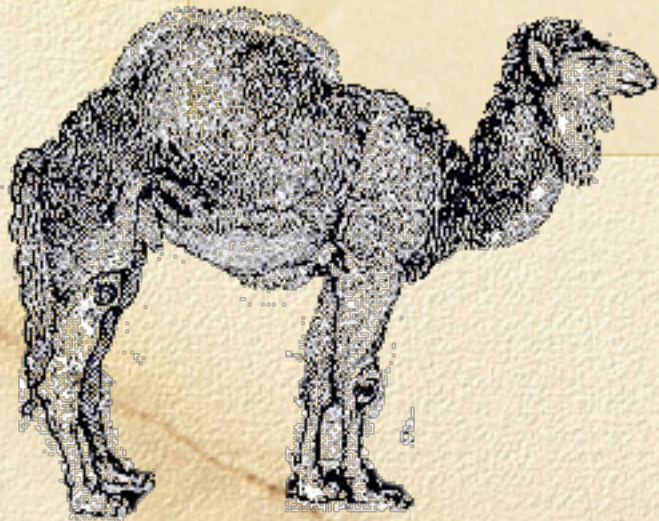


Desert Denizens

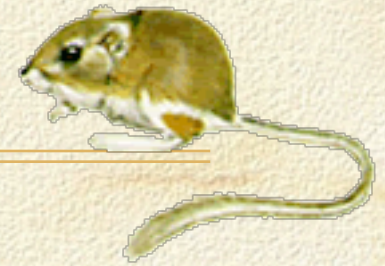
Large and small solutions



Dipodomys, the “2-footed mouse”



Dipodomys strategies



- ❑ Burrows below the surface heat and cold.
- ❑ Nocturnal activity avoids the heat of day.
- ❑ Gathers seeds into fur-lined cheek pouches.
- ❑ Urinating in the burrow humidifies it.
- ❑ “Insensitive” water loss is minimized.
- ❑ Seeds hygroscopically acquire water.

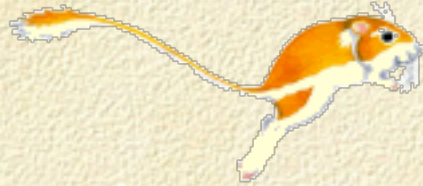


Can drink sea water!



Morro Bay kangaroo rat

More kangaroo rat strategies



- High ratio of l-o-n-n-n-n-g Loops of Henle.
- Makes urine more concentrated than sea water.
- Metabolic water is more than 80% of economy.
- Never drinks unless forced (e.g. by soybean diet with high urea output); then can drink S.W.



-
- ❑ No sweat glands



- ❑ *In extremis* will transfer saliva to skin



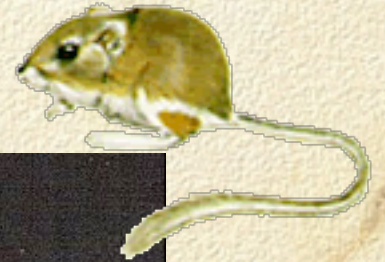
Nasal Demo, Everyone!!!

- Inhale through your nose. Note temperature.
 - Air is warmed, humidified.
 - Epithelium cooled and dried.
- Exhale through your nose. Note temp.
 - Epithelium is warmed & remoistened.
 - Air is cooled and dehumidified.



Cooler air out, lower water loss

- ❑ *Dipodomys* has higher nasal epithelial area
- ❑ Cooler exhalation
- ❑ More condensation
- ❑ Drier exhalation
- ❑ More water saved



Tricks of the Ship of the Desert

□ Shakespeare said it: (almost)

□ “What’s in a hump?”

□ “All the world’s a hump.”

□ “A hump, my kingdom for a hump!”

□ “Water, water, nowhere, nor any drop to drink.”



Tricks of the caravan trade

- ❑ Valvular nostrils, hairy ears and eyelashes to-die-for keep out blowing sand.
- ❑ No, dear, it doesn't store water, except potential metabolic water, but that imposes a heat load.
- ❑ A question a male camel wouldn't dread hearing: "Does my hump look fat to you?"



