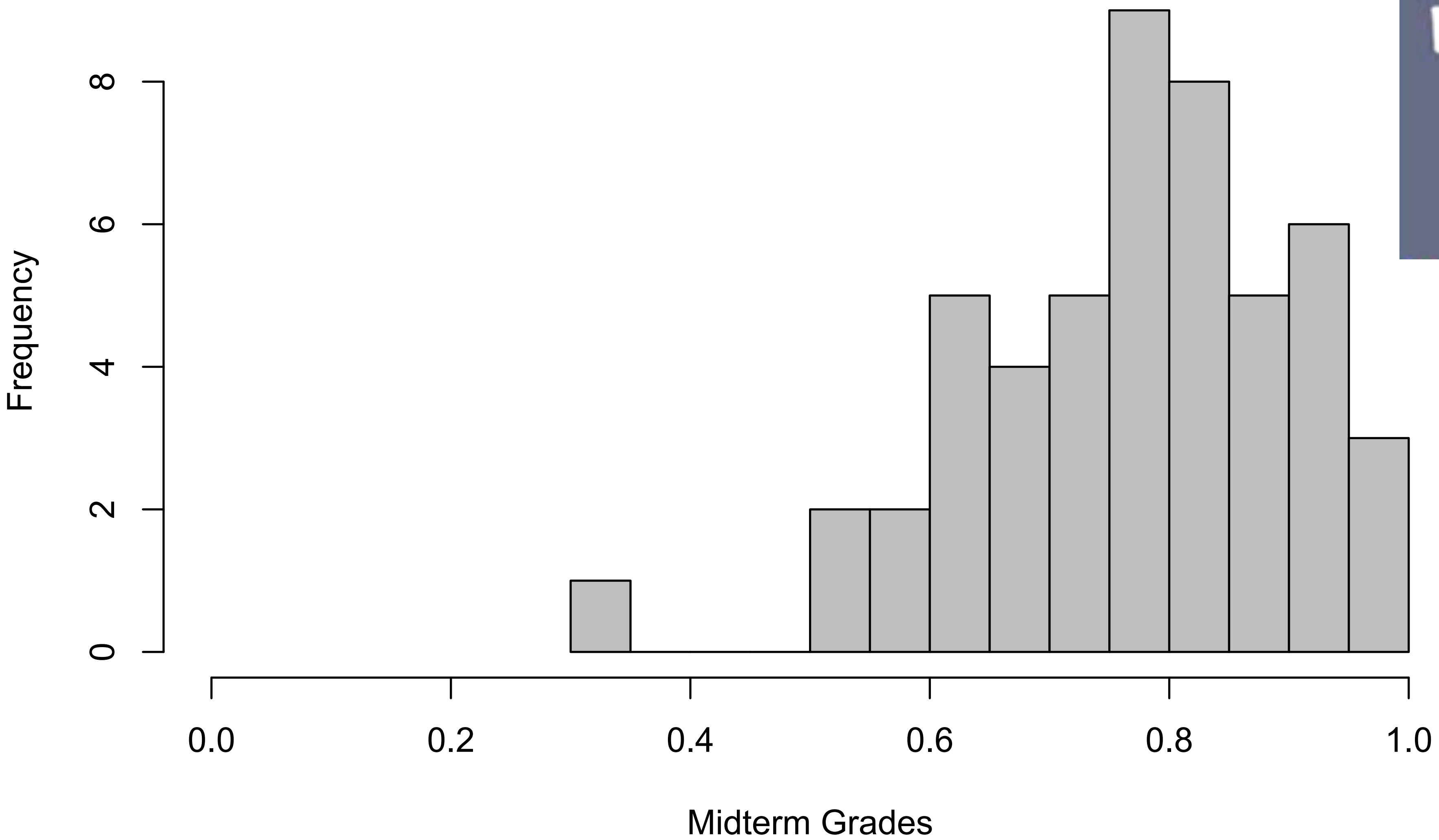
Midterm Grades



Attendance (class + section): 12.5%
Homework: 25%
Exam: 62.5%

Section:

Get back paper abstracts

✔ Start researching your topic
✗ Rewrite thesis; <u>due in class on Friday, March 18th</u>

<u>Research paper:</u>
4 pages, double spaced
5th page will be references
Due April 25th in section
Detailed instructions will be posted on website by end of week

