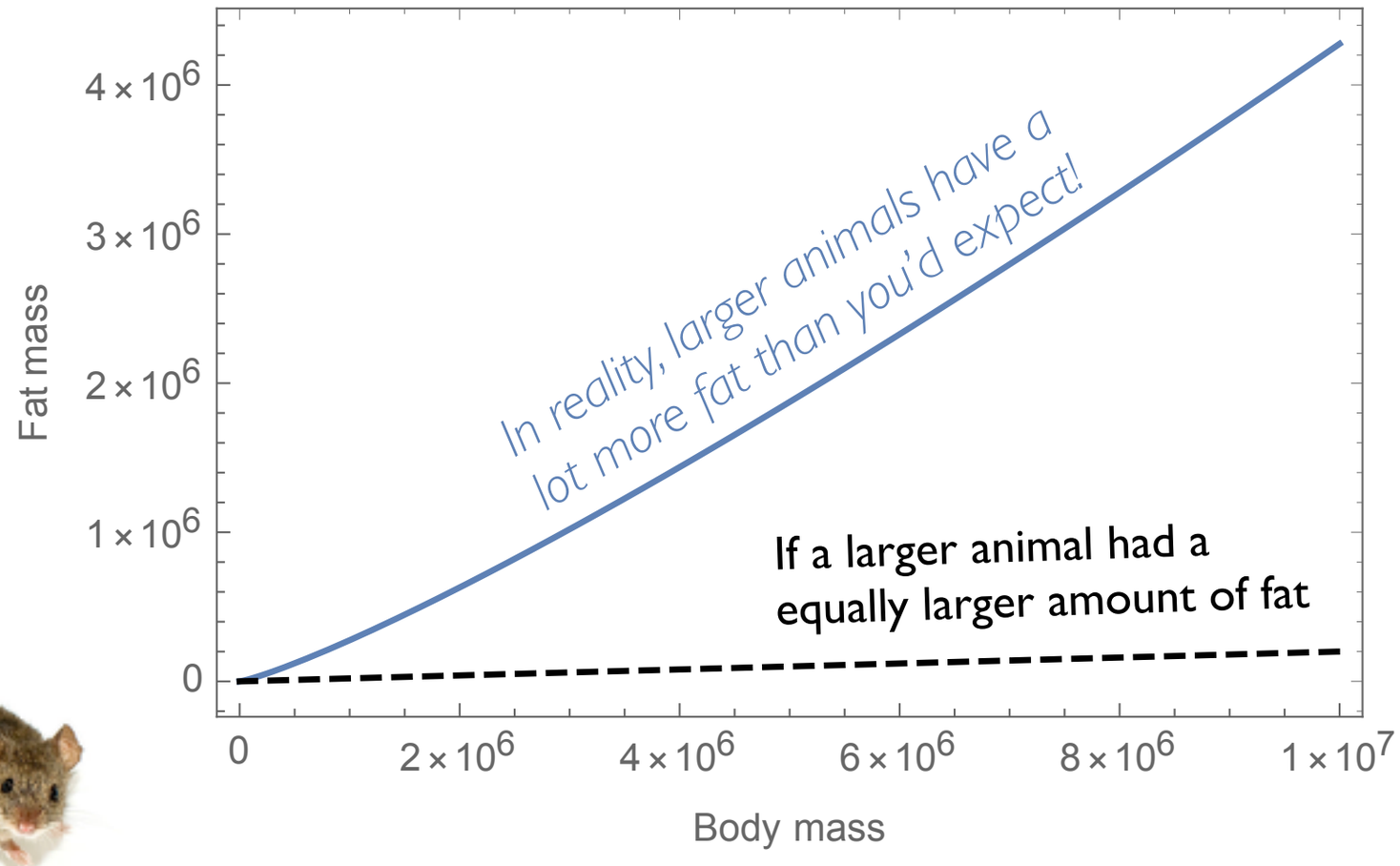
Body size and storage

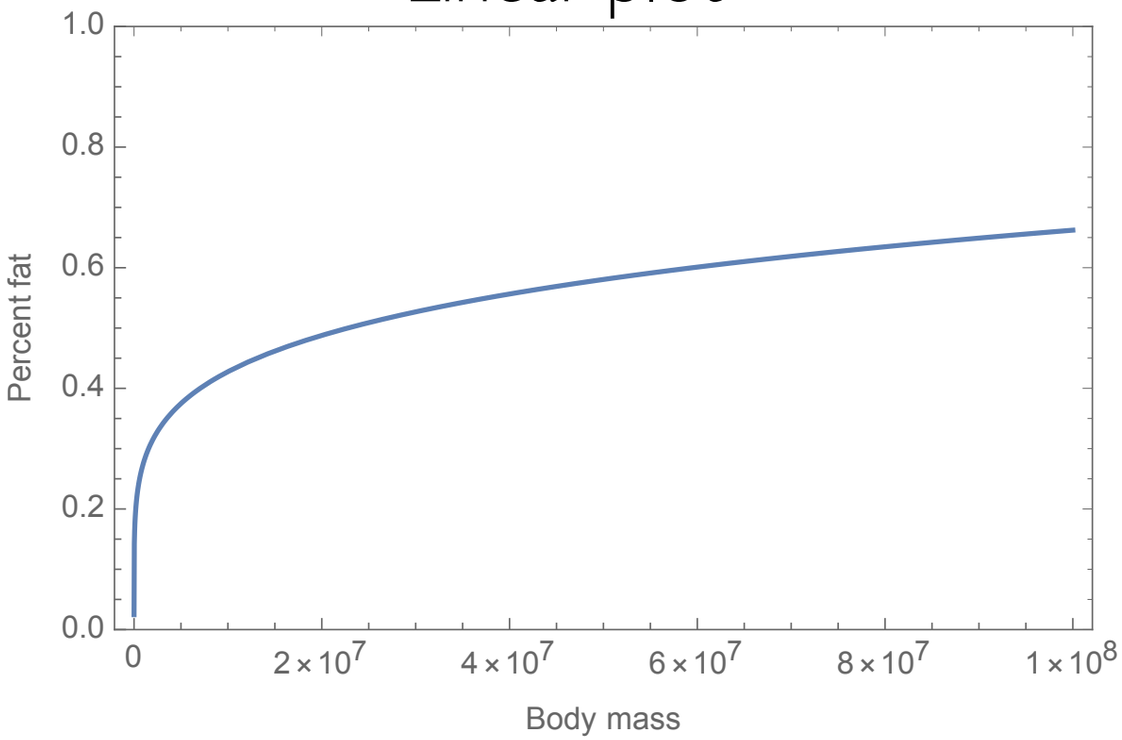
Basic ingredients of life:

