

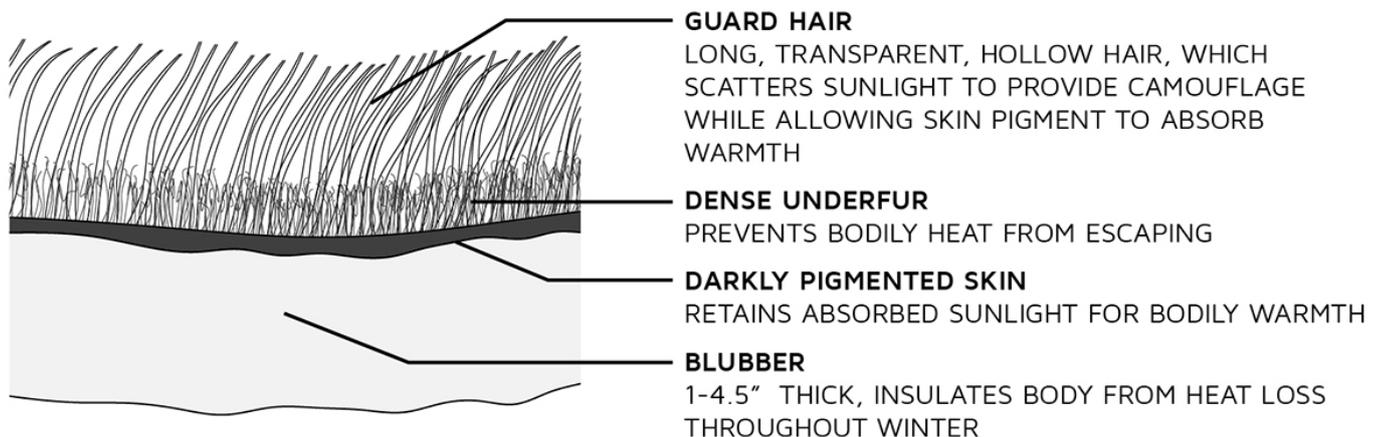
Fur absorbs infrared radiation to prevent heat loss

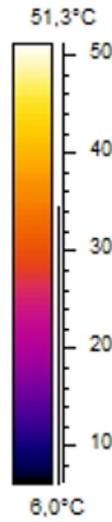
Polar Bear



AskNature Team March 24, 2020

Guard hairs on the polar bear prevent heat loss by absorbing heat in the form of infrared radiation.



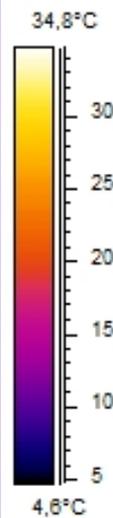
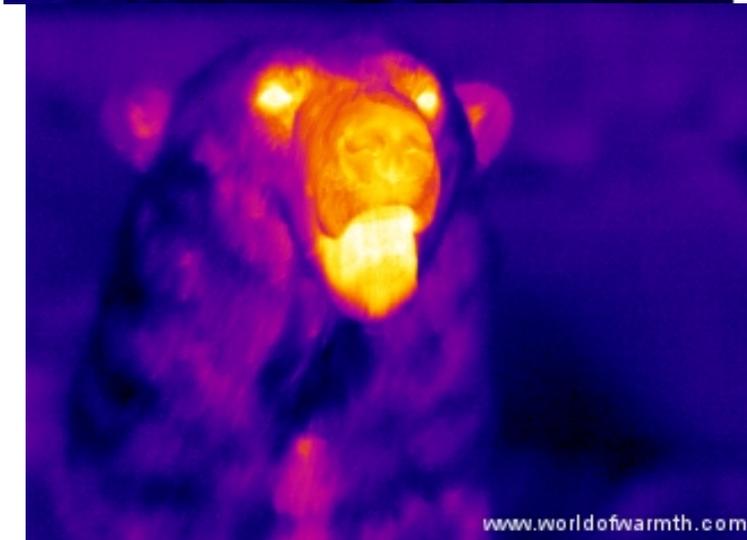