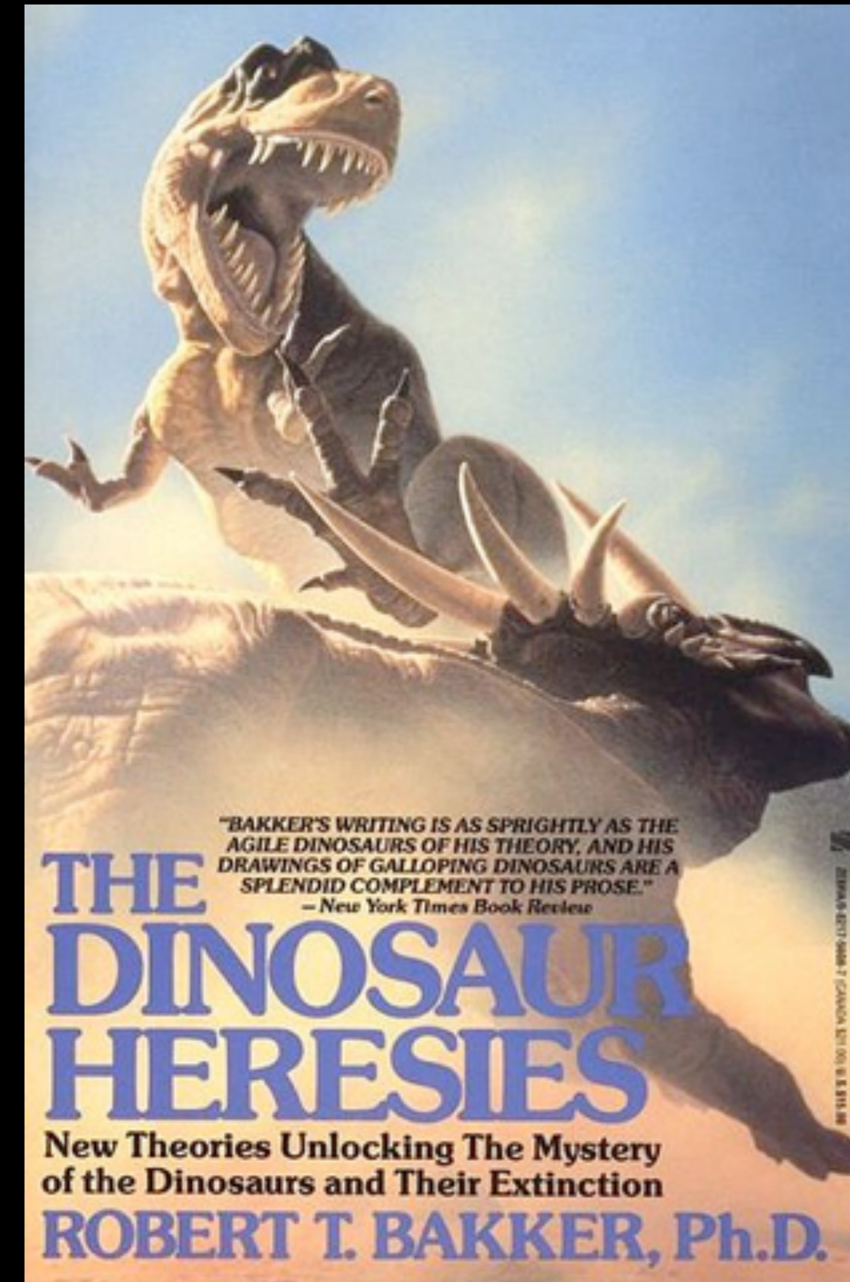
Dinosaur Thermoregulation: **hot or not?**

Dinosaur metabolism?

Cold-blooded?
Warm-blooded?
Different?

Early depiction of *Megalosaurus*

Charles Knight



1988

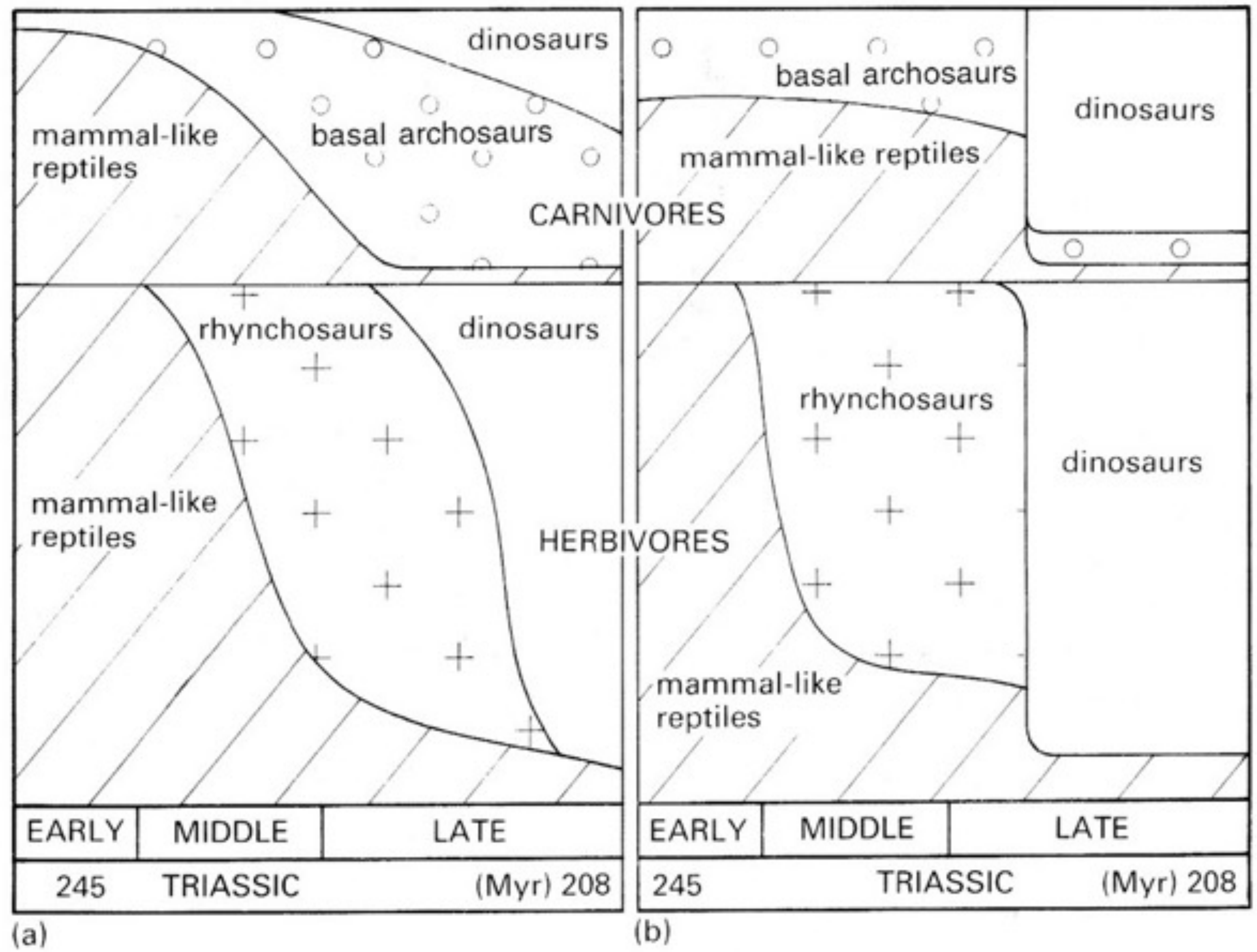


Fig. 6.10 Two models for the replacement of mammal-like reptiles, basal archosaurs, and rhynchosaurs by dinosaurs: (a) a competitive replacement scenario; (b) an opportunistic mass extinction replacement model.