1) reproduce (pass down genetic material)
2) obtain enough ENERGY to reproduce
   carry fat

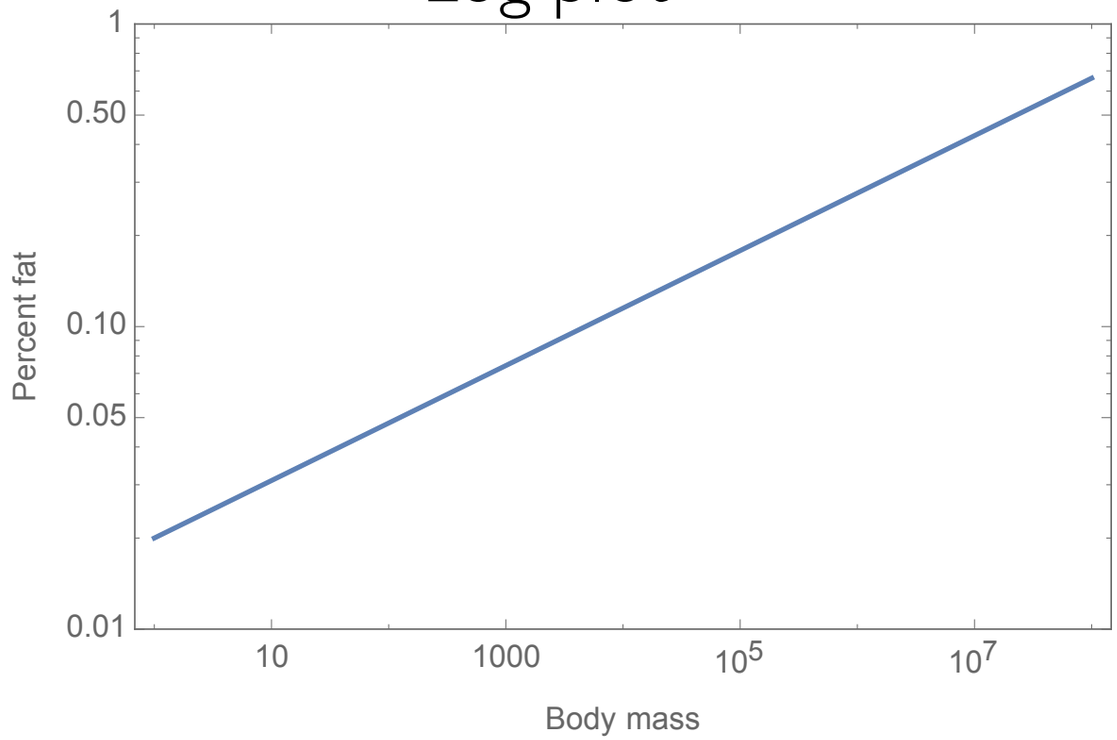
the amount of fat you can carry is key

