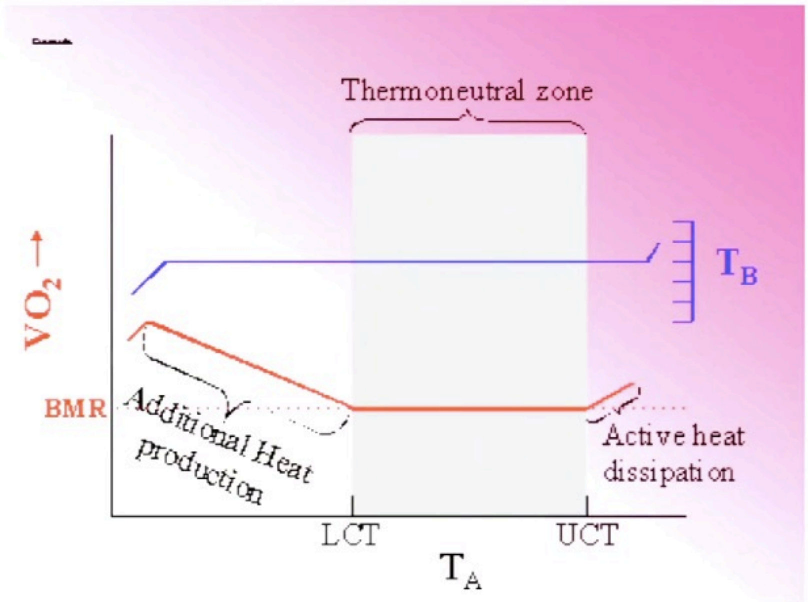
ectotherms and endotherms

- endothermy
  - greater environmental range
  - high and stable body temp
  - high metabolic rate
  - costly
- ectothermy
  - reduced expenditure on thermoregulation
  - 300g lizard needs 6% of food of a 300g rodent
  - limited duration of high activity
  - reliance on environmental heat sources
- kilo for kilo, humans have metabolic rates 10x higher than crocodile
  - we die of starvation a lot quicker

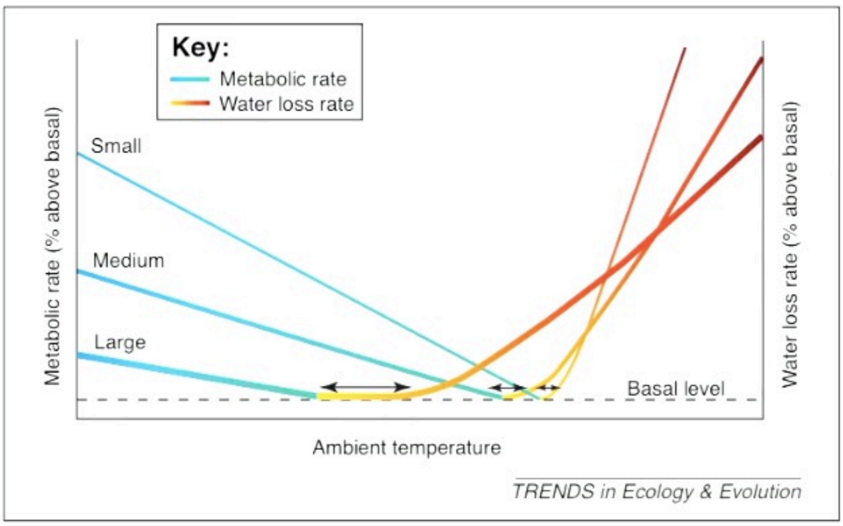
terminology

- Ta = ambient temp
- Tb = body temp
- VO2 = oxygen consumption as a measure for metabolic rate
- thermoneutral zone - ambient temp in this area is perfect, which means this organism does not need to expend energy to maintain body temp
- LCT = lower critical temp
  - below which is a larger window where additional heat production can maintain body temp
    - eating more, increasing metabolic rate
    - shivering
    - some stage body temp starts to drop and death will occur
- UPT = upper critical temp
  - above which - narrow window where active heat dissipation can maintain good body temp, if not maintained the animal will die
- where death occurs due to temp varies with animals
  - monotremes and marsupials run at lower temp than eutherian - more geared to energy saving strategy
    - desert animals have lower body temp and higher lethal body temp - can go up higher
  - birds can handle much higher temp (normal body temp is >40)



body size

- water loss rate and metabolic rate vary with a body size
- small bodied animal
  - thermonetral zone at higher temp
  - increase in metabolic rate as temp go down is faster
  - to do with volume area to surface ratio
- larger bodied animals have a better time holding heat, but struggle to get rid of it - costs water in endotherms
- as temp increases smaller animals get in trouble quicker than larger animals

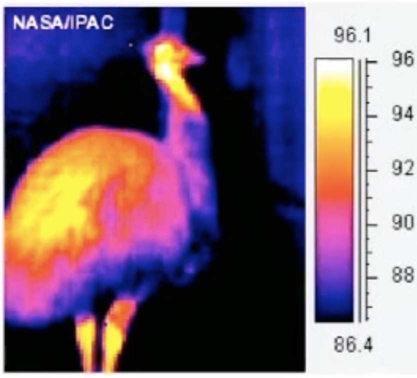


combined dehydration and heat
- heat is factor but humidity is also important for evaporative cooling
- Aus both hot and arid
- sweating increases water and salt loss = cramps
- moderate stress: less effective heat loss, impaired brain function
- extreme stress: kidney failure, explosive heat rise and death

thought:
is a given adaptation for regulating temperature likely to be positive or negative for maintaining water balance, in particular in a hot and arid climate

adaptations to heat:
evaders, evaporators and endurers
- strategies to deal with heat, you can evade it, evaporate it away or endure it
- evaders
    - e.g. burrowing
    - as sand gets hotter, can go down to get cooler
    - only works for small animals - high surface to volume ratio
    - too small for evaporative cooling (e.g. sweating)
    - use microclimates to beat the heat through microhabitat selection (e.g. crevices, burrows, shading vegetation)
    - often nocturnal
- evaporators
    - size and water intake high enough to allow evaporative cooling
    - uncommon in deserts - not enough water to fuel this
    - generally medium sized animals - big enough to store water, but not so big that your core will warm up if evaporate on surface
- endurers
    - e.g. red kangaroo
    - large animals, cannot hide in burrows or dens
    - difficulty losing heat due to large body size (small surface to volume ratio)
    - rely upon physiology
    - inactive for hottest part of day

strategies to deal with heat
shuttling & posture
- kangaroo
    - thinner fur on belly and pores, radiate body heat off them by sticking out the thin skin
- lizard only heating up two feet at a time
- sticking rear end in sun - lizard



Infrared (thermal) image

insulation
- fur and feathers - affect thermal conductance, resistance and reflectance
- colour, length and thickness important
- acclimatisation = shedding
- reptiles and frogs less protected
- e.g. emu: back is hot: reflecting heat from sun