Dinosaurs appeared at about the same time as mammals (160-170 Ma)
Dinosaurs took over at the start of the Mesozoic
Competitive Edge
vs.
Luck of the draw (Opportunistic)

Bakker argued that Dinosaurs were competitively superior to therapsids (including early mammals)
Therefore, they had to be warm-blooded animals
2 Major assumptions in this statement...

1) Dinos directly competed with mammals
2) Warm-bloodedness is competitively superior

FOR

- Cold-blooded animals are restricted to 45° North and South of the equator
  - Even then, primarily 20° N & S
- Modern cold-blooded animals are small

AGAINST

- Most living vertebrates are coldblooded

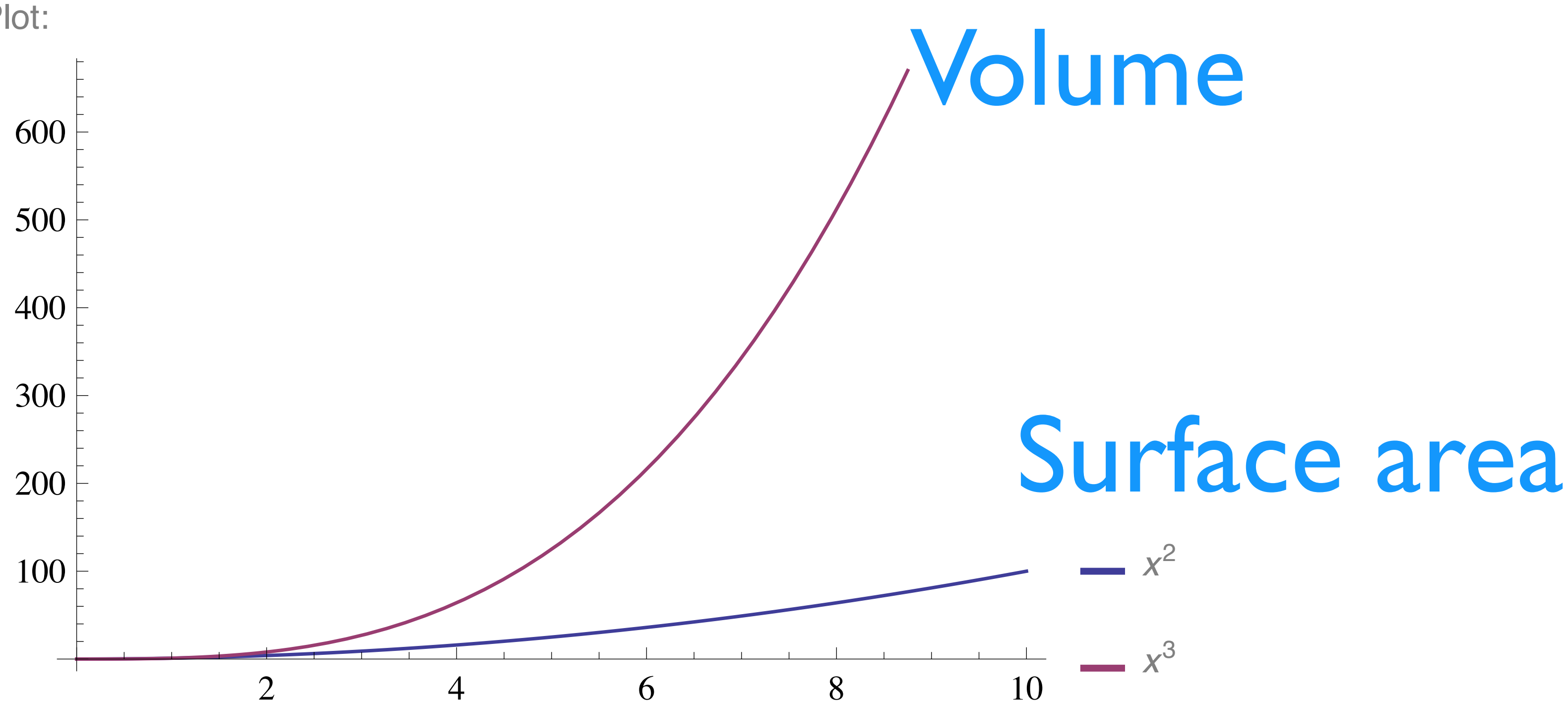
SA => square function
Volume => cubed function

Plot[y = x^2, y = x^3, {x,0,10}]

Input interpretation:

plot	$y = x^2$ $y = x^3$	$x = 0$ to 10

Plot:



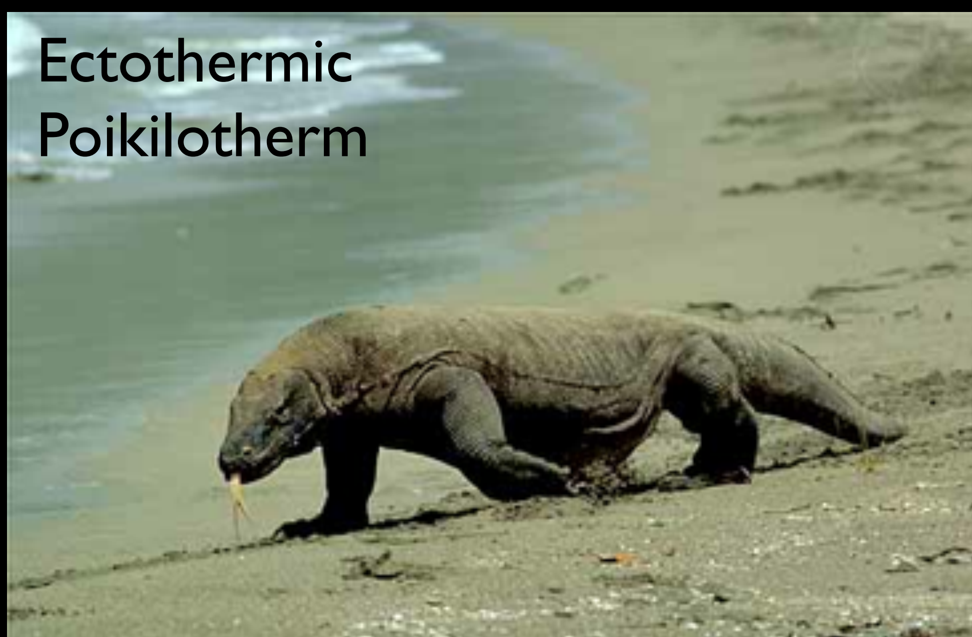
Some Terminology... all animals regulate temperature; it's just a matter of HOW

Ectotherms = animals whose temperature is regulated by external temperature
Endotherms = Animals whose temperature is not regulated by external temperature

EITHER/OR

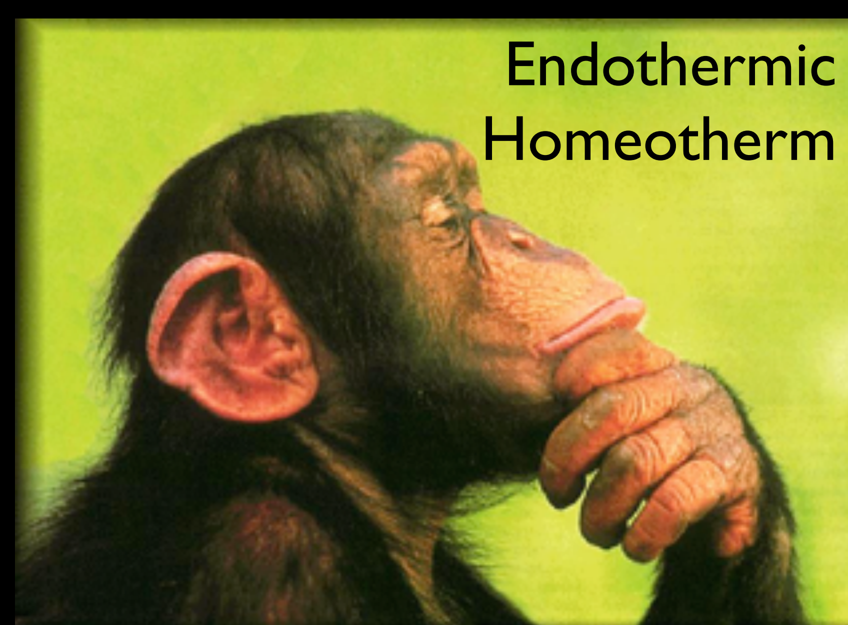
Poikilotherms = Animals whose temperatures fluctuate
Homeotherms = Animals whose temperatures are constant

SPECTRUM


Ectothermic Poikilotherm

FUNCTIONALLY homeothermic

Ectothermic Homeotherm


Endothermic Homeotherm

Endothermic Poikilotherm

Regulating your temperature - not just mammals

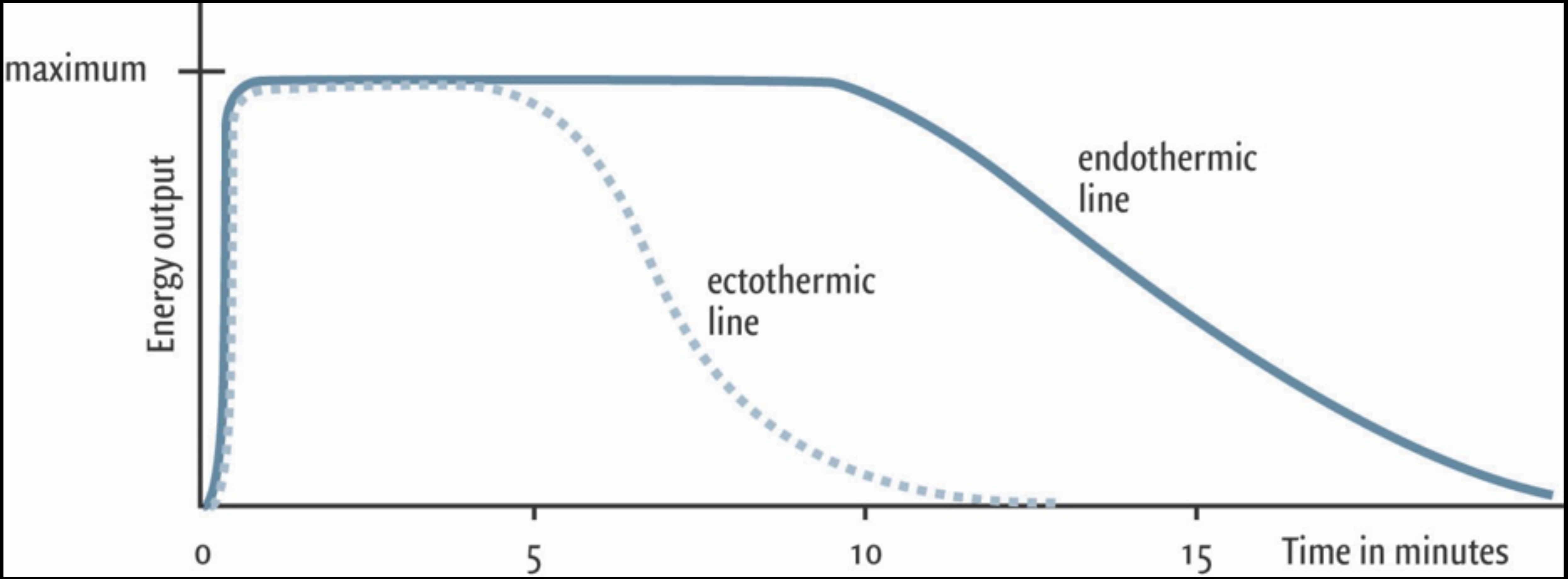
Regulating your temperature - not just animals

