iv) Design of optimal patterns of movement to high altitude in order to minimize its debilitating effects through gradual acclimatization
v) Design of portable devices simulating altitude effects which may be worn while training in normobaria in order to effect prior acclimation

The effectiveness of these methods will be analysed in this review particularly in light of the varying cardiorespiratory characteristics required to operate at peak levels at medium or high altitudes revealed in the recent literature by such studies as Operation Everest I (American Everest Scientific Expedition) and Operation Everest II (the USA I.E.M. 40 day decompression chamber expedition).

23 Cardiorespiratory adjustments to work in cold hypoxic environments

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During submaximal workrates, a competition exists between the cutaneous circulation and the working muscles for blood, the former attempting to enhance heat loss and thus maintain thermal equilibrium, and the latter to adequately supply the muscles with oxygen. The present study investigates the adjustments made during exercise in hypoxic environments and also examines the added effect of cold on the cardiorespiratory and thermoregulatory systems.

Six male subjects exercised on a bicycle ergometer at 50% of their maximal working rate, at an ambient temperature of 0°C and 20°C, inspiring either 20% O_2/80% N_2 or 12% O_2/88% N_2. Subjects participated in the exercise trials on a weekly basis. The order of the trails was randomized and periodic tests of maximal oxygen consumption were conducted throughout the experimental period to account for any training effect.Physiological variables were monitored continuously during a five minute period of unloaded pedalling and the twenty minute work regime. The non-invasive Fick method was used to assess cardiac output and stroke volume during minute fifteen of the work period.

Results indicate no difference in the core temperature or cardiac output during the four experimental conditions: I. Normoxia/20°C; II. Normoxia/0°C; III. Hypoxia/0°C; and IV. Hypoxia/20°C. In the normoxic conditions (I. and II.) the reduction in heart rate during exercise in 0°C was accompanied by an elevated stroke volume. Hypoxic environments (III. and IV.) induced dramatic increases in ventilation and heart rate with a concomitant decrease in stroke volume.

It is concluded that a cold environmental stimulus in hypoxic environments aids venous return by enhancing vasoconstriction. The cold ambient conditions allow a greater dissipation of metabolic heat generated through exercise and thus reduce the competition for blood between the exercising muscles and the cutaneous circulation.

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24 Modelling human exposure to altered pressure environments

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During a reduction in environmental pressure inert gas forms in some tissues and if the pressure drop is too large or rapid a critical excess quantity of undissolved gas will