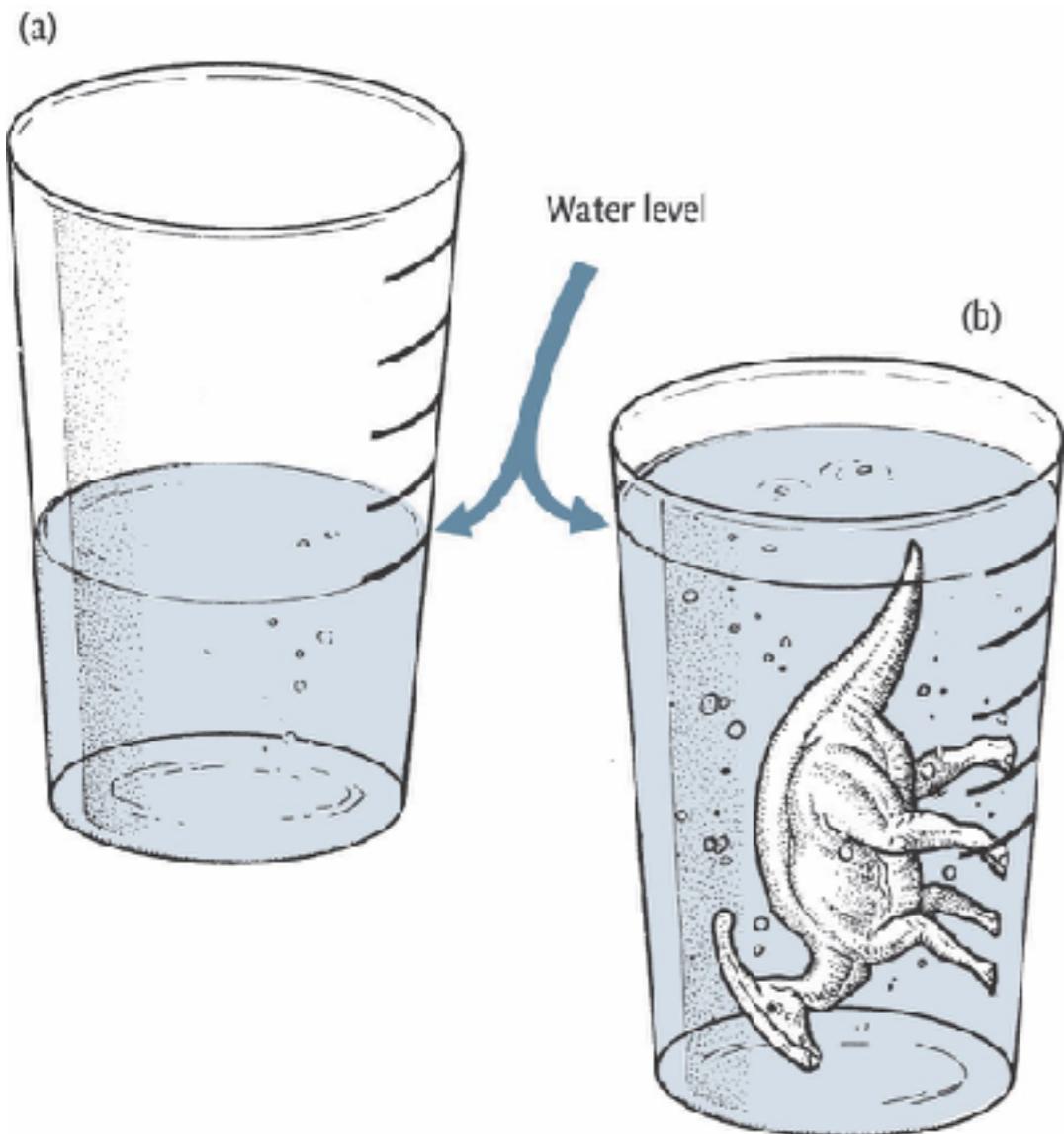


Dinosaurs and Body size

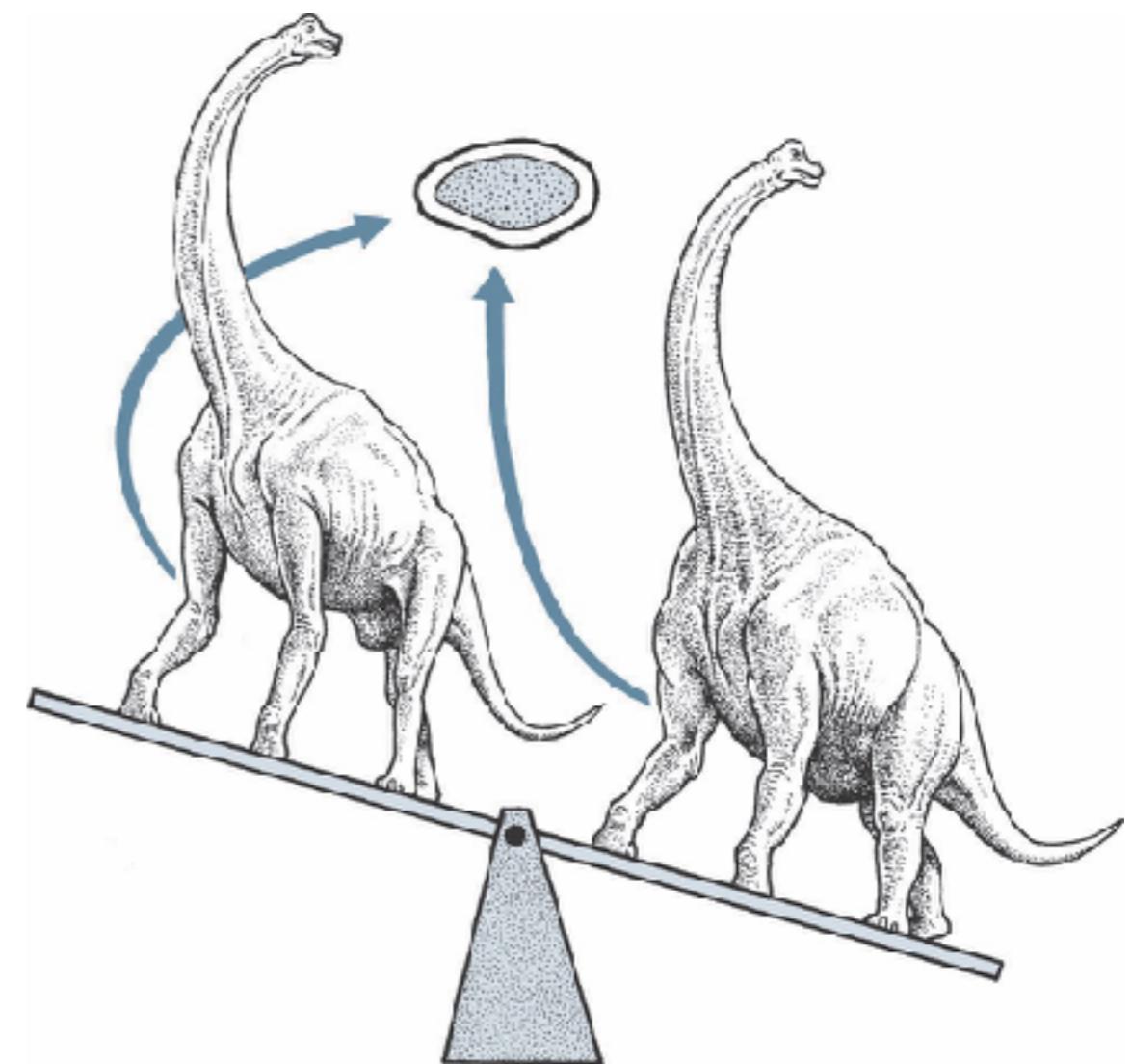


Dinosaurs and Body size

How do we estimate size from fossils?