Eastern skunk cabbage

Dead horse arum lily

Carrion flower

Not just Temperature control; these 'lifestyles' describe the whole of metabolic processes.



Endothermy vs. Ectothermy: both have different metabolic consequences...

For a given activity, the Energy that is required for an ectotherm and an endotherm is the same, but:

1) an ectotherm produces less energy before it hit's the 'wall' (where anaerobic respiration begins ~ lactic acid buildup)
2) an endotherm can produce energy for a longer period of time before it hit's the 'wall'. (It can produce the same amount of energy LONGER) This is partly because an endotherm's <u>resting metabolic rate</u> is HIGHER than an ectotherms

It's good to be an ectotherm because:

1) Energetically cheaper
   Lower resting metabolic rate
2) Potentially higher quick bursts of energy

Costs:
Cannot expend a lot of energy for a long period of time

It's good to be an endotherm because

1) You can expend more energy for a longer period of time

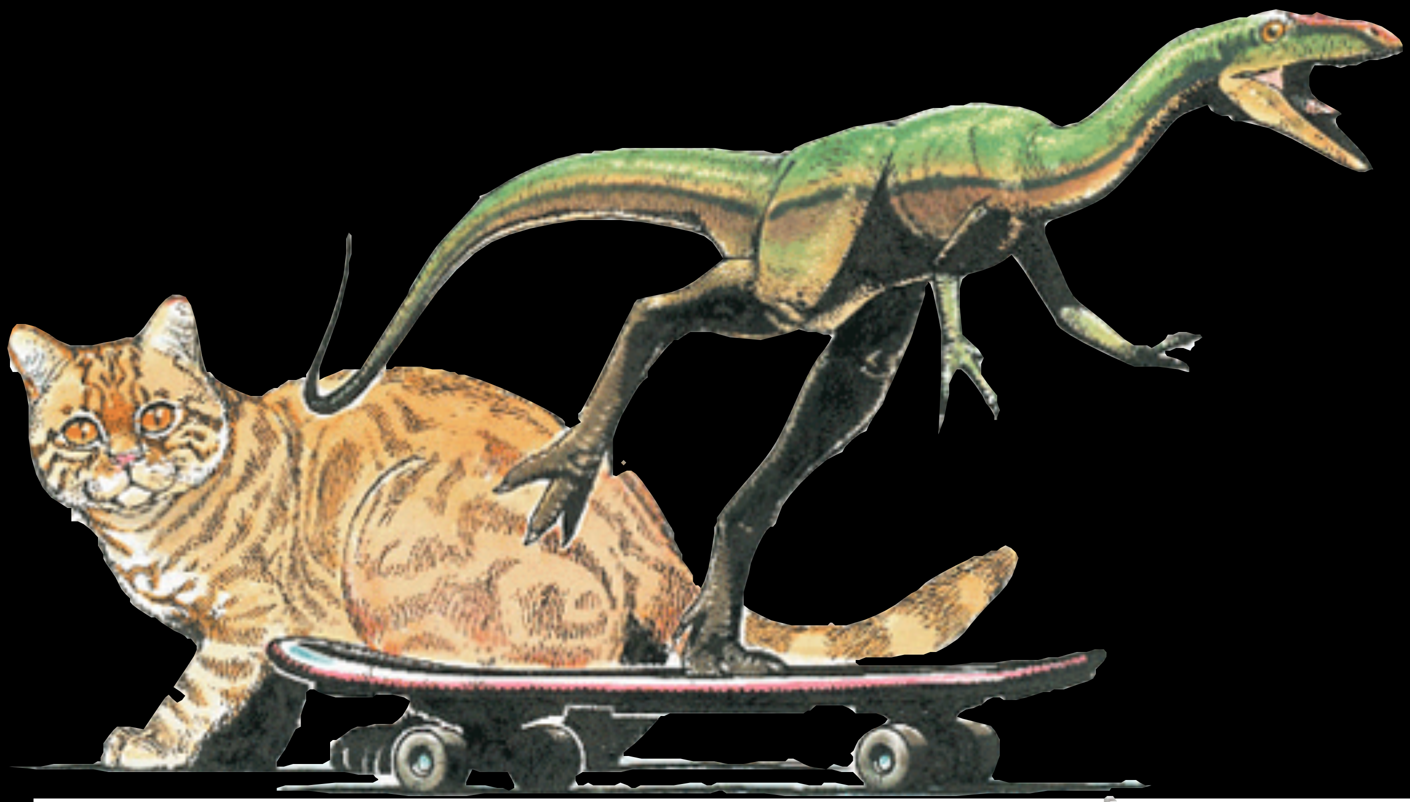
Costs:
Energetically EXPENSIVE

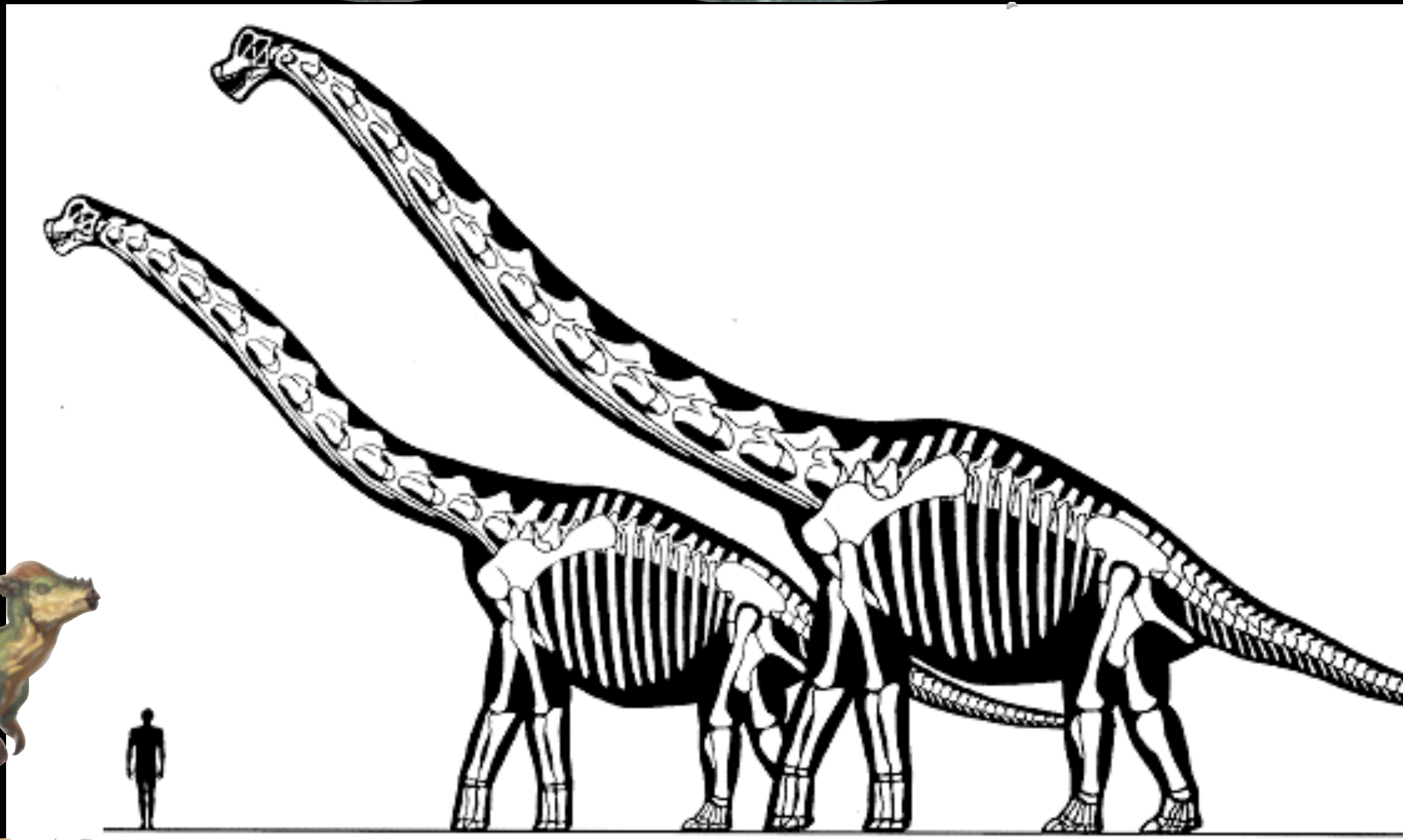
Consequences:
For a given 'energy landscape'
You can support more ectotherms
b/c they are more economical

Conclusion:
Endothermy is not superior.
It is just another lifestyle

Deciding Factor:
What is the best strategy for survival in a given ecological scenario? Varies from scenario to scenario

The Million Dollar Question: Were dinosaurs endothermic or ectothermic or something else entirely???





