

ERGONOMIC ASPECTS OF COLD STRESS AND COLD ADAPTATION

G M Budd

National Institute of Occupational Health and Safety, Sydney, Australia

Address for reprints:

Work Environment Research Unit, National Institute of Occupational Health and Safety, Building A27, University of Sydney, NSW 2006, Australia

Unsolved problems of clothing and adaptation continue to reduce the safety and efficiency of people living and working in cold regions. Equipped as he is with whole-body evaporative cooling but no body fur, man has powerful physiological defences against heat but very limited defences against cold. In the cold he must therefore rely heavily upon clothing and shelter, reinforcing (and largely replacing) the continuously-varying fine control of physiological temperature regulation with the intermittently-adjusted coarse control of behavioural temperature regulation. Clothing adjustments have to compete with the other tasks that claim his time and attention and hence may be delayed or inadequate, so that he is often too hot or too cold. Outstanding practical problems include the avoidance of unwanted sweating, protection of the feet from cold injury, and reconciliation of the conflicting requirements of the hands for protection and performance.

Many investigations of human responses to cold have been laboratory studies, usually of only a few hours' duration, in which the subjects' environment, activity, and clothing were controlled and usually constant. A considerable extrapolation is required to apply the results to normal work in cold regions, in which the thermal environment is complex and variable, exercise and cold exposure are intermittent, and people are free to adjust their clothing for comfort.

This paper considers human responses to cold in the laboratory and in the field; the extent to which behavioural responses attenuate the stimulus to physiological adaptation; and the development, mechanism, and practical utility of acquired adaptation to cold.