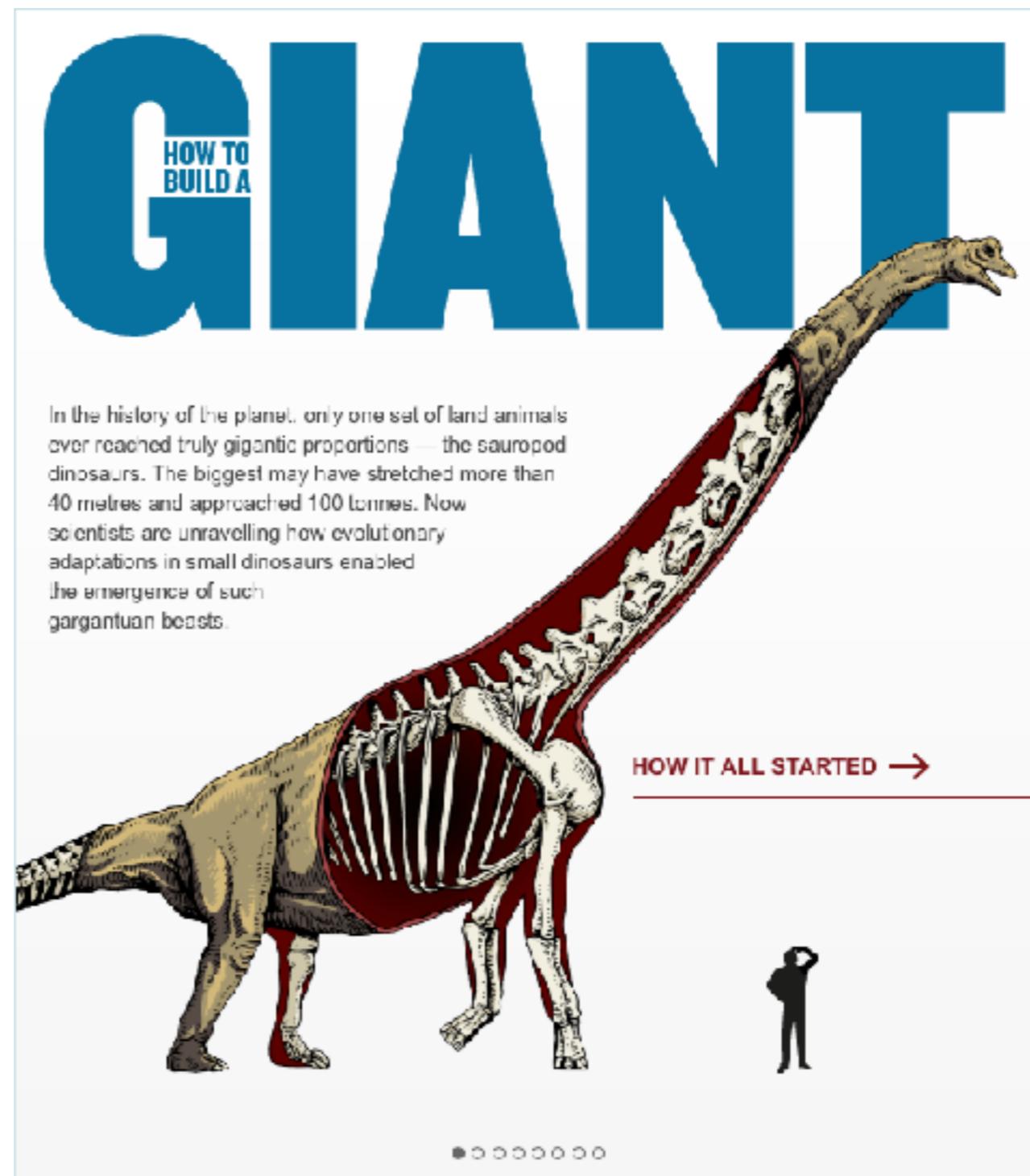
Volumetric reasoning



Cross sections of individual bones

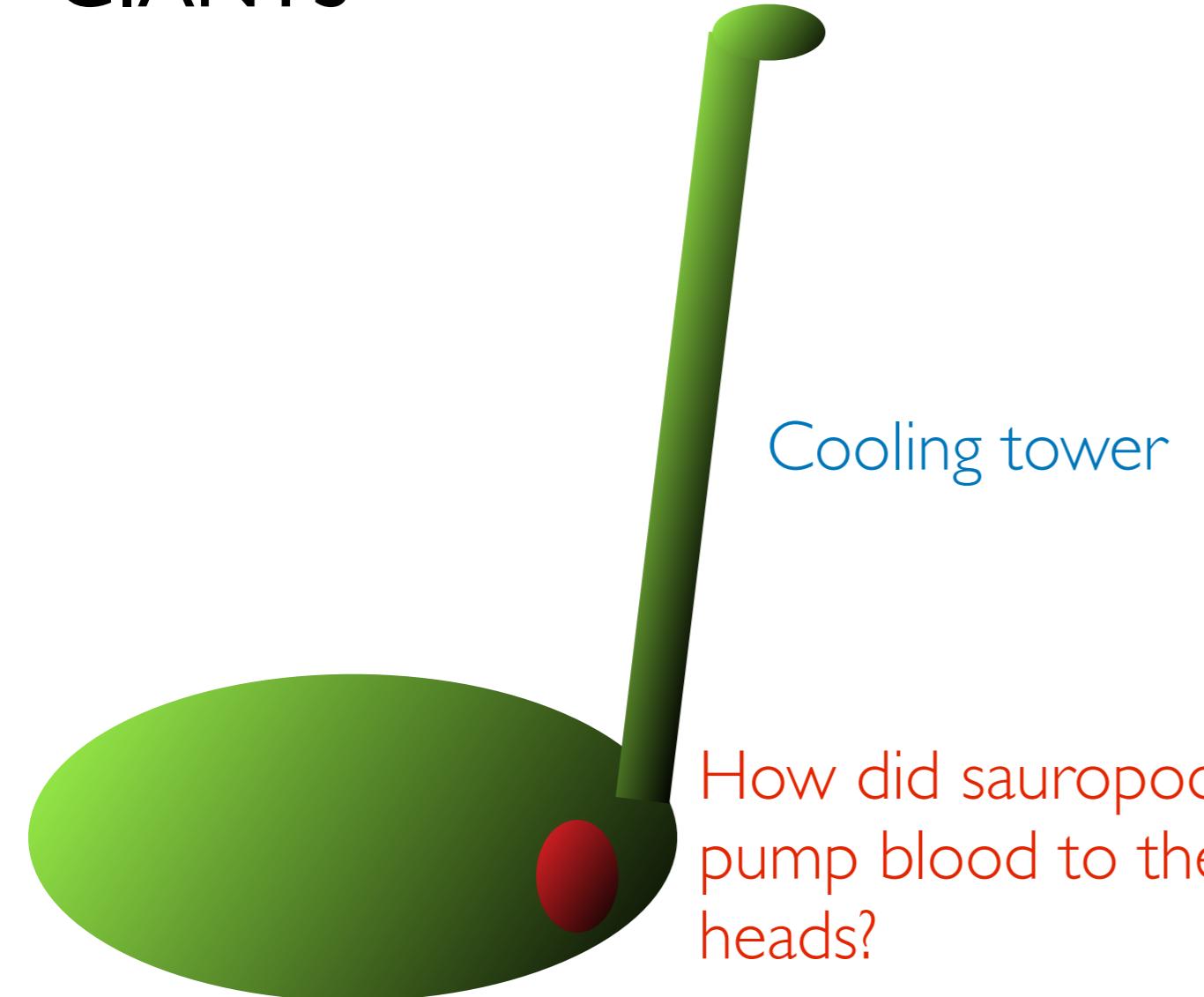
Dinosaurs and Body size

How to build a GIANT



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

GIANTS

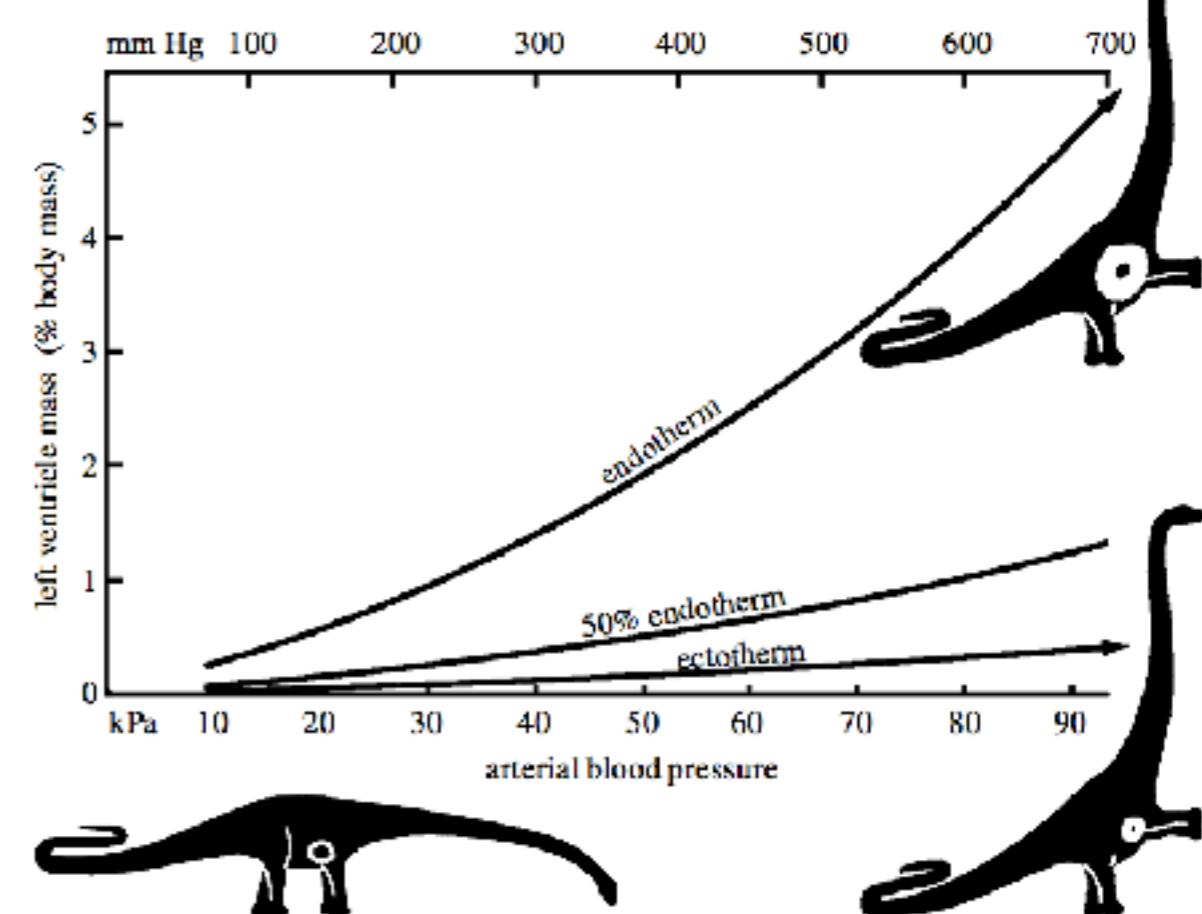
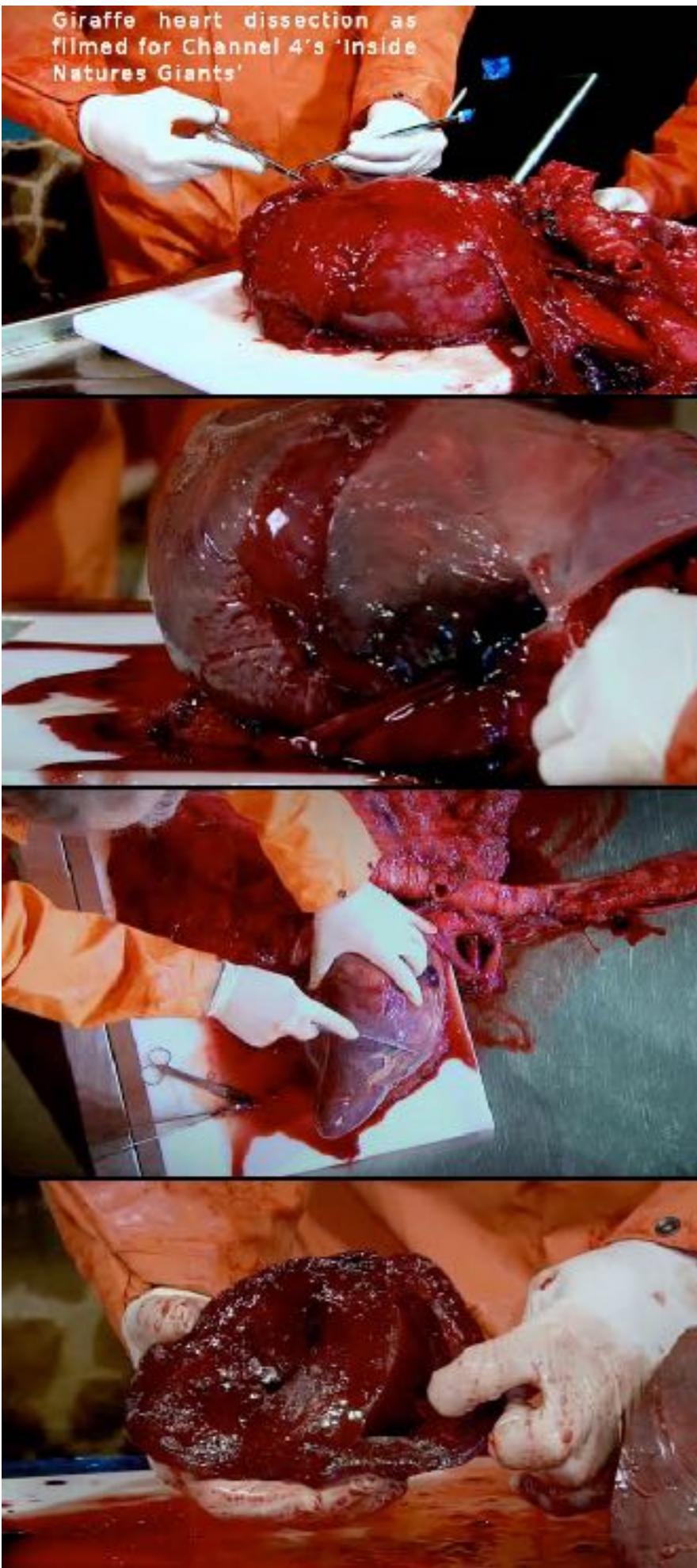


How did sauropods
pump blood to their
heads?