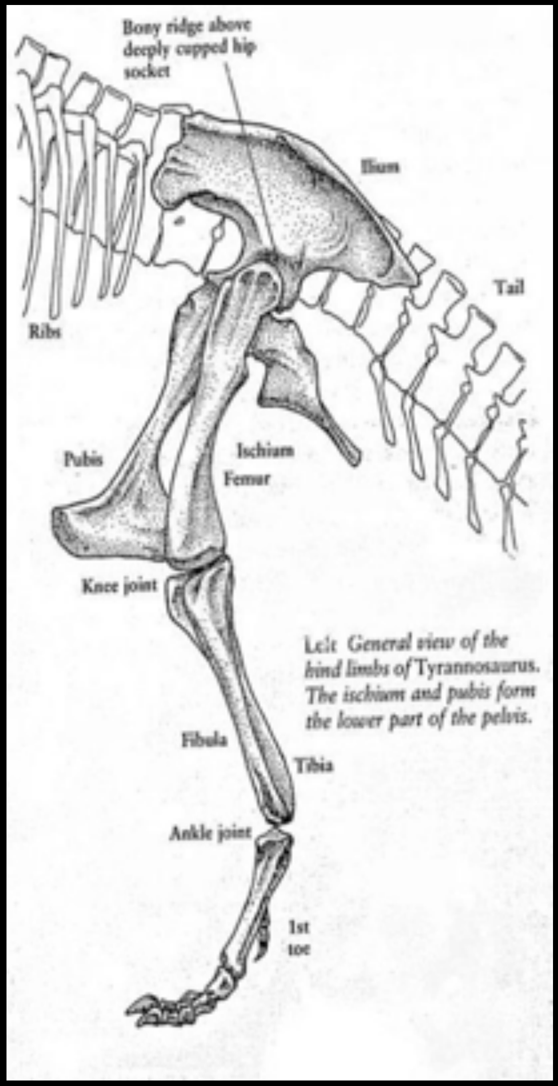
Dinosaur Metabolism: The evidence

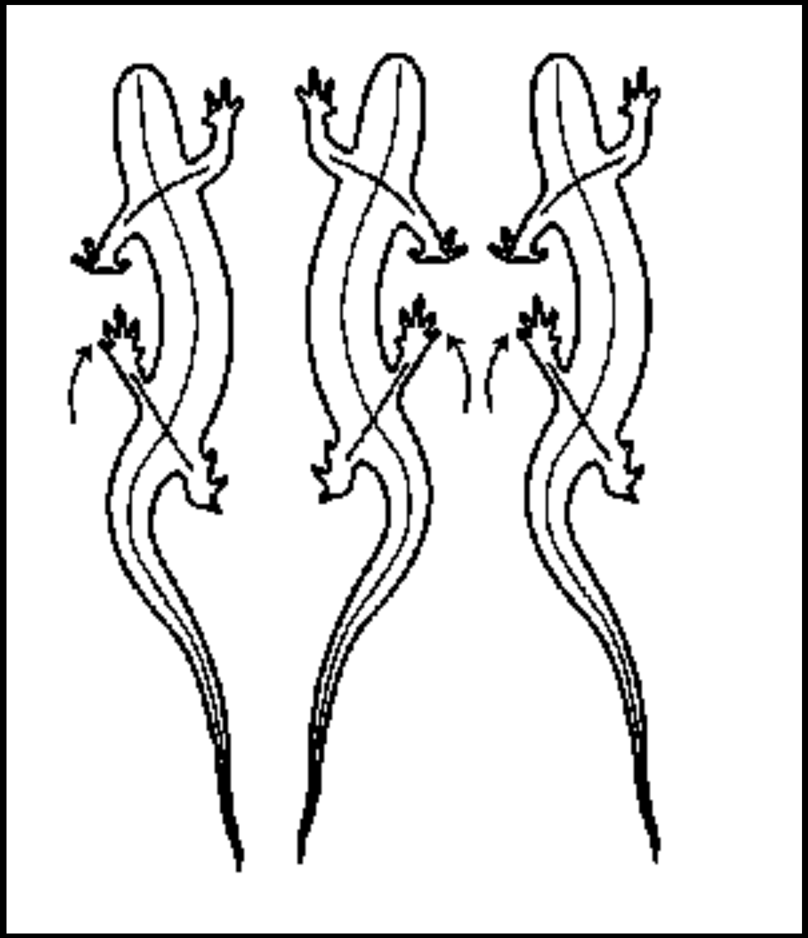
1) Anatomy
2) Diet
3) Hearts
4) Brains
5) Bone Histology
6) Growth and LAGS
7) Plumage
8) Ecology / Zoogeography
9) Chemistry
10) Noses

Dinosaur Metabolism: The evidence

1) Anatomy

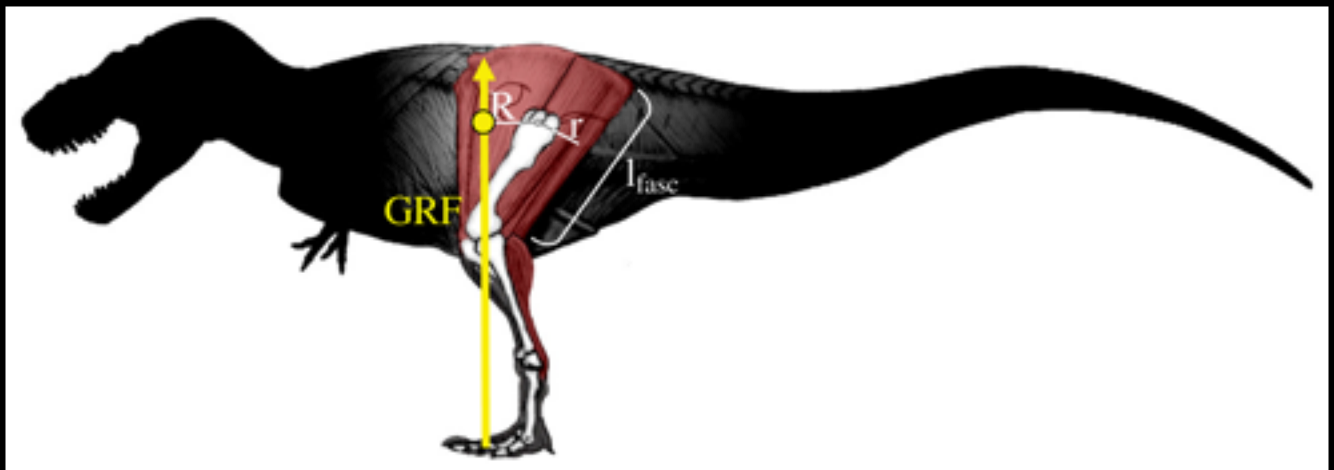
1) Among modern animals, all animals with erect stances are endotherms
2) Sprawling animals have limited O2 intake while moving quickly; parasagittal stance evolved to overcome this? Upright stance may be a prerequisite for endothermy
3) Trackways: indicates slow animals (compared to quadrupedal mammals)



