Hibernation in arctic mammals.
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arctic ground squirrel
(*Urocitellus parryii*)
Arctic ground squirrels supercool their body fluids during hibernation.
Two year record of core body temperature of a free-living arctic ground squirrel in northern Alaska.
Hibernating ground squirrels suppress metabolism first, then body temperature falls.
arousal and re-entry at ambient temperature -5°C

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metabolic rate (ml O₂/gm/hr)
0.0 0.2 0.4 0.6 0.8

body temperature (°C)
-5 0 5 10 15 20 25 30 35 40

activity
0 250 500 750 1000

hours
Stroke and heart attack are a problem of:

(Blood) supply = (metabolic) demand.
Stroke and heart attack are a problem of:

(Blood) supply ≠ (metabolic) demand.
Stroke and heart attack are a problem of:

\[(\text{Blood}) \text{ supply} = (\text{metabolic}) \text{ demand}.\]

Create stasis, time for transport to advanced medical care.
arousal and re-entry at ambient temperature -5°C

**Graph:**
- **Y-axis (left):** Metabolic rate (ml O₂/gm/hr)
- **X-axis:** Hours
- **Y-axis (right):** Activity
- **X-axis (top):** Body temperature (°C)

Key:
- **Black line:** Metabolic rate
- **Blue line:** Body temperature
- **Red spikes:** Activity
- **Green line:** Basal metabolic rate (BMR)
Comparison of the mammalian hibernation phenotype in human-sized and small hibernators.
contrast of body temperatures during hibernation in small and large mammals

Hibernating black bears are human-sized, do not need to eat, drink, defecate or urinate for 7 months, do not lose muscle or bone mass, and can be wakened at anytime.

Hibernation in Black Bears: Independence of Metabolic Suppression from Body Temperature

Tøien et al. 2011 Science