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

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

Giraffe heart dissection as
filmed for Channel 4's 'Inside
Nature's Giants'

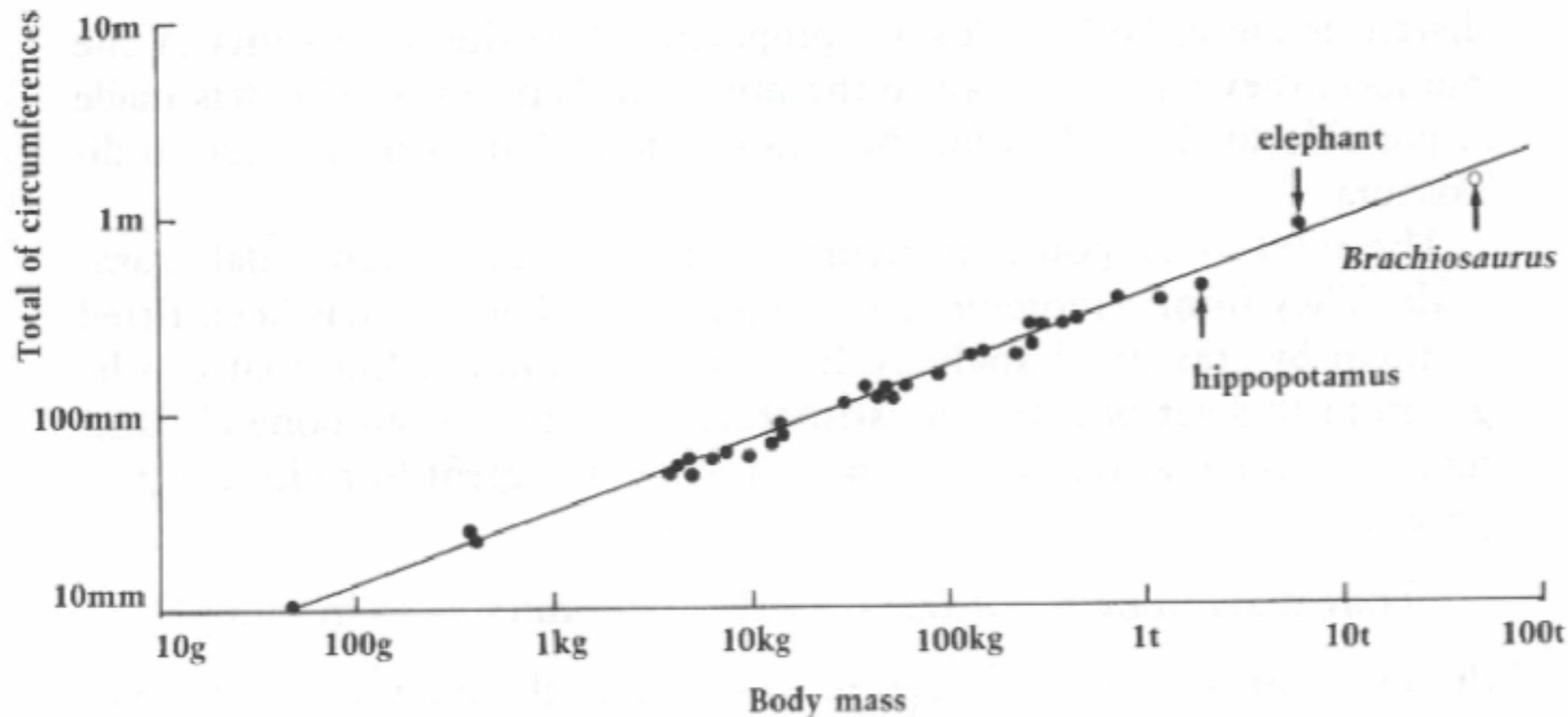


Arterial blood pressure:
~200 mmHg (2x norm)

Dinosaurs and Body size

How do we estimate size from fossils?

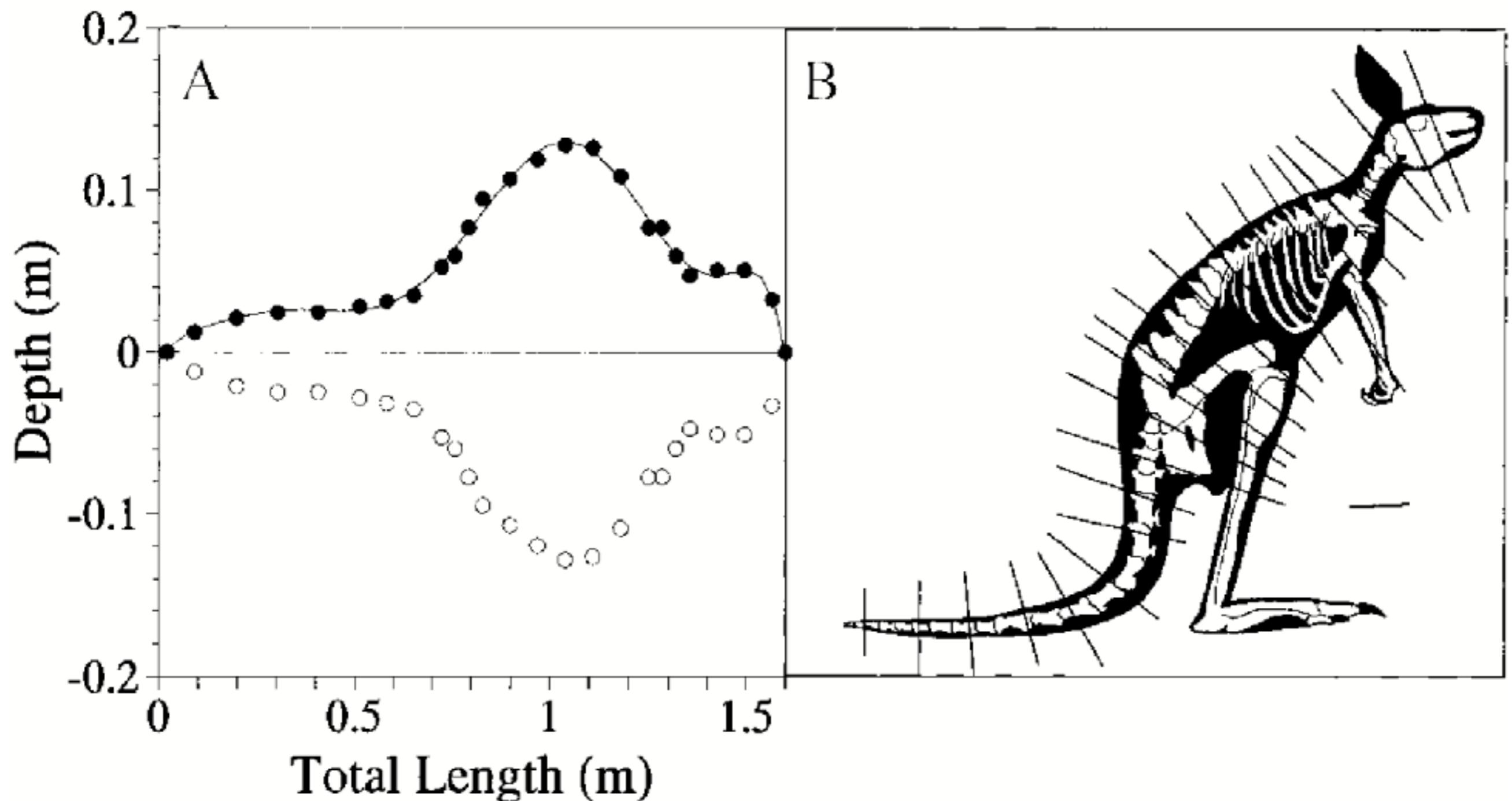
Weighing Dinosaurs with Leg Bone Measurement (cont.)



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?