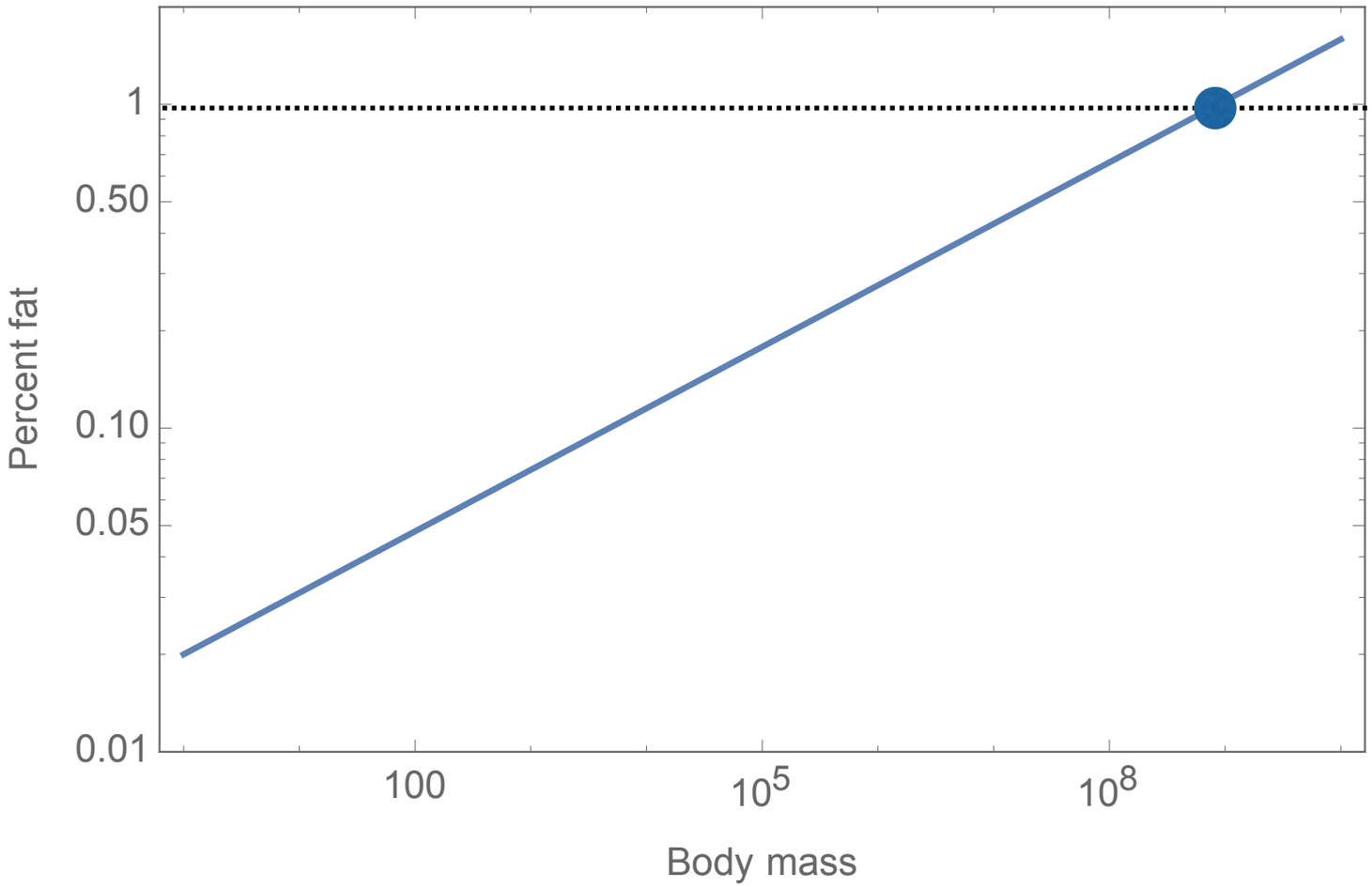


Linear plot



Log plot

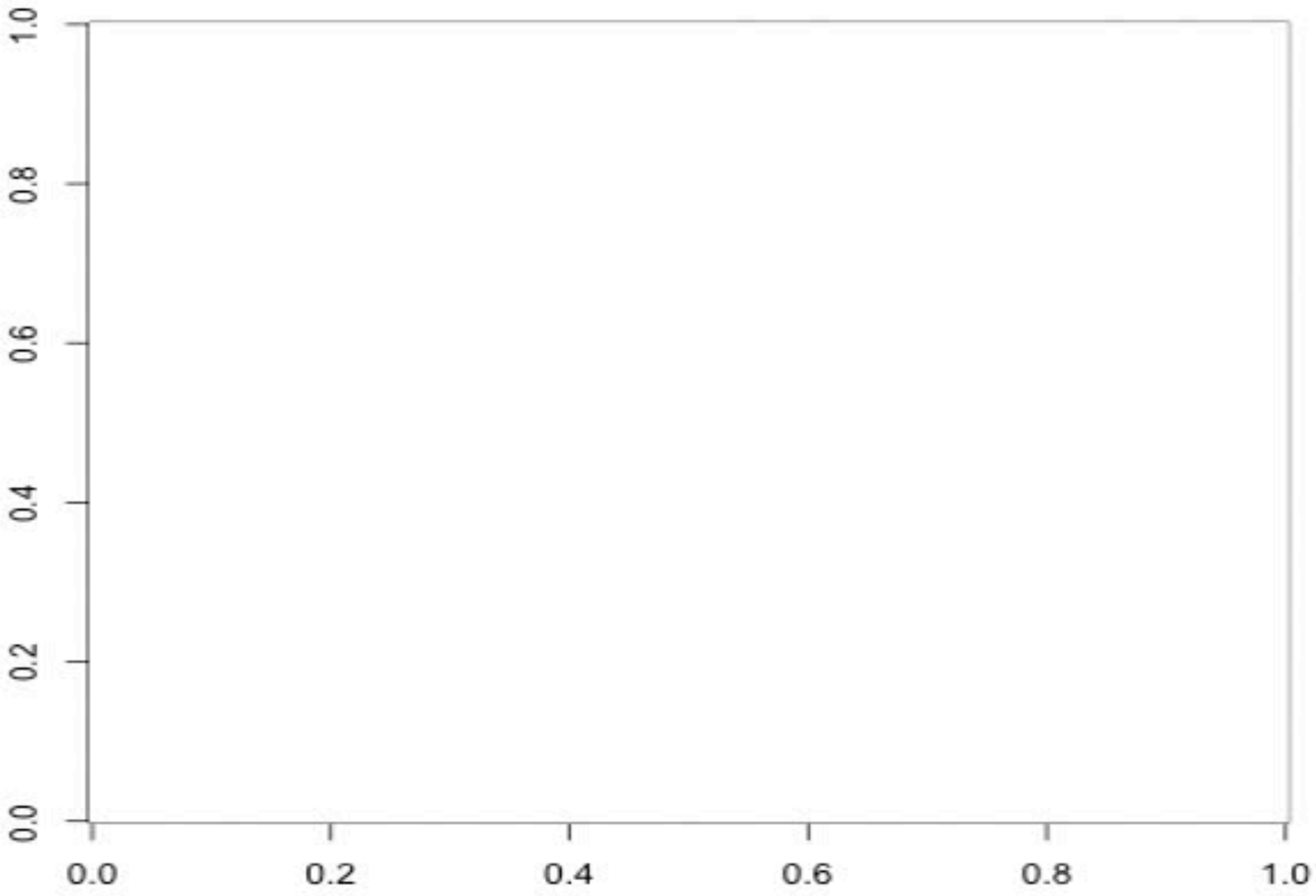




According to the relationship, at what size would a mammal be 100% body fat???

