Introduction:

Humans are able to exercise in very hot and very cold conditions due to their body's ability to maintain homeostasis through physiological adjustments. Tolerating hot and cold environments is dependent on the ability to regulate core temperature. Behavioral and physiological responses to environmental temperatures contribute to maintenance of core body temperature. In cold climates, humans maintain core temperature by increasing heat production, decreasing heat loss by putting on more clothes, or simply turning the heat on. In hot conditions, increased heat dissipation via sweat, increased blood flow to the skin, removal of clothes, or turning on the air conditioning contribute to maintenance of core temperature. While the normal core temperature range is between 36-38 degrees Celsius, humans are able to survive for short periods of time under extreme core body temperatures, ranging from 24-42 degrees Celsius (Brooks, 2005). Serious health risks are associated with core temperature extremes if the body is unable to quickly return to the normal range. This Wiki page covers three main topics associated with limitations and adaptations to exercising in hot and cold temperatures: acute responses, acclimatization, and heat and cold related athletic injuries.
Important Terms:

Acute: The body's response to one bout of exercise in hot and cold climates.

Acclimatization: People who repeatedly exercise in hot and cold climates physiologically adapt to that lead to improved performance and comfort. The physiological compensation to environmental stress over a period of time is called Acclimatization whereas the term Acclimation refers to the reversible physiological changes in environmental conditions (Brooks, 2005). Although the two terms are often used interchangeably, acclimation usually refers to rapid (days or weeks) adaptation to environmental changes. In contrast, acclimatization is most appropriately used when environmental adaptations occur over a long period of time (months). Although humans are capable of acclimatization, the mechanisms that contribute to the process in hot and cold environments differ.
Exercise Performance Limitations in Altered Environments: Heat and Cold
Athletes who exercise in hot or cold climates are limited in their performance abilities. Power output and muscle activity during cycle ergometry is reduced in hot and cold environments and is significantly lower in a hot climate than in a cold climate (Tucker et al., 2004). As shown in the graph below, time to exhaustion varies with ambient temperature. Athletes have the greatest exercise endurance in temperate climates and have the least endurance in hot climates. (Galloway and Maughan, 1997)
Exercise Performance Limitations in Altered Environments: Heat and Cold

![Bar graph showing time to exhaustion at different air temperatures (°C).]

- Time to Exhaustion (min)
  - 0 °C: 80 min
  - 4 °C: 80 min
  - 11 °C: 100 min with a
  - 21 °C: 80 min
  - 31 °C: 60 min with b

Air Temperature (°C)
Figure 2: Exercise endurance time at a given metabolic rate in cold (4°C), cool (11°C), temperate (21°C), and warm (31°C) ambient temperatures. $P < 0.05$ (Galloway and Maughan, 1997).