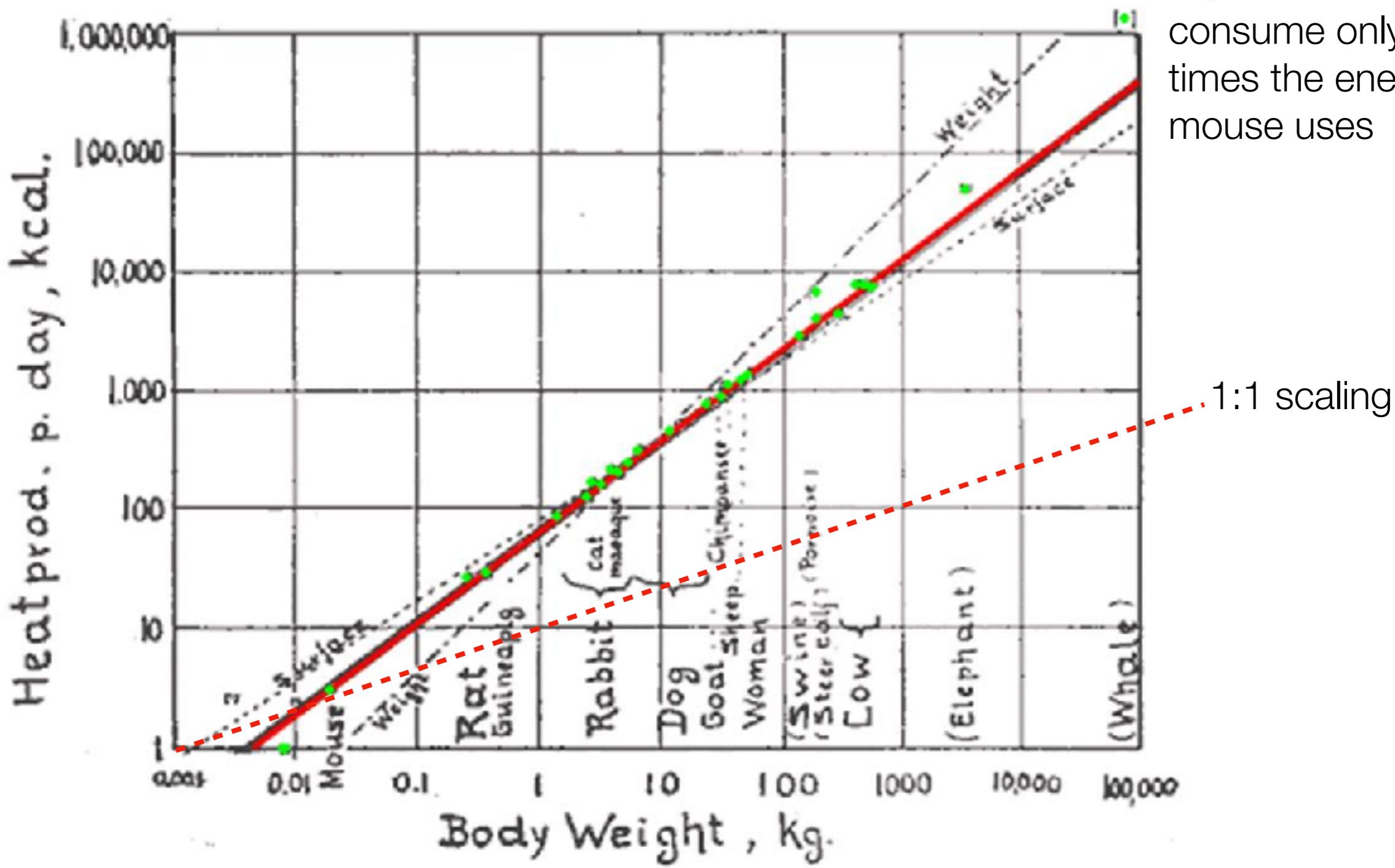


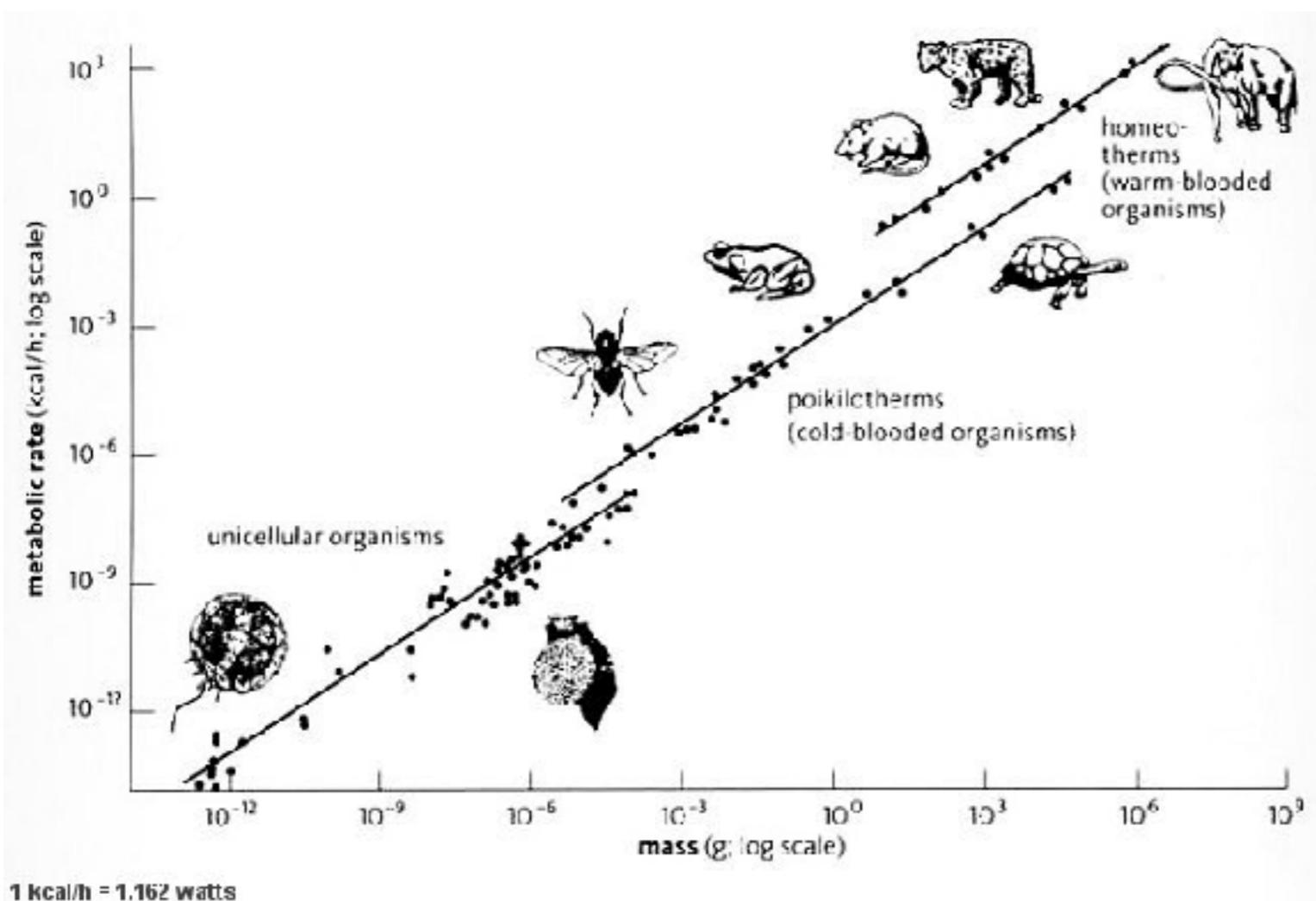
Fig. 1. Log. metabol. rate/log body weight

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

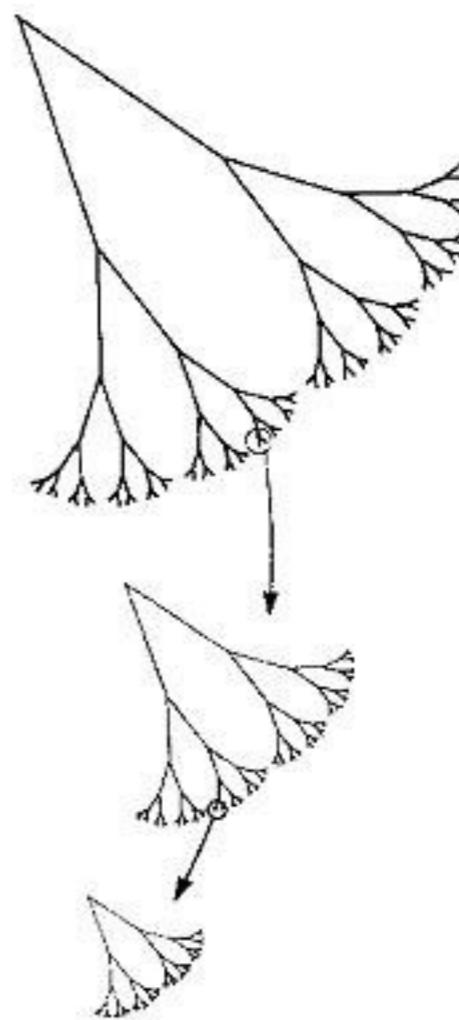
Dinosaurs and Body size

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

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



Self-Similar Structure (Fractal)



The Networks



CIRCULATORY SYSTEM

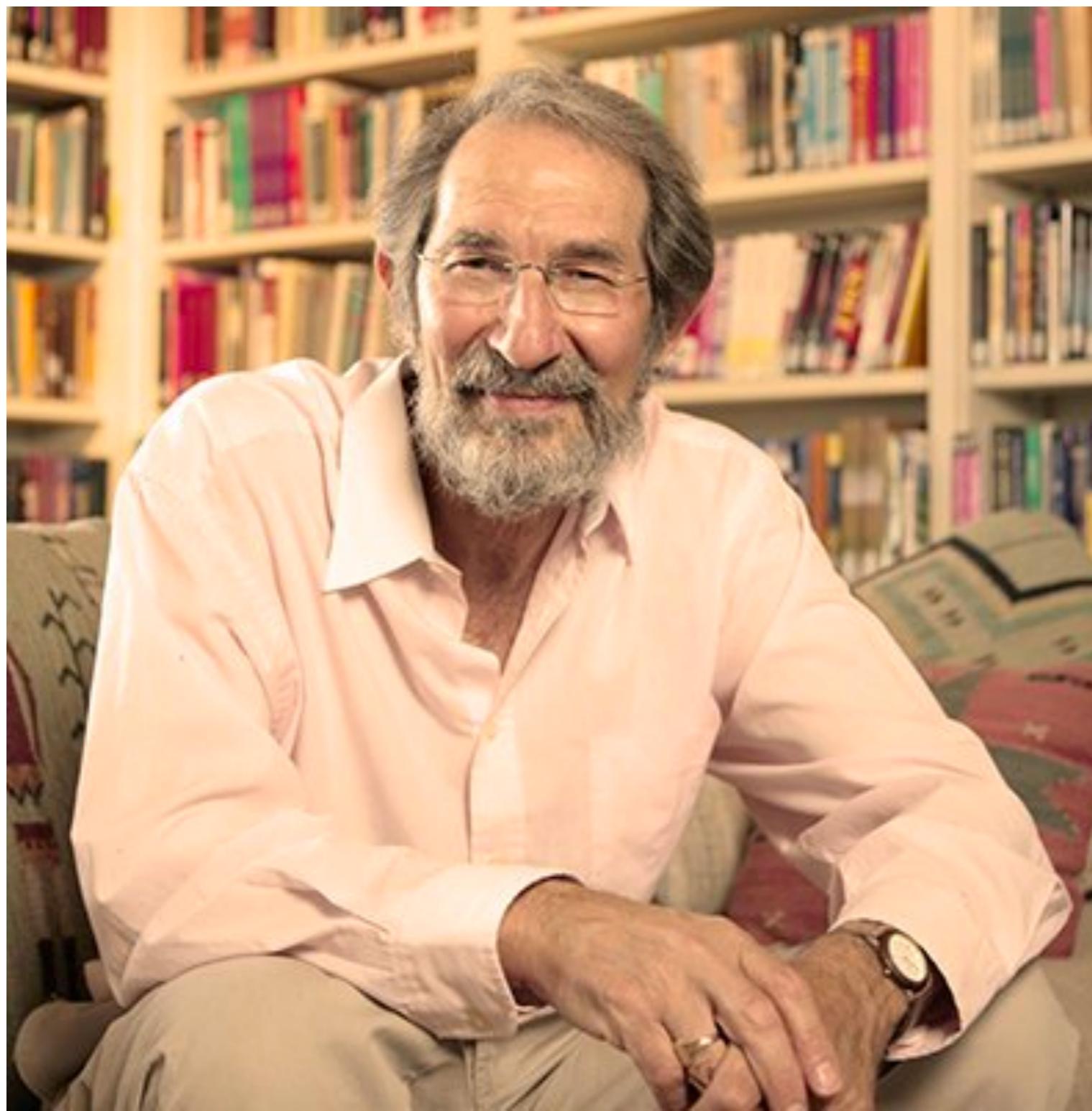


LUNGS



TREE BRANCHES

The scientists who developed the scaling theory took clues from naturally occurring networks that carry life-sustaining fluids in organisms in which each small part is a replica of the whole. No matter how big the organism, the ends of these fractal networks are always the same size, since individual cells are of similar size in all organisms.



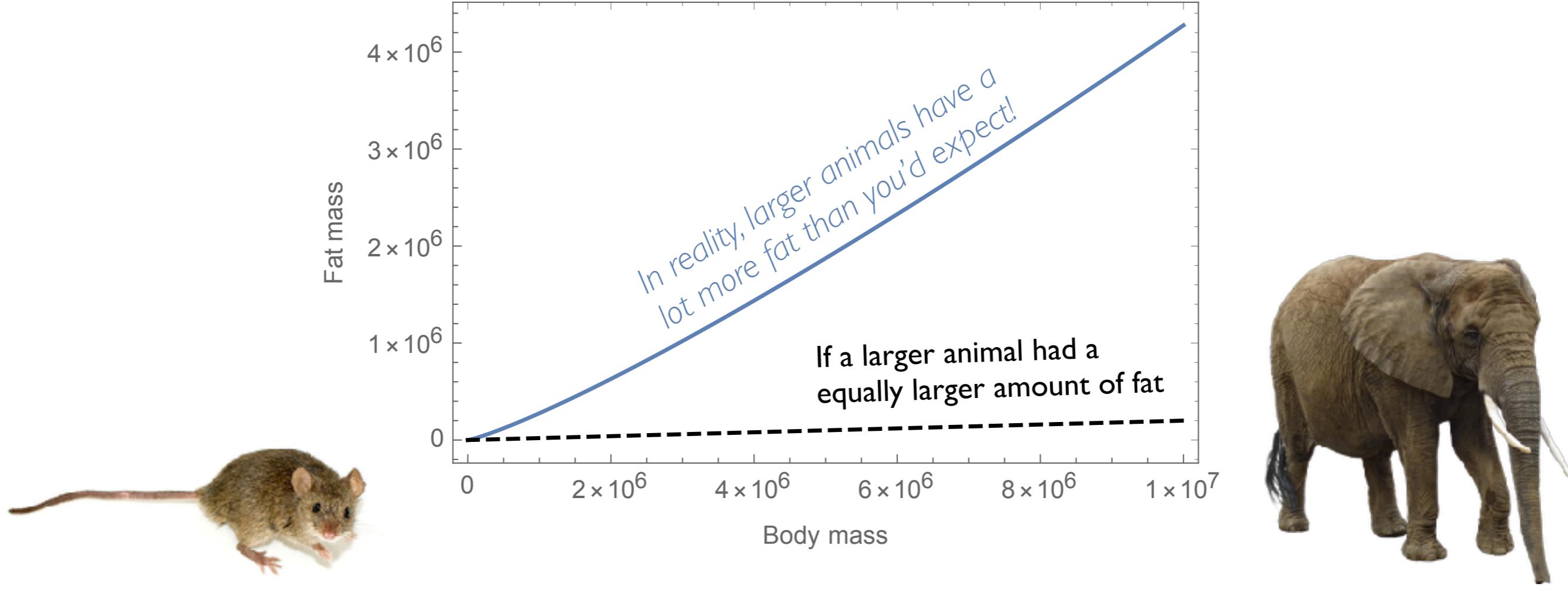
Body size and storage

Basic ingredients of life:

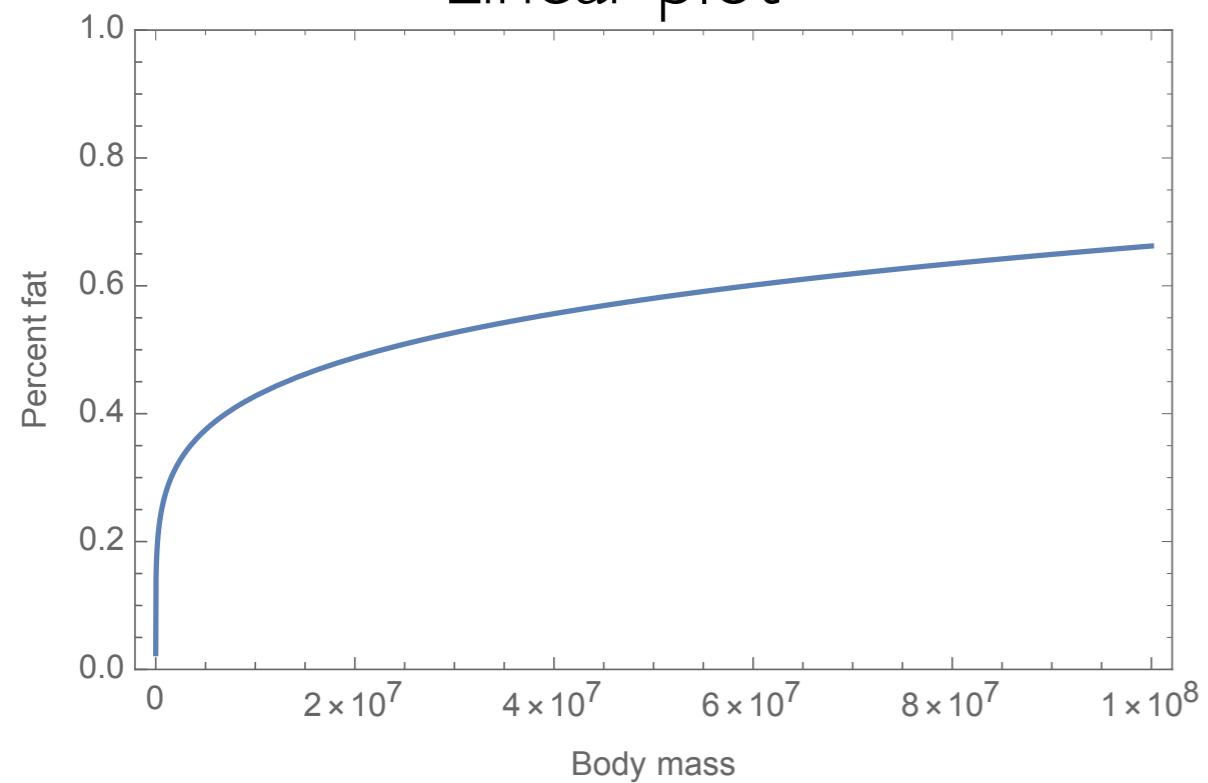
- 1) reproduce (pass down genetic material)
- 2) obtain enough ENERGY to reproduce
carry fat