$M = 8.3 \times 10^8$ …an organism the size of 120 male African elephants

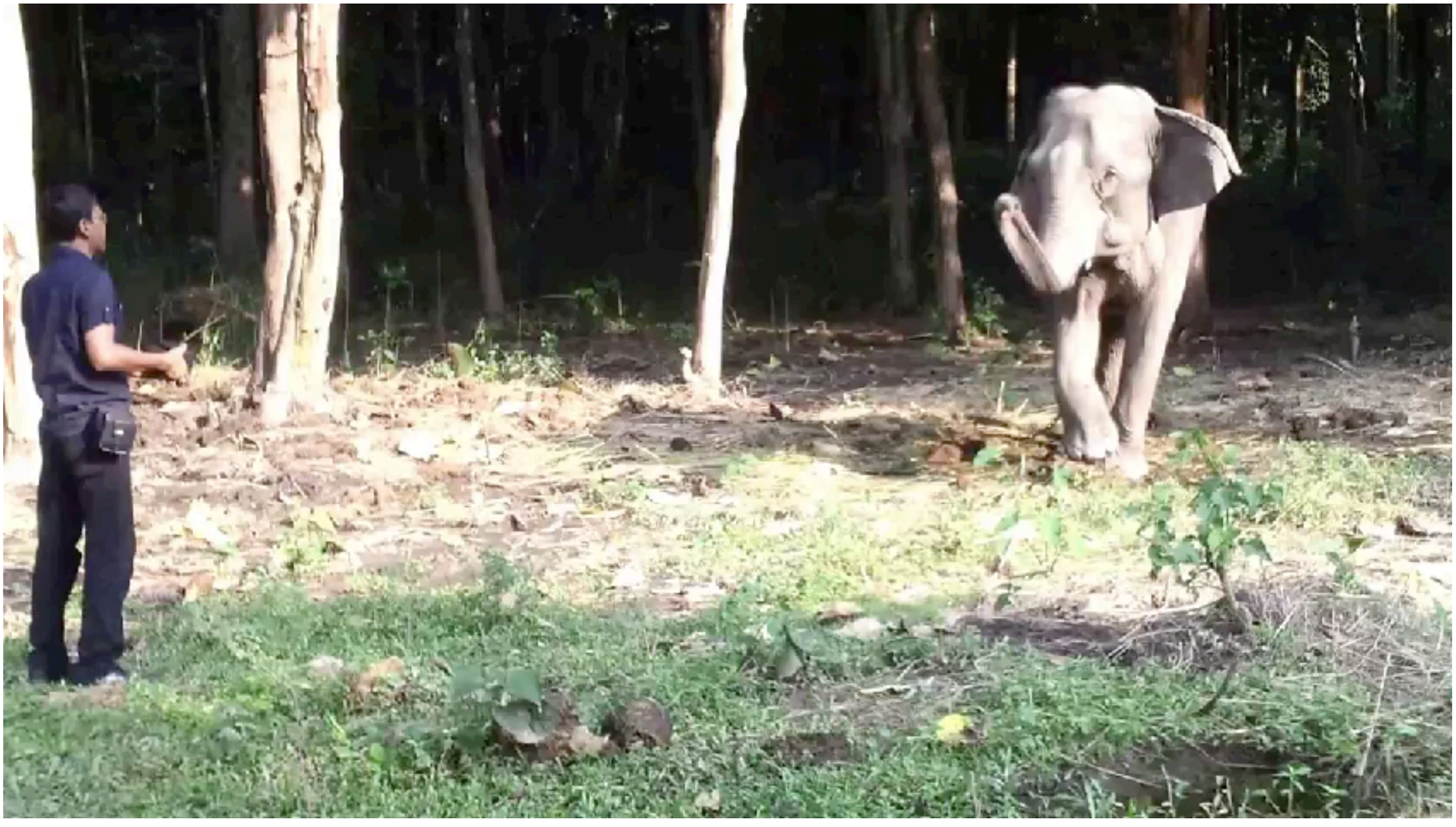
Body size and foraging



Larger animals can travel further
-find resources that are farther apart
-harder to find mates/communicate

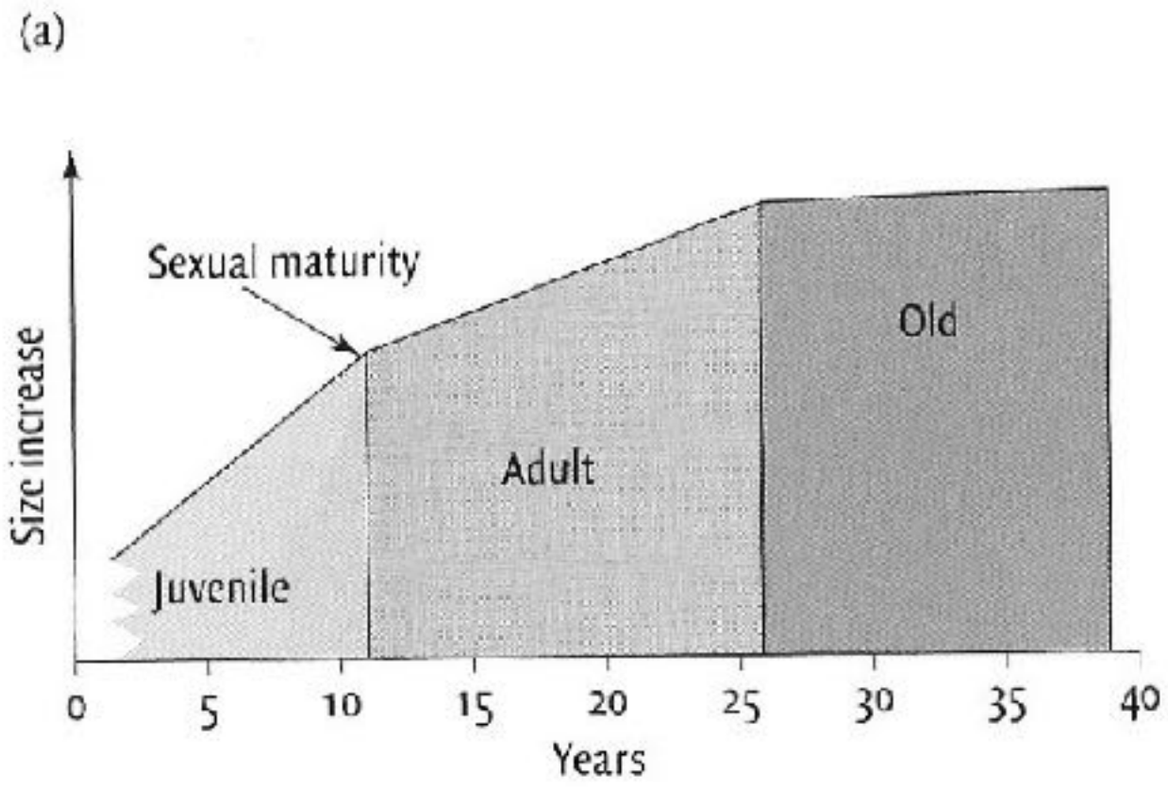
Large body-sized animals: large distances