Putting all the fat up on top maximizes insulation from radiant source above.

- And minimizes insulation below for nocturnal descent into hypothermia.
- Tolerating 41°C hyperthermia & 34° hypothermia lets it absorb huge amounts of heat before it starts sweating.



How much to heat a camel?

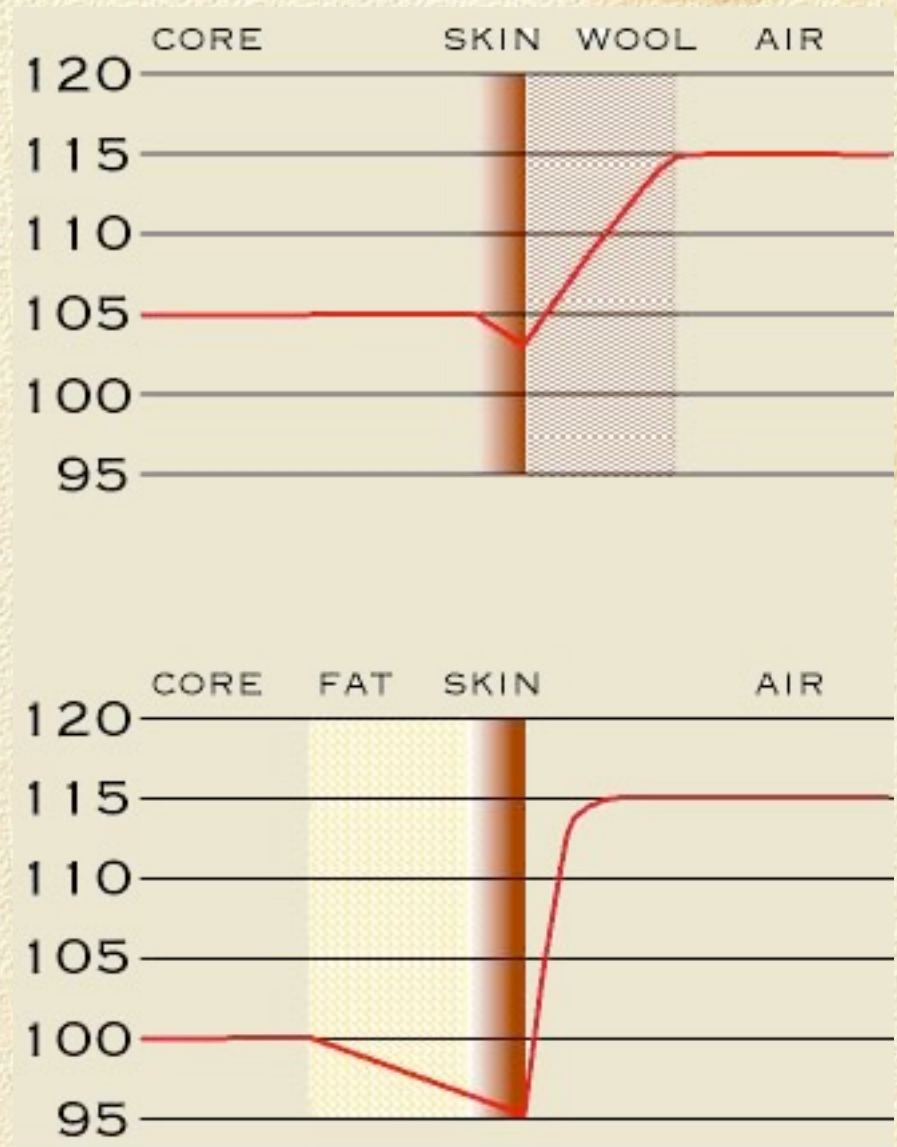
- 34°C to 41°C is an increase of 7°C .
- Camel weighs 500–700 kilograms (70% H_2O)
- @ 1 kilocalorie to heat 1 kg. H_2O 1°C
- $350\text{--}500\text{ kg} \times 7\text{ kcal/kg} = 2450\text{--}3500\text{ kcal}$
- Until then it doesn't have to sweat it.