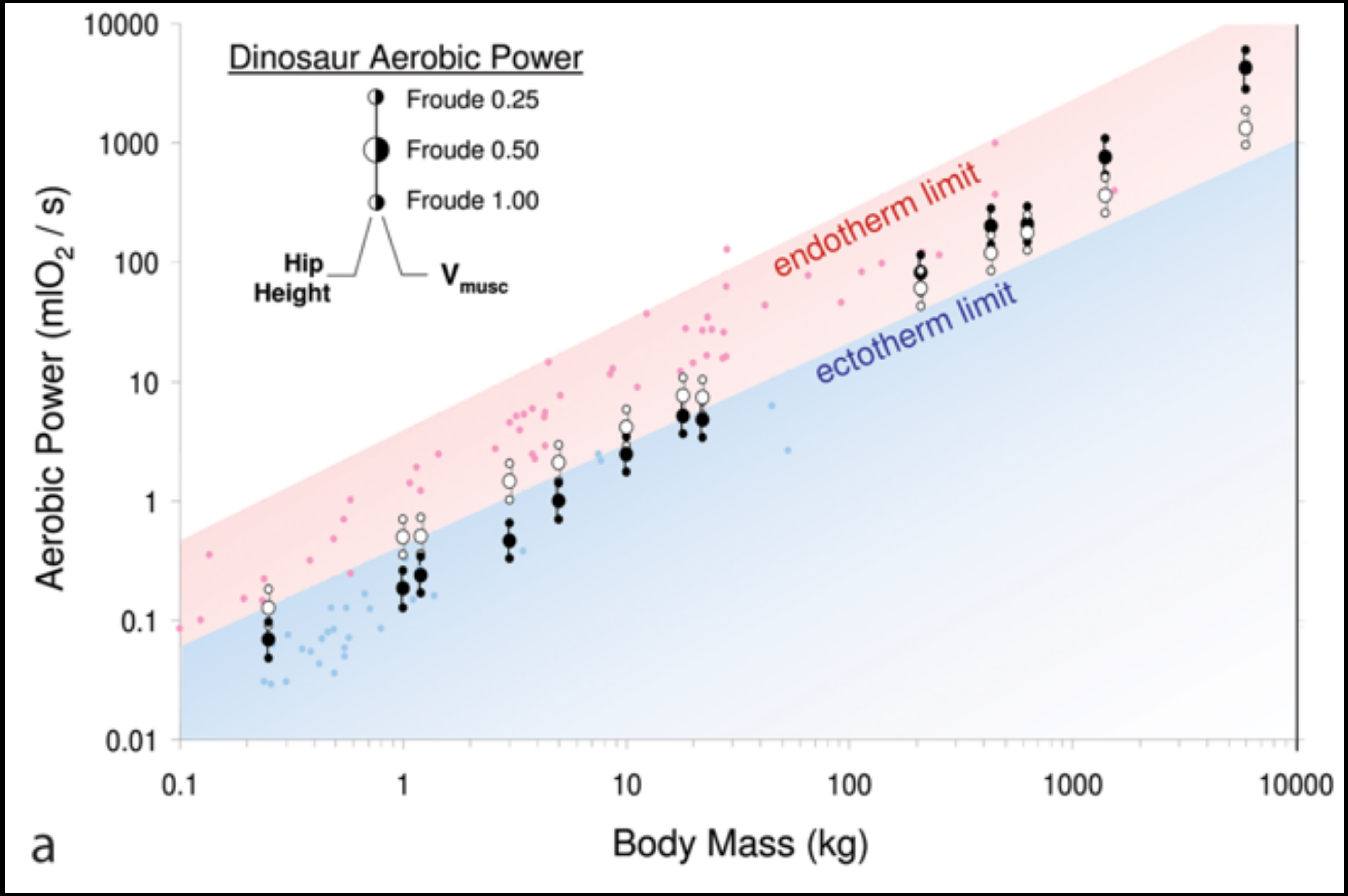


Dinosaur Metabolism: The evidence

1) Anatomy



Limb & muscle proportions
=> estimate aerobic power



Dinosaur Metabolism: The evidence

2) Diet

1) If Dinos required a lot of food, endothermy might be implied (more energetically expensive)
    - Chewing dinos: Ornithopods, ceratopsians

2) If Dinos had secondary palates, endothermy might be implied
    - Ankylosaurs
    - Maybe stegosaurs
    - Hadrosaurids

This isn't clear. Birds don't have these things and they're endotherms!

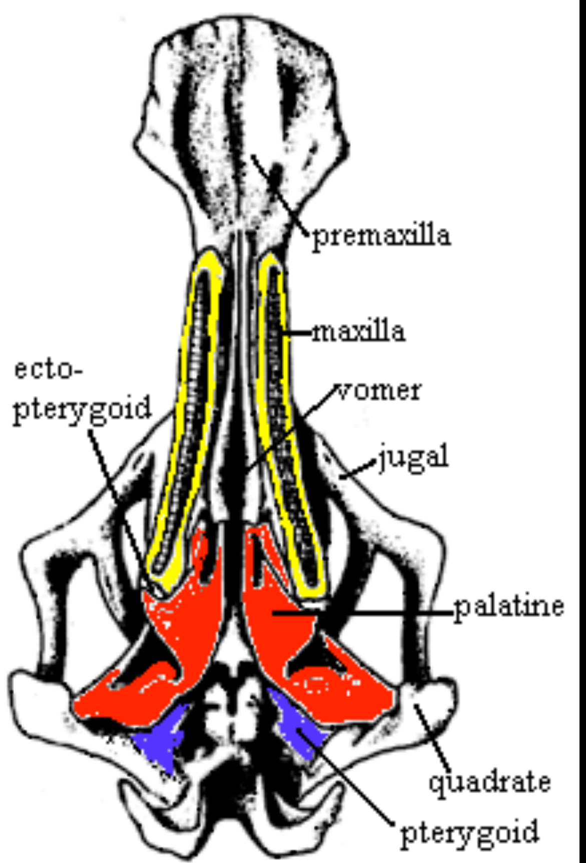


Figure 5. Brachylophosaurus in palatal view. Modified from Weishampel & Horner (1990)

Dinosaur Metabolism: The evidence

3) Hearts

1) All endotherms have a 4 chambered heart (prerequisite?)
   Endothermy require high blood pressure to infuse tissues with O2
   But, this would destroy lung tissue
   So you isolate blood flow to lungs from blood flow to body = 4 chambered

   Sauropods (requirement?)
   Crocs and birds have it => phylogenetically reasonable
   Heart Stone Brewhaha (2000)