the amount of fat you can carry is key

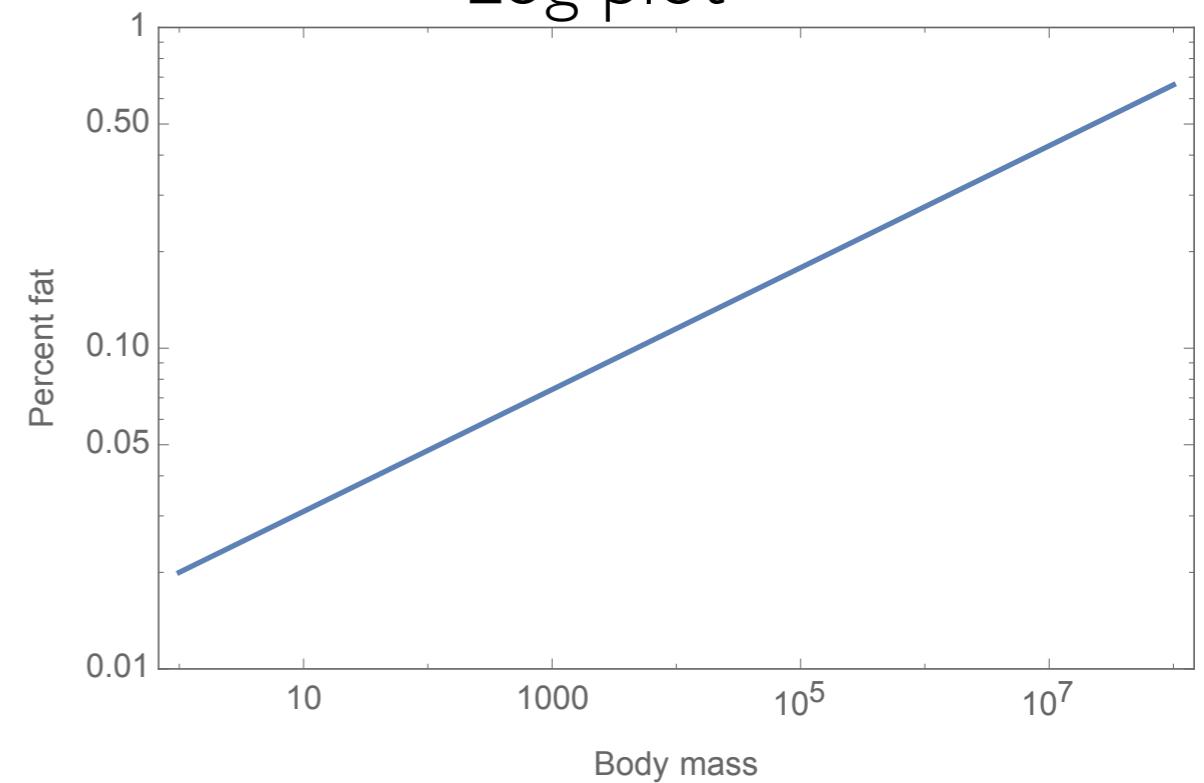


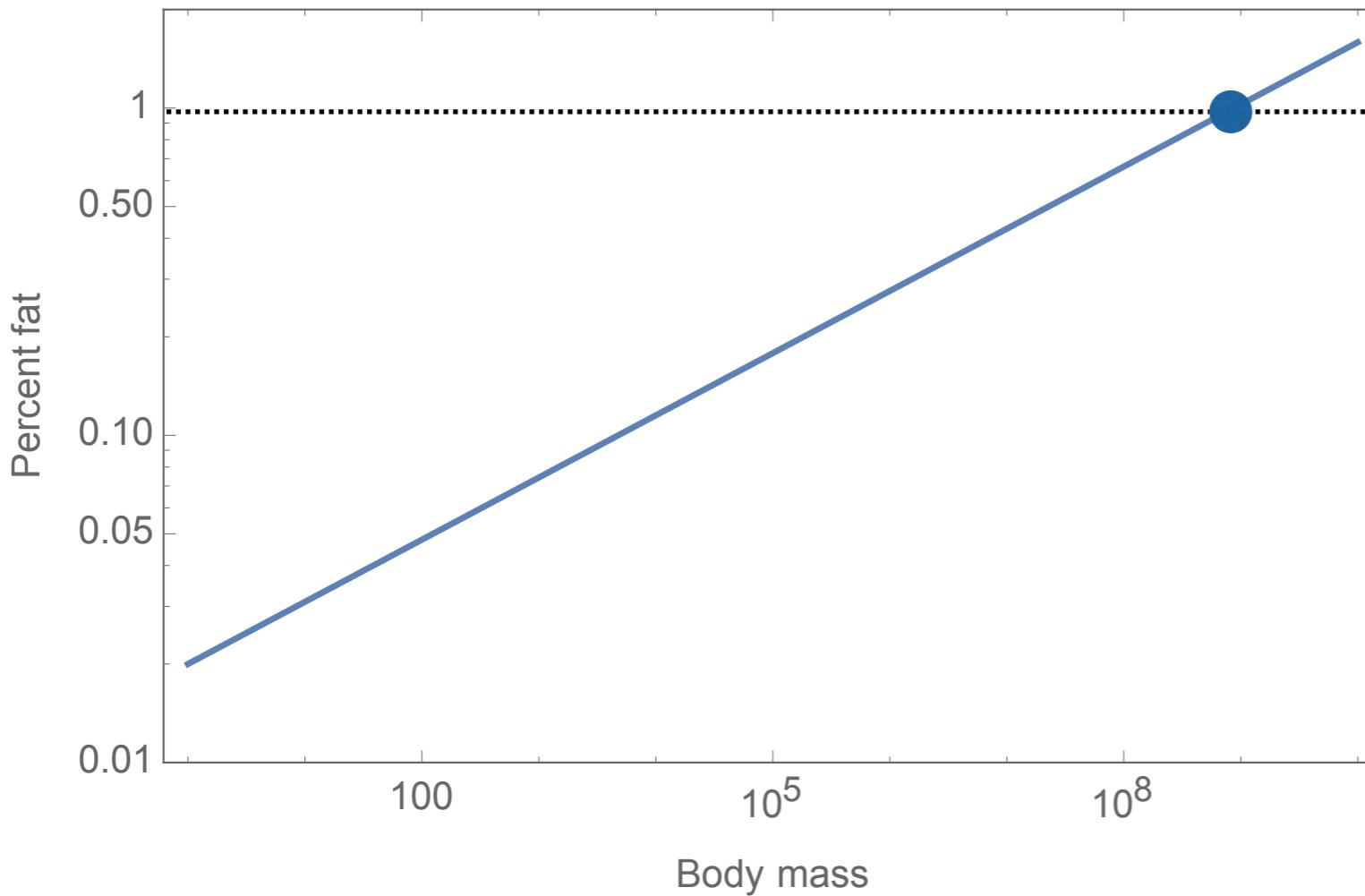


Linear plot



Log plot

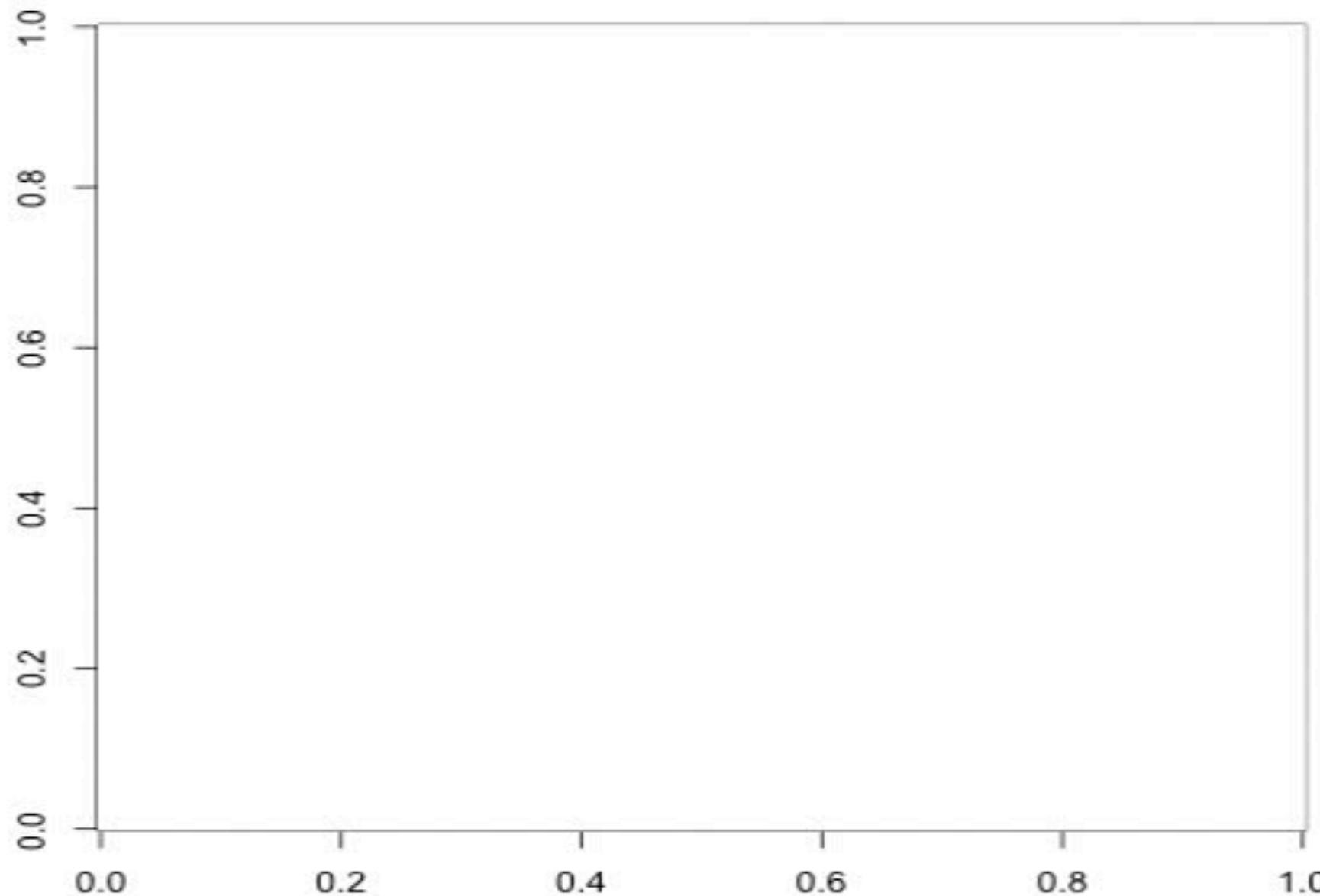




According to the relationship, at what size would a mammal be 100% body fat???

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