More thermal trickery

- ❑ Hyperthermia minimizes temperature gradient to hot environment.
- ❑ Thick wool shades skin.
- ❑ Thin subcutaneous fat layer means skin need not be very much cooler to draw heat from interior. (cf. humans)

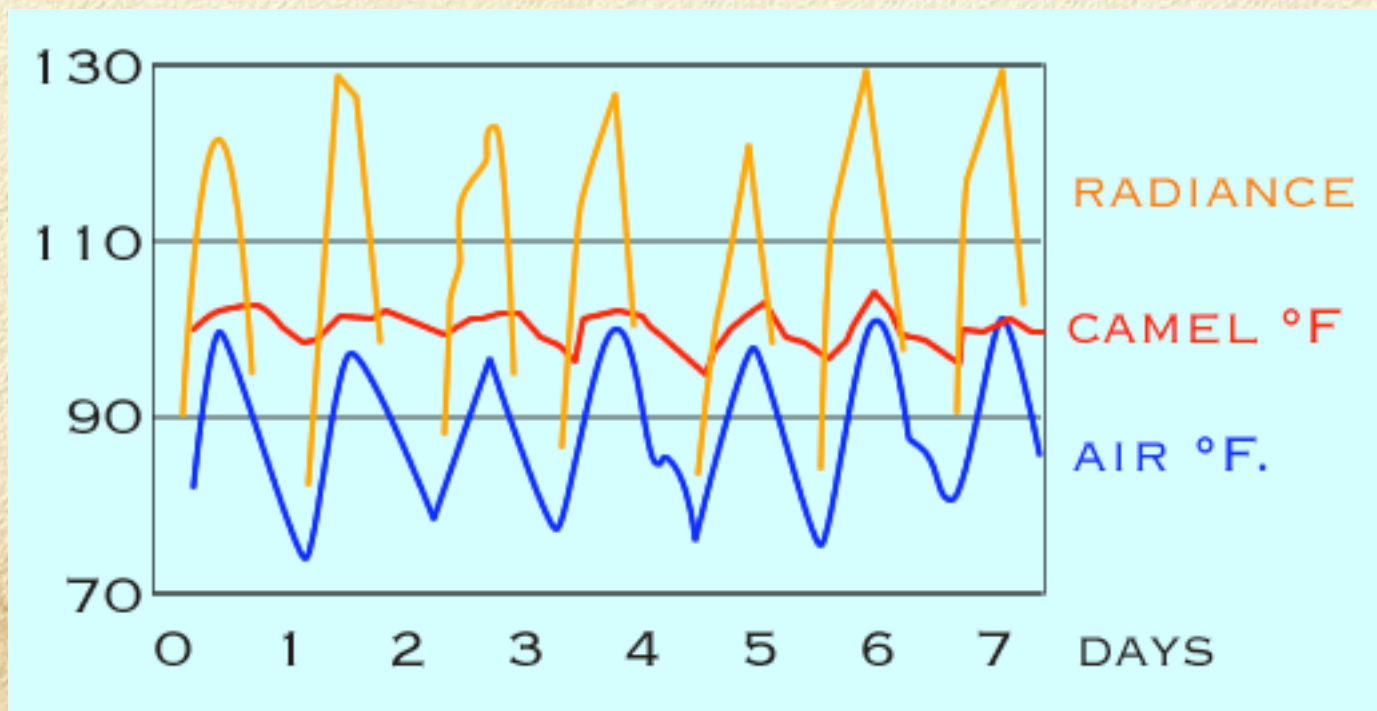
Wool vs Fat as insulation

- Camel's 103° F skin draws heat through little fat from core. Wool shades skin against insolation (*sic*).
- Human must cool skin to 95° F to draw heat through fat. No natural shade on skin.