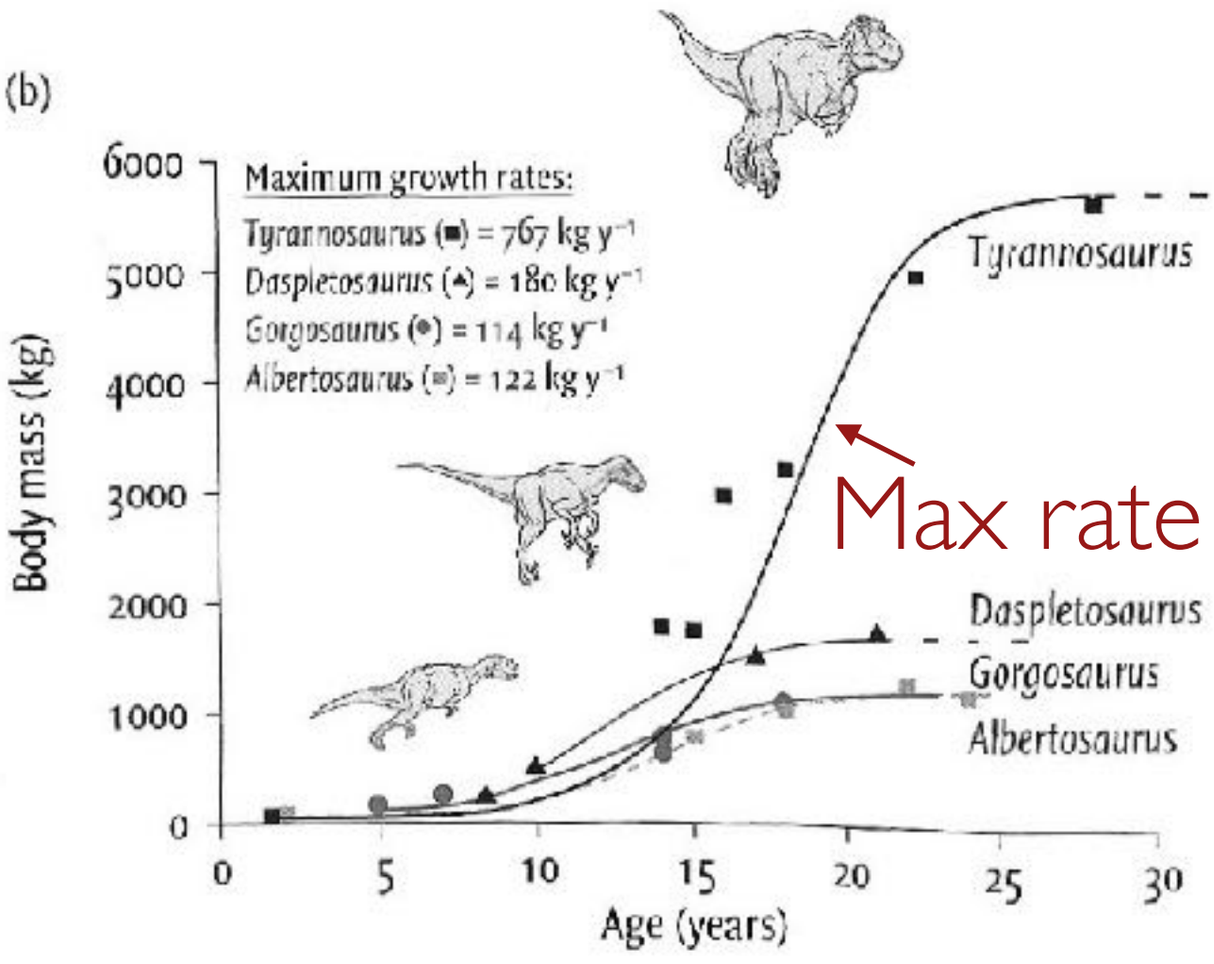
Elephant Ultrasonics



Dinosaurs and Body size

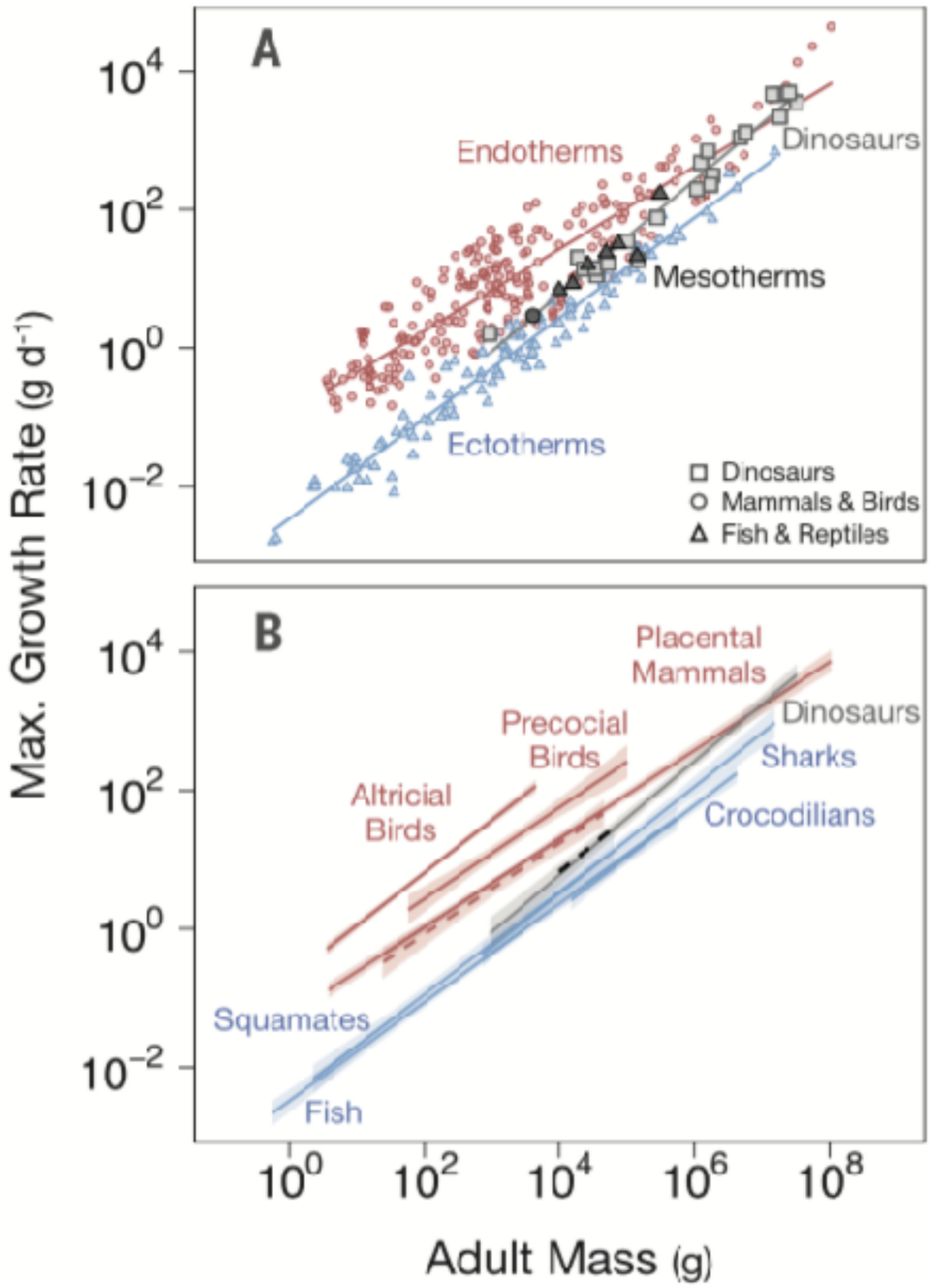
Estimating growth rates from multiple individuals





