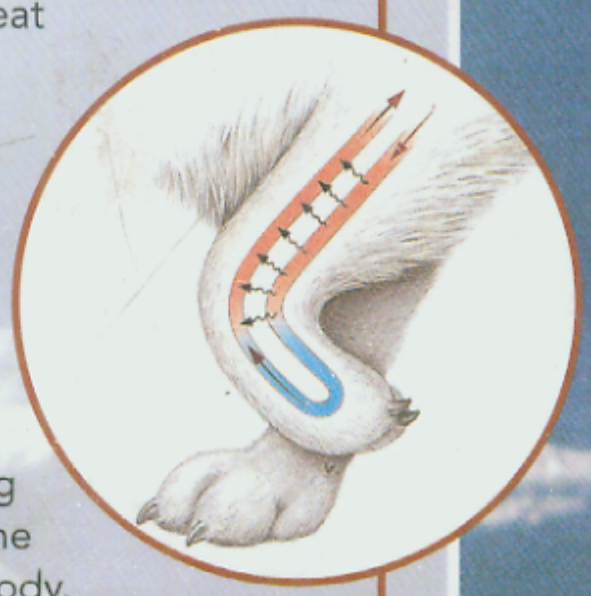
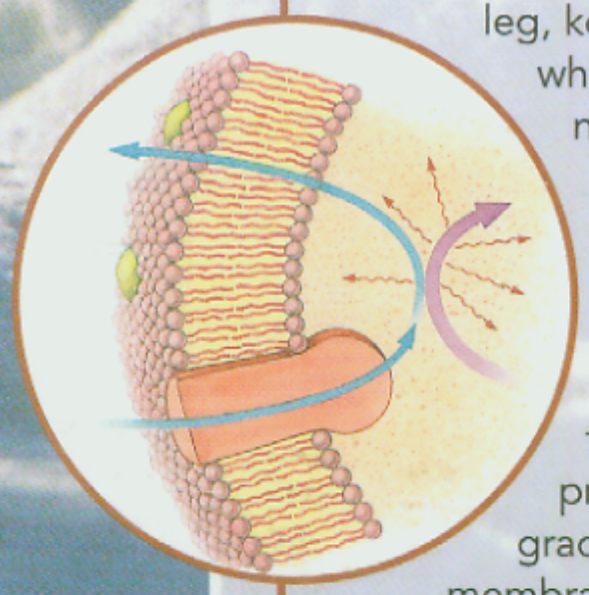
The Arctic fox must maintain body temperature in the cold Arctic environment. (In the drawing above, red indicates a body temperature of 37°C; blue indicates a body temperature below 10°C.) This thermal gradient is achieved by matching heat production to heat loss, and by minimizing heat loss. The legs of the fox, which contact the frigid ground and are not well insulated, constitute a potentially important pathway for heat loss.



Heat loss from the legs is minimized by having a countercurrent arrangement of the arterial and venous blood supply to the leg (drawing at right). Cooled blood (blue) leaving the leg is warmed by blood (red) entering the leg, keeping heat in the core of the body, while at the same time maintaining a supply of nutrients and oxygen to the leg.



Heat production in the body is increased by the synthesis of a protein, thermogenin (light orange in the drawing at left), inserted into the inner mitochondrial membrane (yellow) of several tissues, particularly brown fat. Thermogenin is a proton transporter that short circuits the proton gradient (blue arrows indicate proton flux across membrane) generated by NADH oxidation (thick purple arrow), which results in heat production (red arrows).

These mechanisms for r[illegible] heat loss and augmenting heat production have e[illegible] very cold environments that are l[illegible]

W. H. Freeman and Comp[illegible]
41 Madison Avenue, New York, N[illegible]
Houndmills, Basingstoke RG21 6XS, England