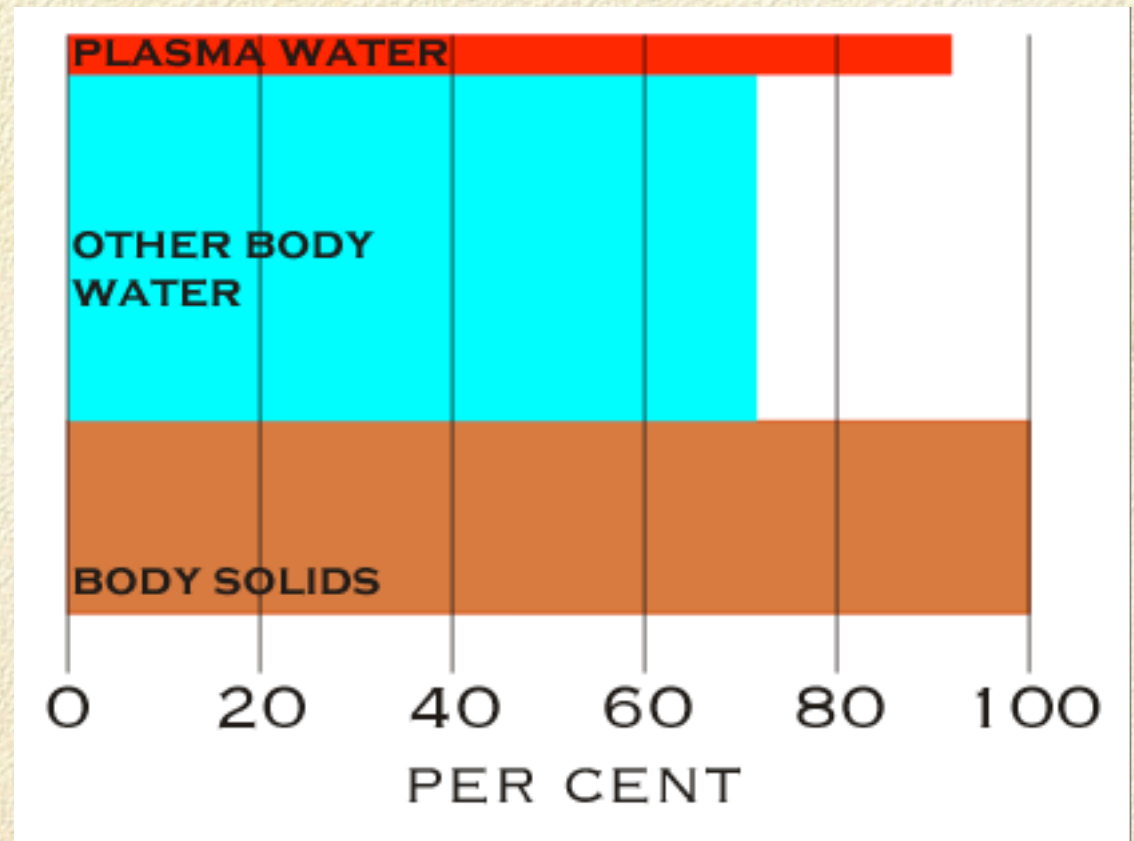
Eurythermic Dromedary or Facultative Homeotherm

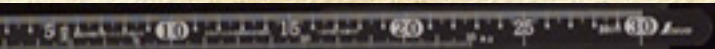
- Camel body temperature varies greatly with air temperature and radiation from sun and surrounding sand, rock, *etc.*



Why can't a human be more like a camel?

- ❑ Lose 25% of your body water, you die.
- ❑ The camel recovers.





Despite the canines, it's a ruminant!

- Urea is recycled by micro-organisms in the rumen into amino acids; thus less water needed for urine-formation.

Dromedary

Camels



- Dasher
- Dancer
- Prancer
- Vixen
- Comet
- Stupid
- Donder
- Blitzen