Dinosaurs and Body size

Not ectotherms… not endotherms… *mesotherms*



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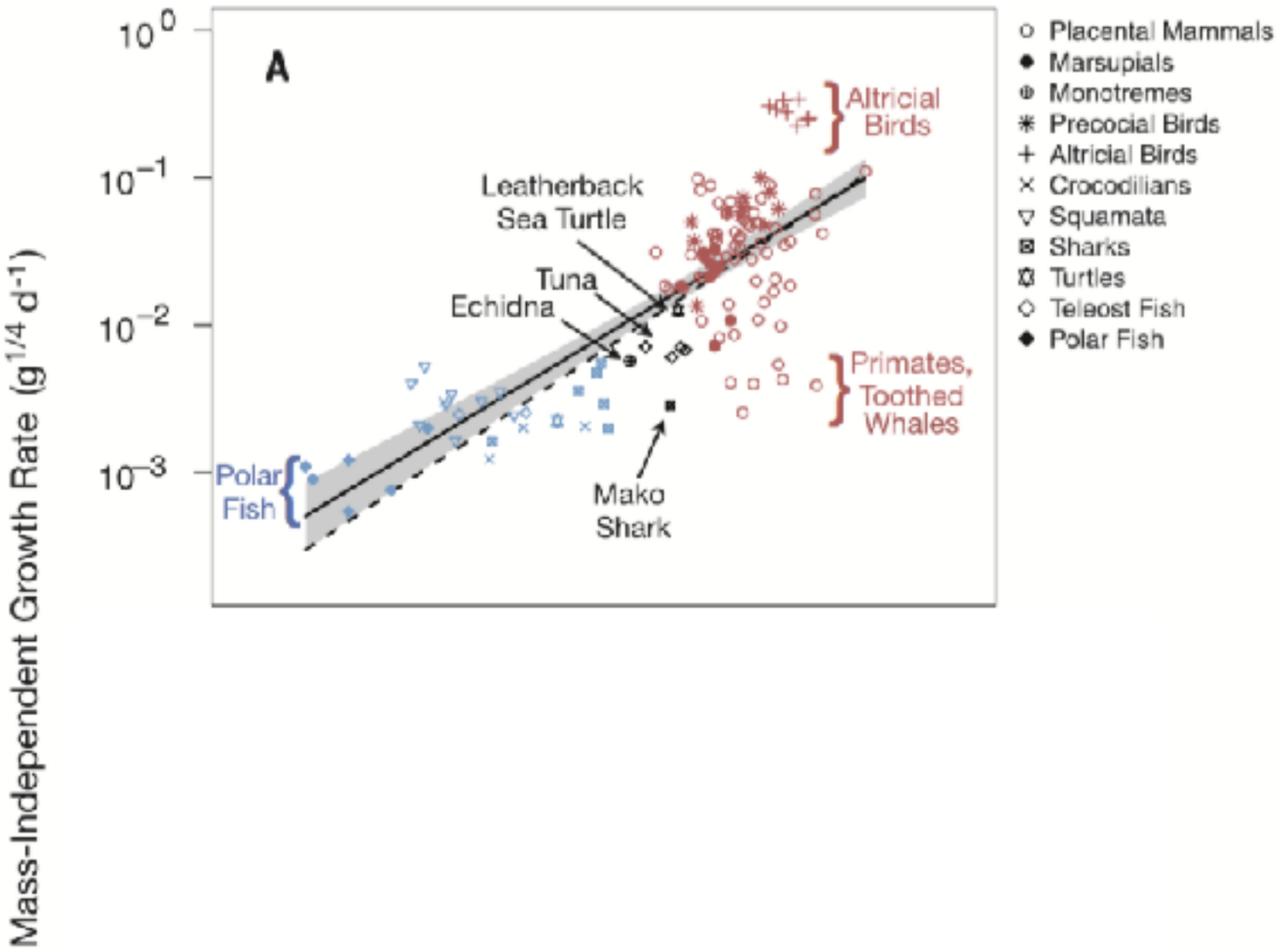
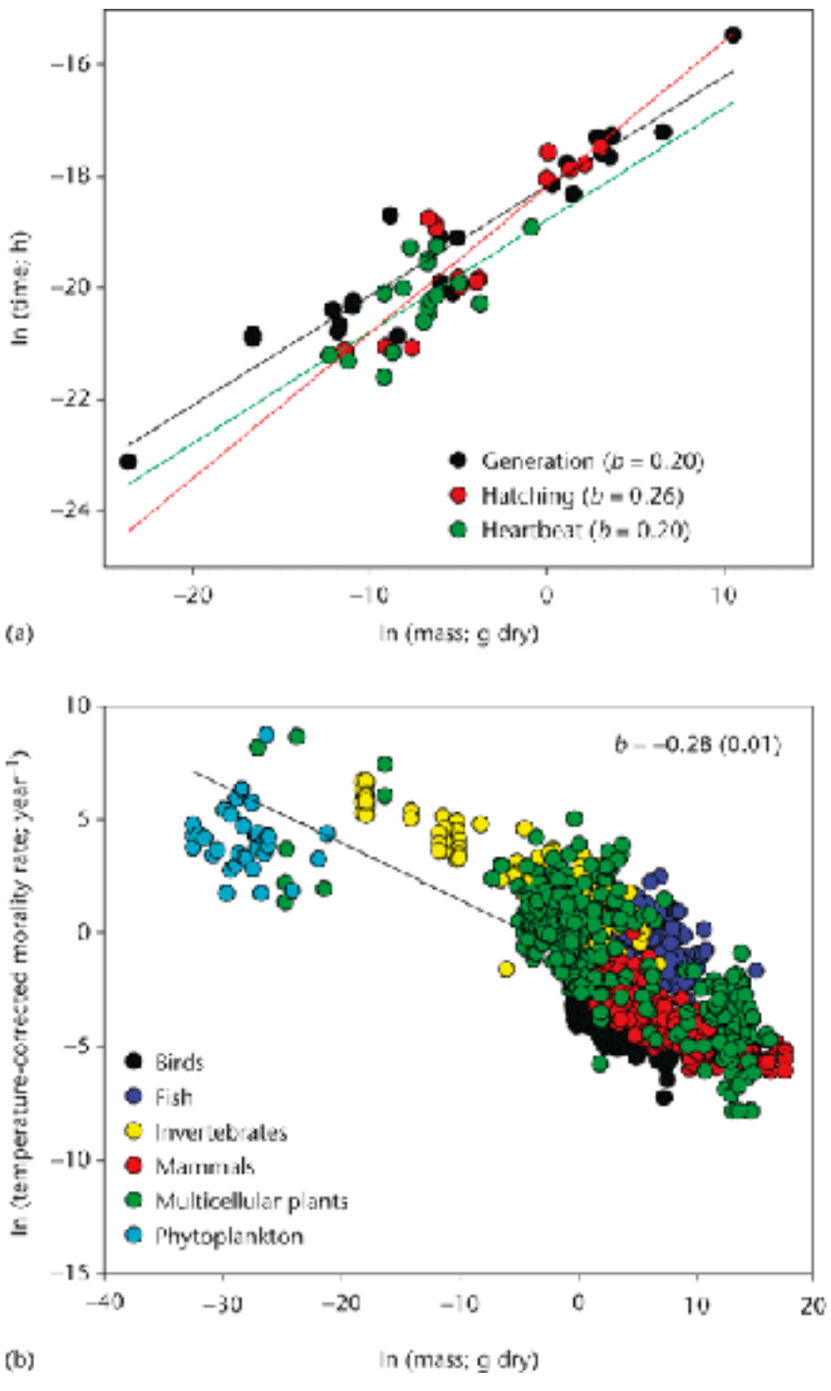
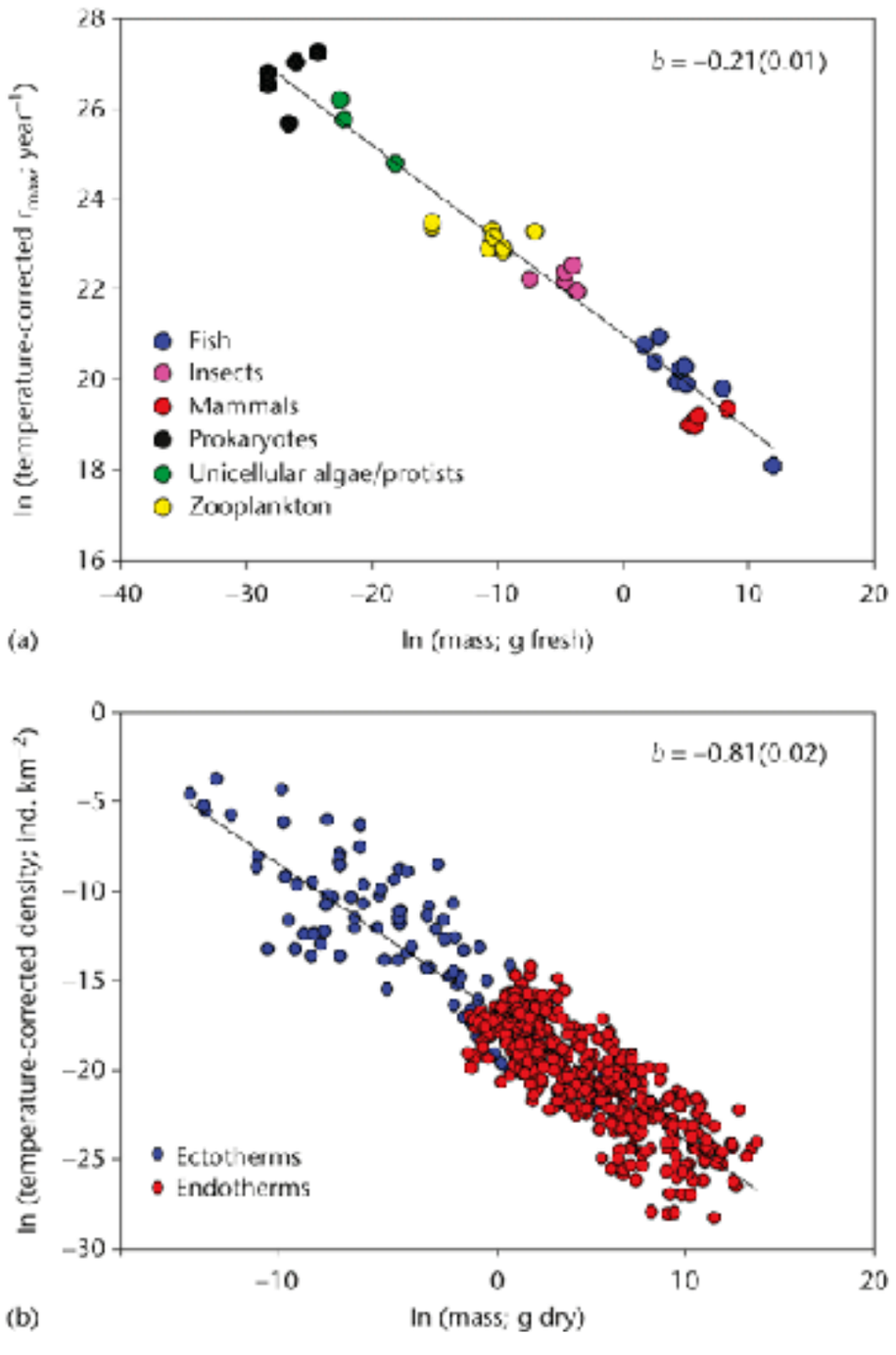


