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Birdie Bowers, a member of Scott's expedition to the Antarctic in 1911, slept soundly in temperatures below -20°C, without the eiderdown lining of his sleeping bag. Siberian inhabitants experience temperatures of -60°C. How exactly do humans survive these temperatures?

At -50°C, bare skin freezes within just one minute

The first key to survival is to wrap up warm [3] and to find shelter. We also need to considerably increase our food intake as the body burns calories to keep warm.

When Sir Ranulph Fiennes [4] and Dr Mike Stroud crossed Antarctica, they each expended 11,650 calories in one day (the normal is approximately 2,500).

The body has inbuilt mechanisms to protect against the cold

Reducing blood flow to the skin lessens heat loss, especially from the hands, feet, nose and ears.

This is exactly what happens in cold weather, though in an attempt to maintain at least some blood and oxygen delivery to these parts, blood vessels open for brief periods during the cold to restore blood supply.

This explains the red nose observed on cold faces. In extreme cold, blood supply is severely reduced to the skin, resulting in frostbite.

Muscle contraction increases heat production, as heat is produced as a by-product of contraction. Shivering is an example of involuntary muscle contraction; we can also choose to jump up and down, stamp our feet and slap our arms to keep warm, just as the spectators do at a Boxing Day football match.

Babies don't shiver, but remarkably are supplied with pockets of 'brown fat' along their shoulders and back and

around their kidneys. This acts like a home fire, burning fuel to produce heat.

Cold can actually benefit the body

Freezing conditions can impair nerve function and adversely reduce circulation. But in the recent case of a Russian climber, cold weather may have saved his life as he performed emergency leg surgery on himself, applying snow to the wound to stem blood loss and numb the area.

During some operations, and after some heart attacks, the body is deliberately cooled down to reduce oxygen needs of the body and so protect the heart and brain from damage.

But freezing can be fatal

When Hannibal set out with his 90,000 infantry, 12,000 cavalry and 40 war elephants to cross the Alps in 218 BC, almost half died from exposure to cold weather.

In the winter of 1941, almost 100,000 German soldiers died or were seriously injured by a freezing cold Russian winter and a lack of warm clothing.

Extreme cold can freeze the lungs, slow the heart and lead to dehydration due to increased urine output. Fortunately, temperatures do not plummet so dramatically in this country.

The coldest temperature ever recorded on earth is -89°C, measured in 1983 at a Russian research station. Braemar, in Aberdeenshire is one of the UK's coldest places, reaching -27°C in 1982, but generally Jack Frost's bite is not so fierce.

Nonetheless, a recent study suggested that even moderately cold temperatures can be harmful to health, with cold weather leading to 20 times more deaths than warm weather.

Eating warm soups [5] and keeping our homes warm [6] can help us give winter a warm welcome this year.

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