Body size and foraging

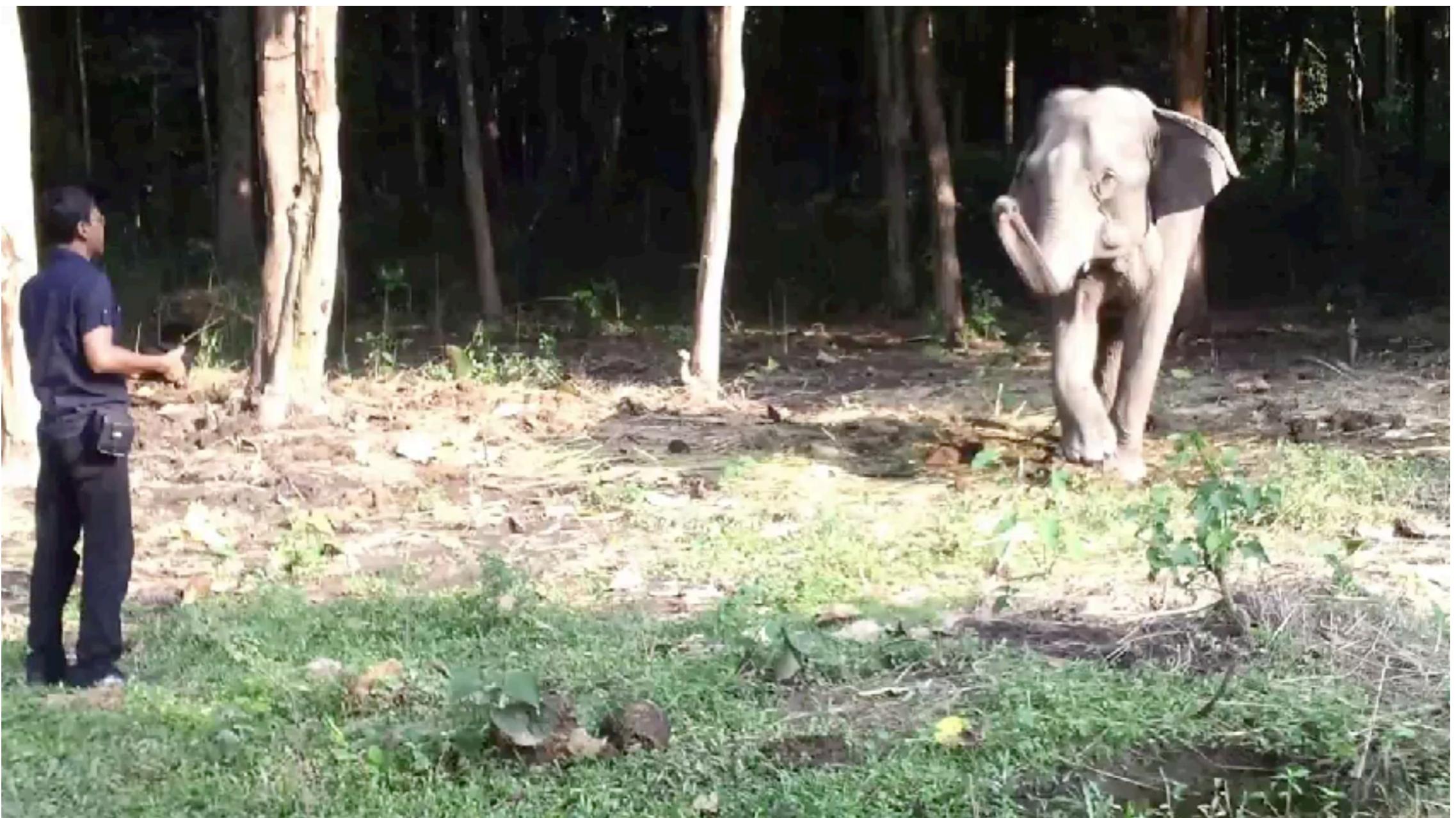


Larger animals can travel further
-find resources that are farther apart
-harder to find mates/communicate



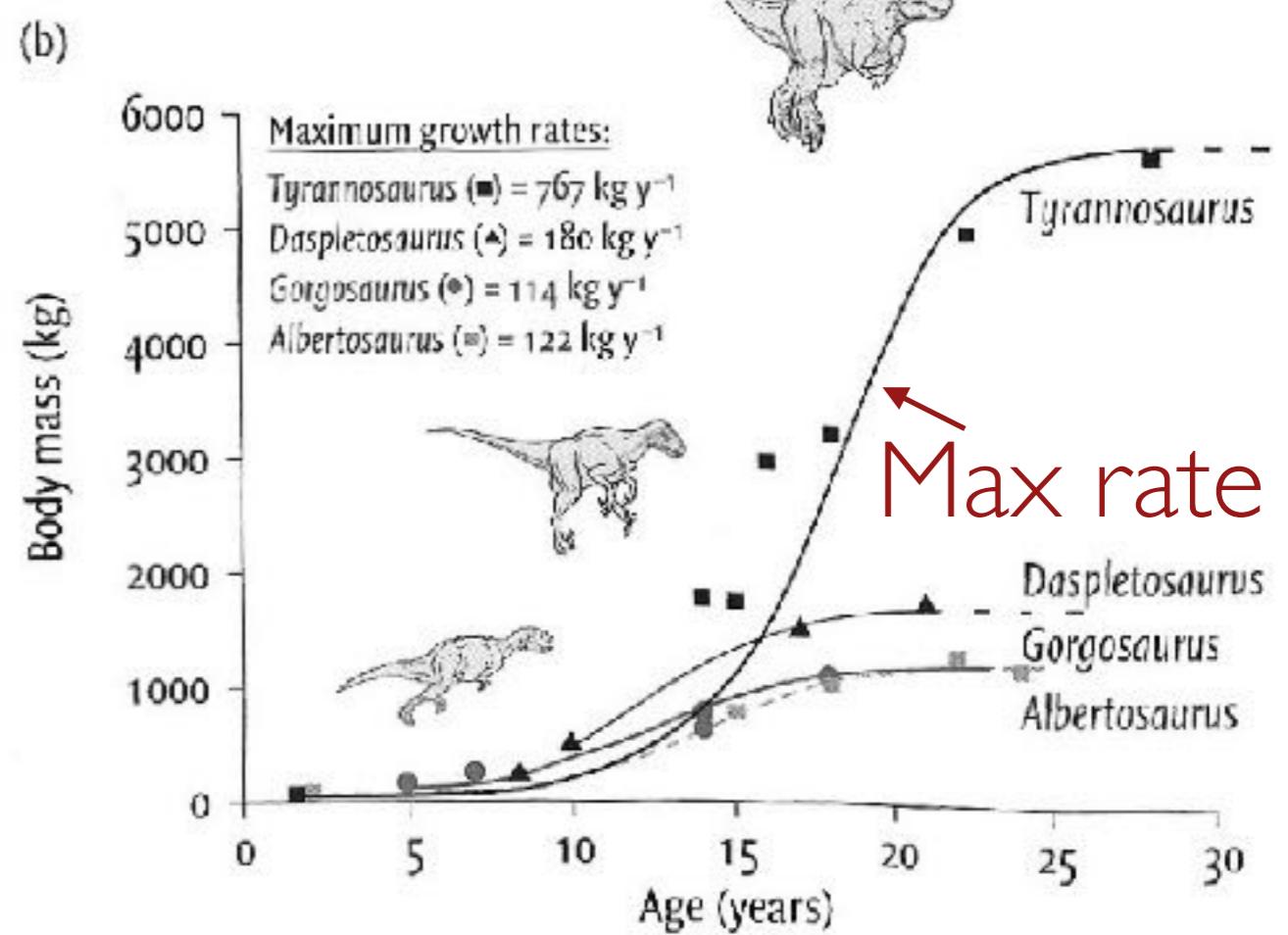
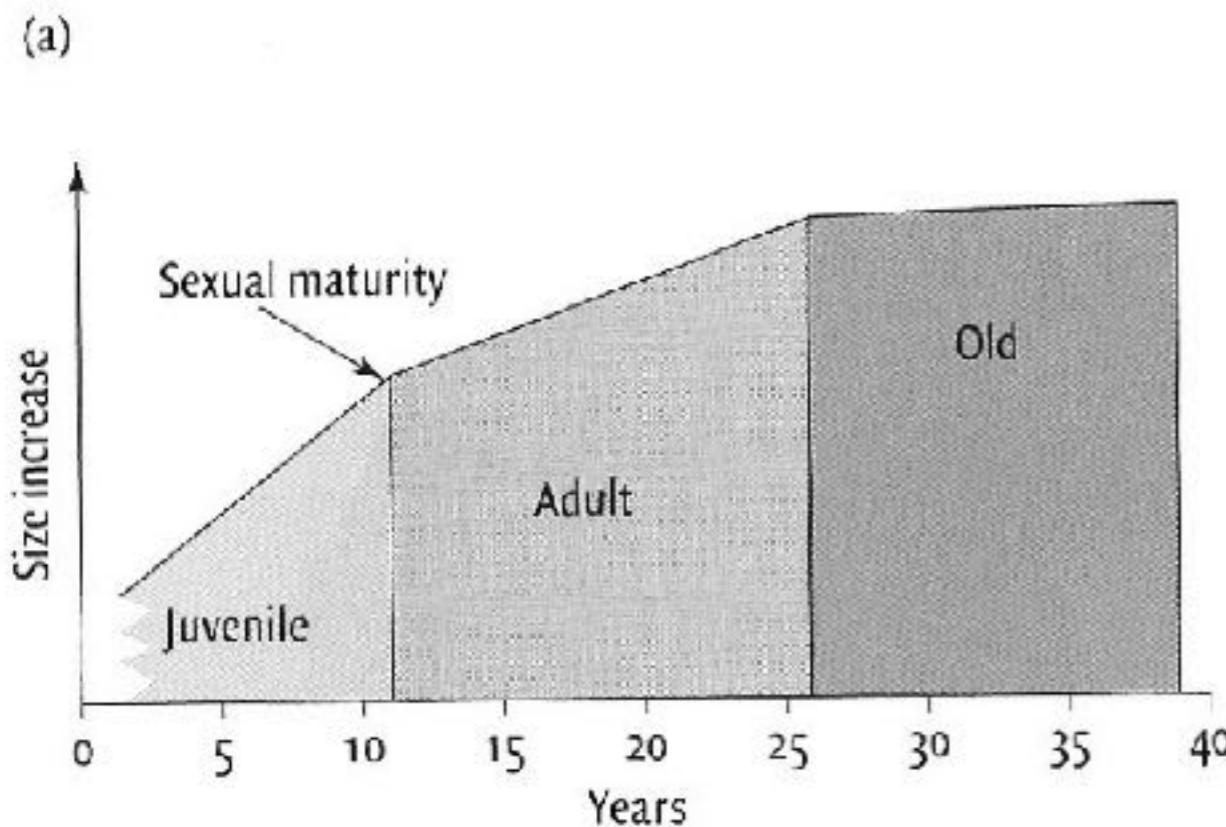
Large body-sized animals: large distances