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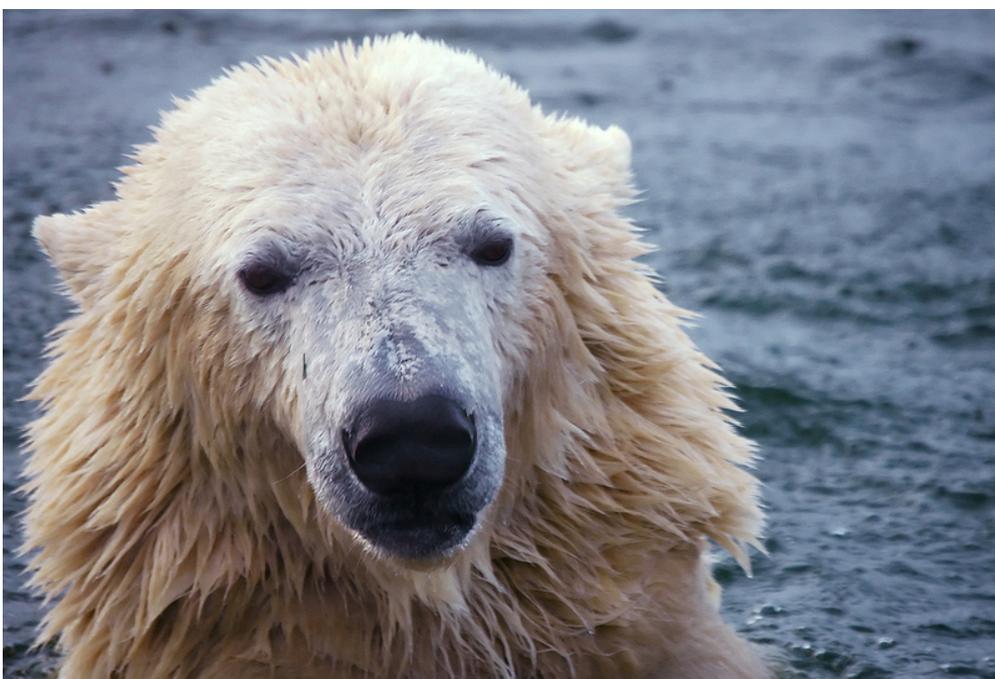
Polar bears living in the Arctic Circle survive in one of the harshest climates in the world. Winter temperatures can fall to $-40\text{ }^{\circ}\text{C}$, but polar bears manage to keep their internal body temperature at a steady $37\text{ }^{\circ}\text{C}$.

One physical feature that helps the polar bear stay warm is its fur coat. The coat is made up of two distinct layers: a short and dense underfur layer right next to the skin, and an outer layer of longer and coarser guard hairs. The guard hairs are transparent but the polar bear's coat appears white because the hairs scatter sunlight.

Research on these transparent guard hairs has revealed a key property that helps to prevent heat loss in the cold Arctic air.



The guard hairs appear to be very effective at absorbing infrared radiation, which makes up a portion of the electromagnetic spectrum that most mammals (including humans) cannot see but can feel as heat. This means that heat emitted from the polar bear's warm body could be absorbed by the hairs instead of transmitted through them, where it would be lost to the cold environment. The hairs' ability to absorb radiation is especially high at the specific part of the infrared spectrum where mammals tend to radiate heat most strongly.



An interesting consequence of this property is that a polar bear appears invisible in the infrared if the temperature at the surface of its coat matches the temperature of the ice and snow around it.

“The high absorptivity of both bear and human hair in this wavelength range is significant because fur, made up of many hairs with this property, will act as a radiatively participating media, almost completely eliminating the radiative losses from a mammalian body in cold environments [6]...[E]volution has resulted in the presence of such an excellent infrared absorber in the coverings of mammals, thus ensuring not only insulation, but also high absorptivity exactly for those wavelengths where it would yield the greatest survival value. The mammalian blackbody radiation peaks near 1000 cm⁻¹ (10 microns) and the high absorptivity in this region minimizes radiative losses during a cold night for any living mammal, polar bear and hominid alike.”
(Preciado et al. 2002:58)

JOURNAL ARTICLE

Radiative Properties of Polar Bear Hair*Advances in Bioengineering, ASME 2002 International Mechanical Engineering Congress and Exposition* January 1, 2002
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<https://asknature.org/strategy/fur-absorbs-infrared-radiation-to-prevent-heat-loss/>