

## **Evidence for altitude and hypoxic training protocols – early 2012 update**

While the erythropoietin (EPO) initiated increase in total haemoglobin mass (tHb) after altitude training is the most commonly cited mechanism to enhance performance, it is becoming increasingly clear that this explanation is far too simplistic (Levine and Stray-Gundersen, 2005), and even that in some cases where well trained athletes have gained performance from altitude sojourns, this can be completely independent of any change in tHb (Pottgiesser et al., 2009).

In a particularly novel study, whereby a group of athletes completed 16 nights of simulated 'live high, train low' altitude exposure, Garvican et al (2011) conclusively showed that performance gains were not simply due to the tHb increase, as they removed this additional blood (via phlebotomy – blood donation), yet performance improved (Garvican et al., 2011).

The real significance of these findings is that it is now clear that non-haematological adaptations (i.e. not involving the blood) do take place as a result of altitude training, and that other adaptations must then take place, at the active muscles. It is unsurprising then, that in addition to spending time living for multiple weeks at physical or simulated altitude, intermittent hypoxic exposure (IHT) is increasingly being utilised by elite athletes all over the world. It is the active exercise component of this IHT exposure that initiates the muscle specific adaptations (Kuno et al., 1994; Vogt et al., 2001; Zoll et al., 2006), and can provide a powerful addition to an athlete's training regime. It is imperative that IHT is not confused with intermittent hypoxic exposure (IHE), whereby individuals rest in hypoxia for a mere 1-2 hours per day, as there is no evidence whatsoever that this IHE can enhance athletic performance; to quote Dr Randy Wilber, Physiologist at the US Olympic Committee Training Centre in Colorado Springs, "data regarding the effect of IHE on haematological indices and athletic performance are minimal and inconclusive" (Wilber, 2001)

To gain optimal advantages from altitude exposures, a combination of living, sleeping and exercising in hypoxia should be undertaken, as part of a well planned and routinely trialled regime – see a thorough review by Millet and colleagues for details on combining altitude approaches to optimise performance (Millet et al., 2010). Thanks to recent technological advances, it is now possible to simulate living, sleeping and exercising at altitude, and many of the best in the world are taking advantage of these methods.

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