Elephant Ultrasonics



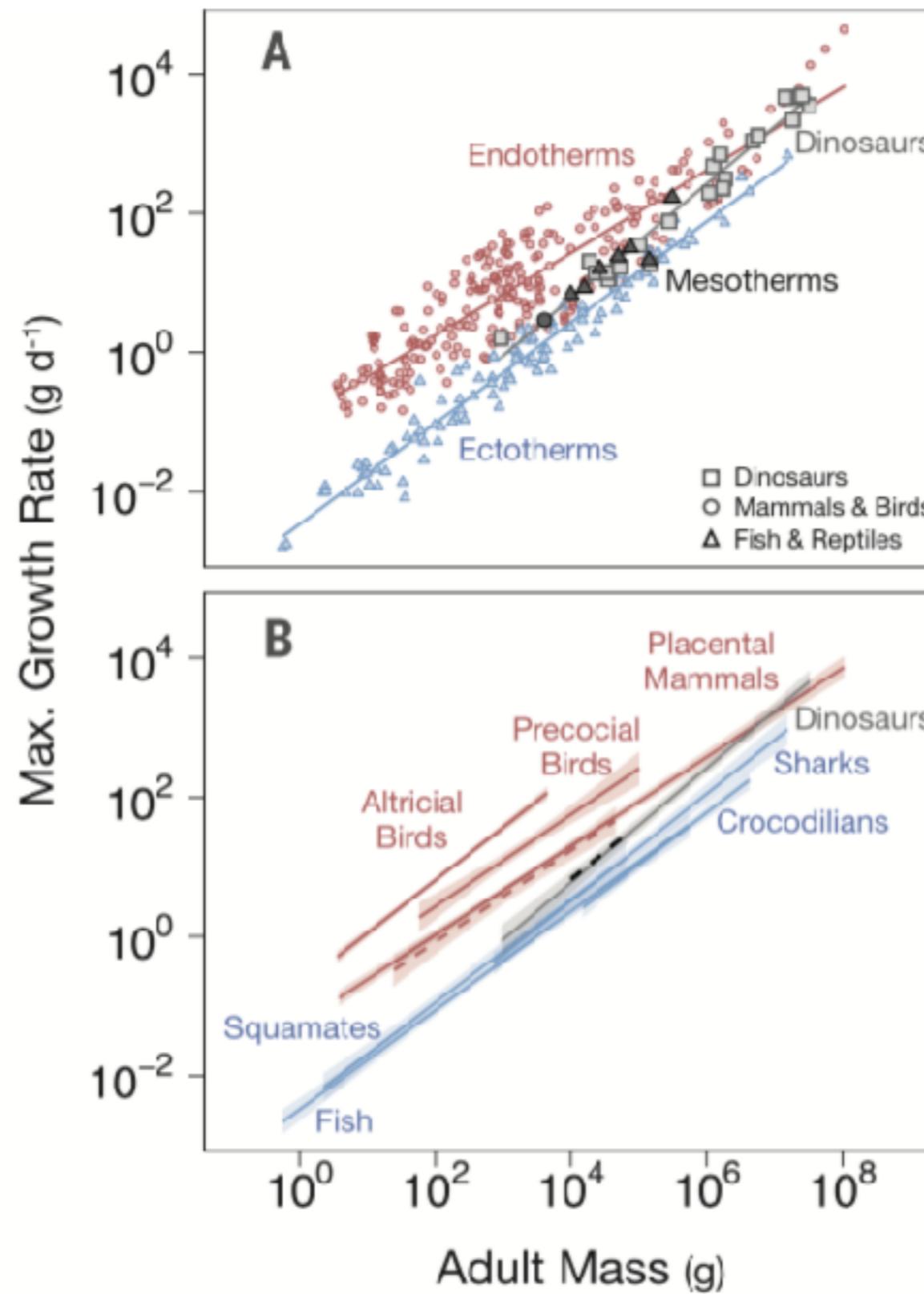
Dinosaurs and Body size

Estimating growth rates from multiple individuals



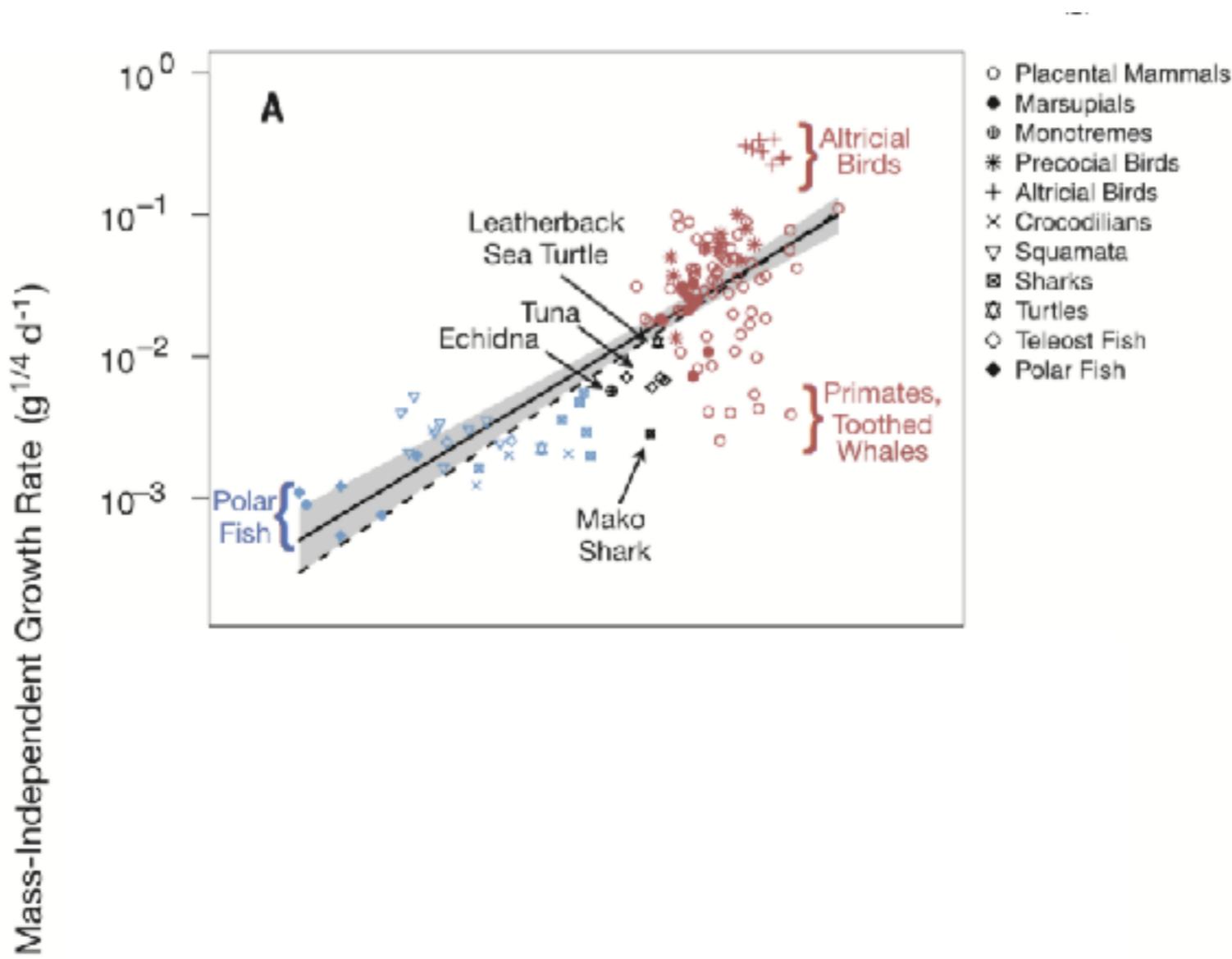
Dinosaurs and Body size

Not ectotherms... not endotherms... mesotherms



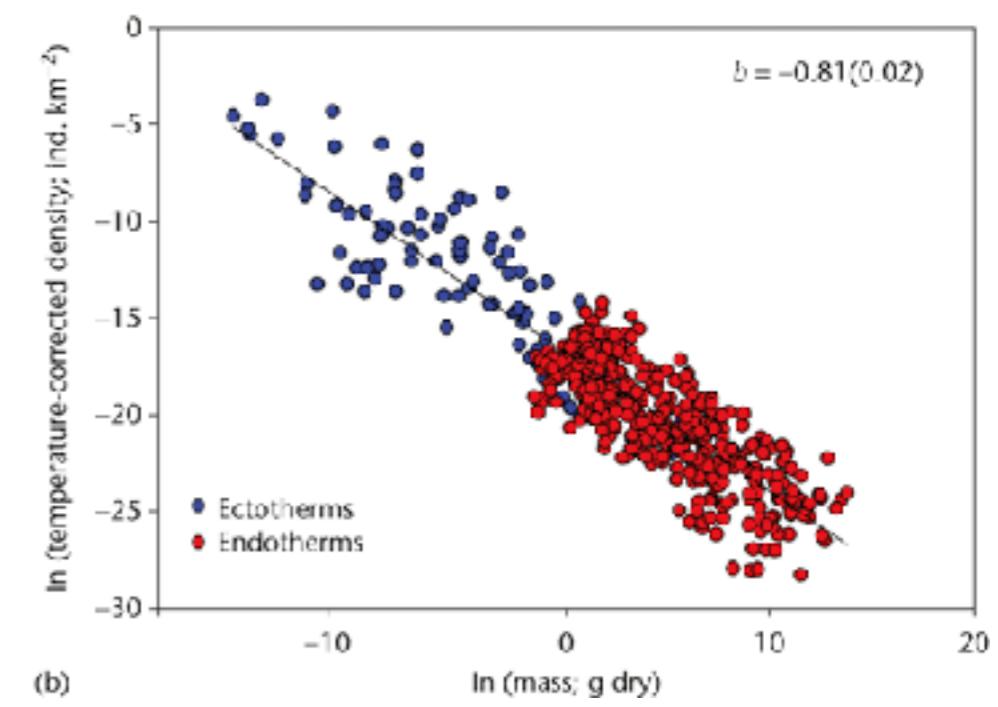
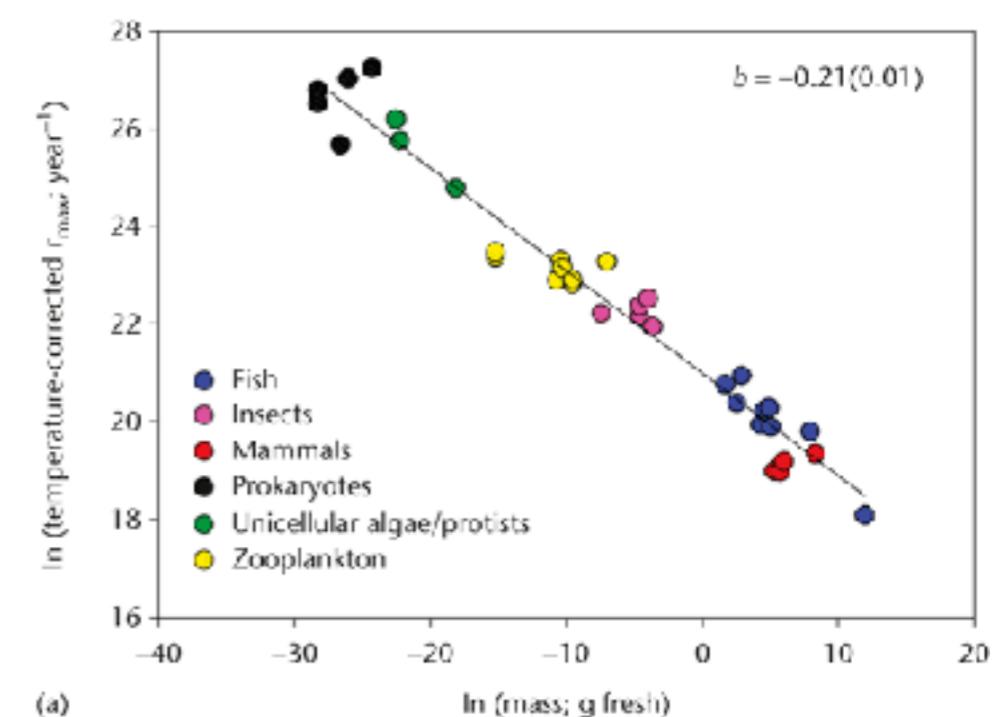
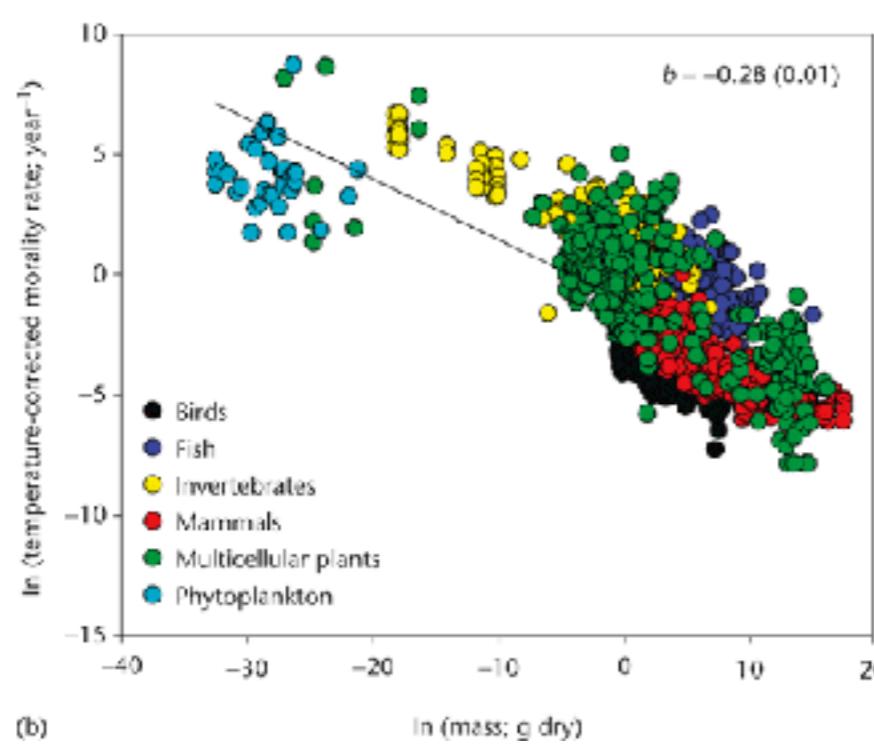
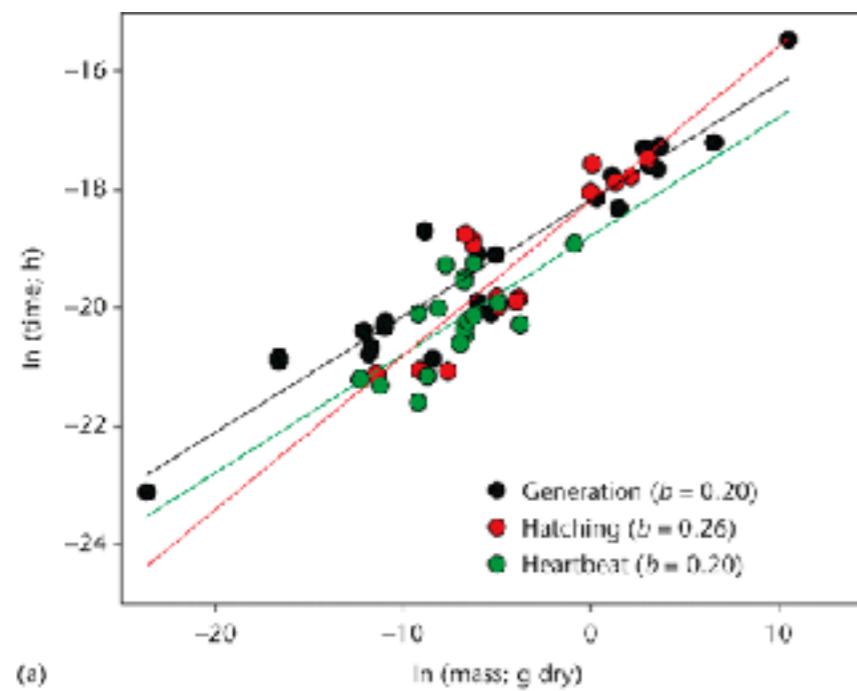
Dinosaurs and Body size

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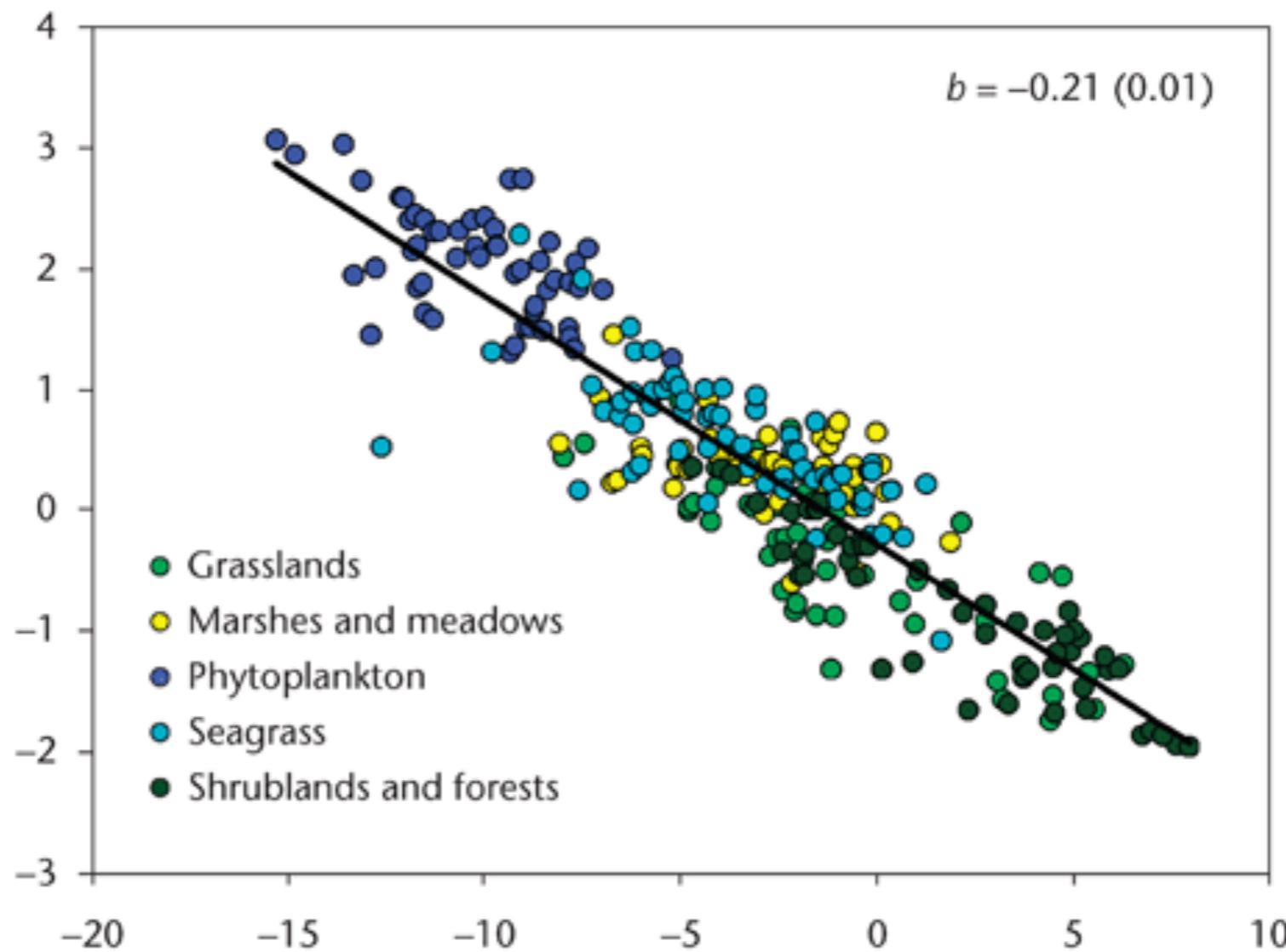
Dinosaurs and Body size

What can body size tell us about the life of the animal?
“Allometric Scaling”



Dinosaurs and Body size

What can body size tell us about the life of the animal?
“Allometric Scaling”



Dinosaurs and Body size

What can body size tell us about the life of the animal?
“Allometric Scaling”

Predator prey relationships