Dinosaurs and Body size

What can body size tell us about the life of the animal?

"Allometric Scaling"





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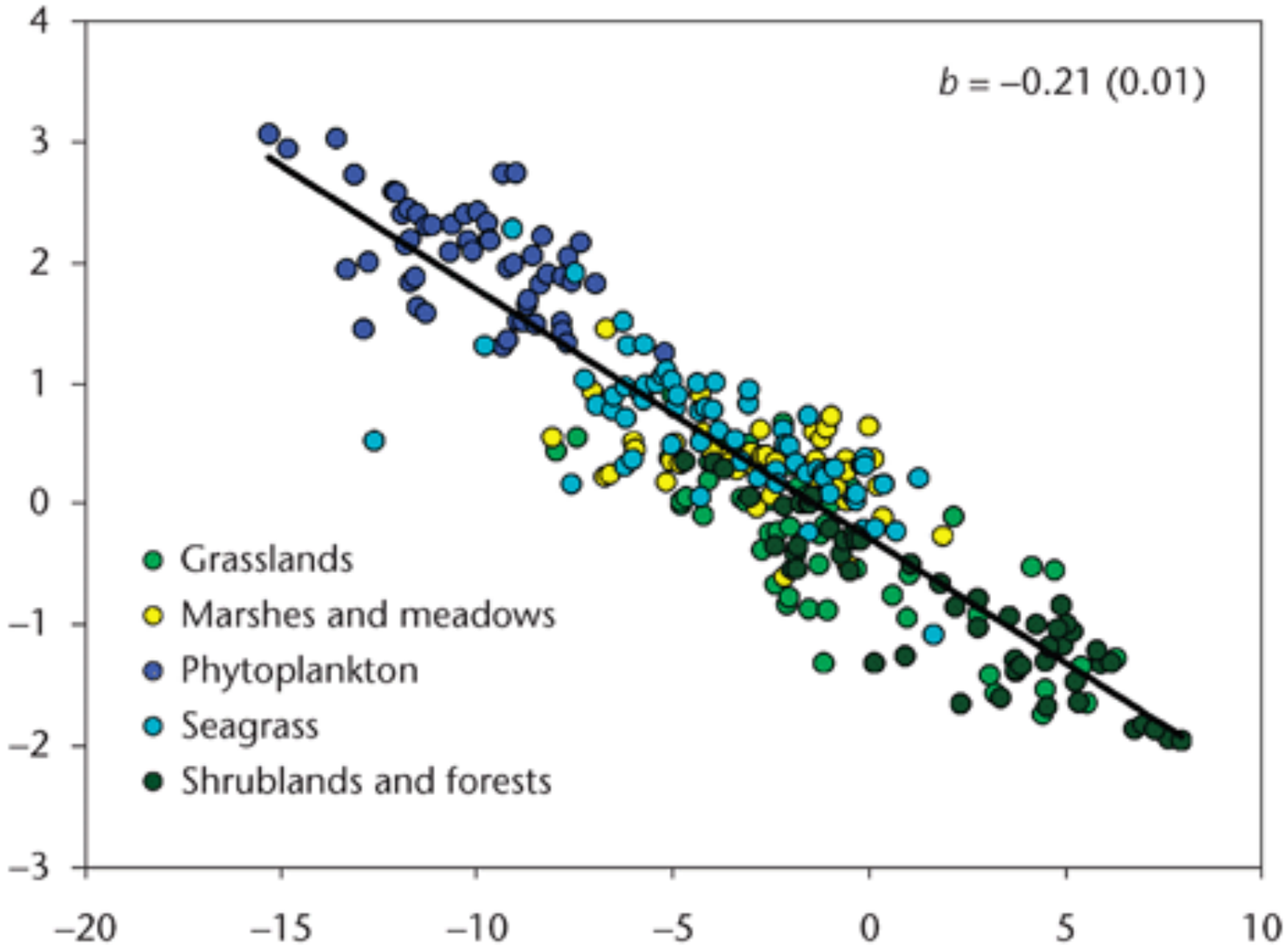

Dinosaurs and Body size

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Predator prey relationships