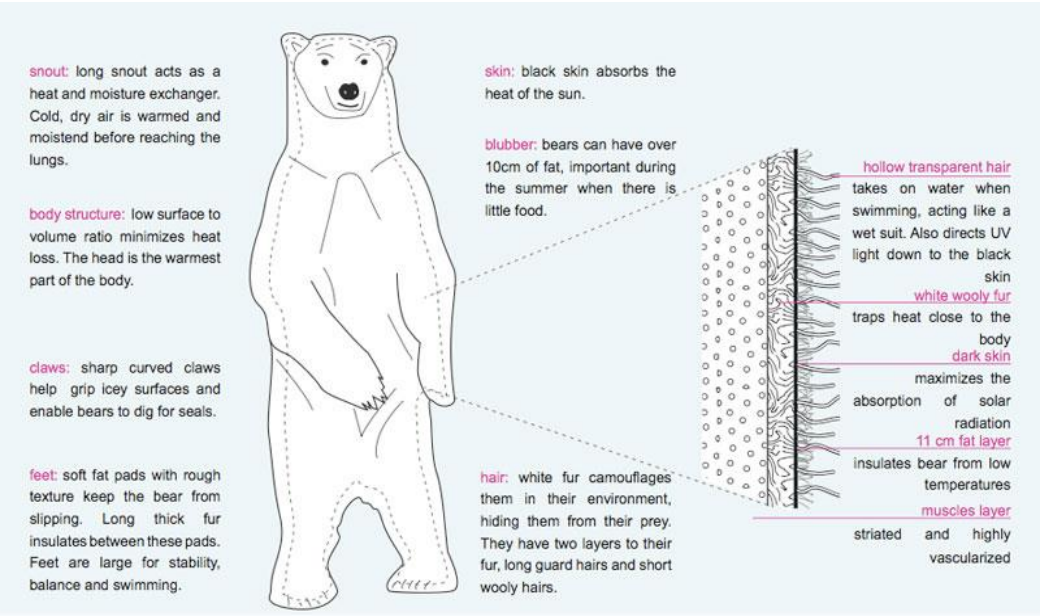
Poikilotherms and Homeotherms

An animal's response to wide ranges in temperature is influenced by its physiology. All invertebrates, lower chordates (hemichordates, urochordates and cephalochordates), cyclostomes, fishes, amphibians and reptiles have no internal mechanism for temperature regulation, and their body temperatures vary with the surrounding environmental temperatures. Such animals are called **cold blooded**, **ectothermic** or **poikilothermic** organisms.

The temperature range that a poikilothermic animal tolerates can be correlated closely with the environmental temperatures normally encountered in nature : tropical animals cannot withstand low temperatures; polar animals cannot withstand high temperature; temperate-zone animals survive a wide temperature range. Many poikilothermic animals show a rather precise discrimination of temperature. If the temperature decreases or increases appreciably, these animals may tolerate and adjust to change, may avoid the change by seeking a less exposed environment or may become inactive. Some animals respond by becoming dormant during periods of extreme temperatures. Such dormancy is called a **estivation** at high temperatures and **hibernation** at low temperatures.



Insulation by fur and blubber in polar bear

For example, most poikilotherms become inactive when the temperature of their surroundings goes below 8°C or rises to 42°C. A few exceptional poikilotherms, especially insects, certain amphibians and reptiles, exercise a degree of thermoregulation by either physiological or

behavioural mechanisms. For example, Hawkmoths can rise the temperature of their flight muscle to 32°–36°C by vibrating the wings before take-off and gregarious butterfly larvae may raise their temperature 1½–2°C when clustered together. Locust, and grasshoppers may increase their temperature 10°C by basking, sideways in the sun. Ants move their larvae to warm or cool places within the nest and bees maintain temperatures within their hives between 13° and 25°C by fanning with their wings to evaporate water droplets when it is too hot, or releasing body heat through increased metabolic activity, when too cold.

The dormouse hibernates in winter when food is scarce.

When temperature drops, lizards bask in the sun to achieve the desired body temperature; once this thermal level is attained, they will divide their time between sun and shade to maintain it. Poikilotherms such as desert dwellers that live in environments where the temperature is apt to be very high are often nocturnal and, thus, avoid the highest temperatures of the day. Some poikilotherms, both vertebrates and invertebrates, lower their body temperatures slightly by evaporative cooling. In frogs and reptiles, evaporative cooling can occur through the skin or via the respiratory tract by panting .

Among the invertebrates, evaporative cooling has been reported in tropical intertidal-zone animals . In contrast to poikilotherms, birds and mammals can, within limits, maintain constant body temperatures, regardless of temperature variations of air and water. Such animals are termed **warm blooded**, **homeothermic** or **endothermic animals**. The life processes are adjusted to function at the animals's normal temperature, averging a little less than 38°C in mammals and 3 to 4° higher in birds. If its temperature control fails, the animal dies. The homeothermic animals are

able to maintain the constancy of body temperature by a combination of several factors :

(1) a thermoregulating centre in the brain (hypothalamus)

(2) insulation

(3) a peripheral vascular response to ambient temperature; and

(4) metabolic compensation.

Among these factors, **insulation** is highly important particularly in enabling large arctic animals to withstand very low temperature. If the temperature is lowered, the oxygen consumption rate of tropical mammals increases, whereas that of arctic mammals remains basal. This response pattern is due to differences in insulation; some arctic animals are fur-insulated, whereas others are insulated with a layer of blubber. Many small animals, however, are not well insulated and must seek heat retention by other means, often by huddling together. Homeothermic animals living in very hot environments cannot tolerate greatly elevated body temperatures and they utilize methods that facilitate heat transfer to the environment, including an increased peripheral blood flow and surface cooling by sweating or panting. Birds may accomplish this by rearranging their plumage so that more skin is exposed. There is however, no reduction in metabolic rate. Animals subjected to high temperature may exhibit diurnal patterns of behaviour–that is, they may reduce locomotor activity during the heat of the day or may move into the shade to avoid direct sunlight. Some animals such as monotremes and marsupials have a limited power of temperature regulation, they are called **heterothermic animals**; *e.g.,* the pigmy mouse and the little pocket mouse, which respond to temperature extremes by a estivating or hibernating, and others such as the humming bird, which experience a nocturnal drop in temperature.

Plants too can be divided into the following three categories on the basis of their heat tolerating capacity : **megatherms**, **microtherms** and **mesotherms**. Megatherm plants occur in warm habitat (*e.g.* desert vegetation). Microtherm plants occur in cold habitat, (*e.g.,* plants of high altitudes). Mesotherm plants are the plants of the habitat which is neither very hot nor very cold (*e.g.,* aquatic plants). **Hekistotherms** include alpine vegetation which tolerate very low temperatures.