Although the Russian cosmonaut Valeri Poliakov's 438 days aboard Mir has been Man's longest stay in space, with apparently no major cardiovascular complications [1-3], how certain can we be that we can tolerate as well, a 20 month round trip to Mars even without consideration of unknown radiation hazards? The longer the mission, the greater the risk to the cardiovascular system and the cardiac risk during Earth re-entry; will the re-entry forces be as great as those after the Apollo missions of 7 g, experienced by Irwin, for example, after his Apollo 15 mission with classic angina and symptoms of severe heart failure? [4].

A major complication of space flight is invariably dehydration, triggered by loss of the thirst mechanism and plasma (consisting primarily of water), with leaks through defective capillaries [4, 5]. Rather than gene therapy, far too complicated and many decades off, a 20 month round trip to Mars is more likely to succeed by our taking advantage of the genetic gifts exemplified by horse breeders; similarly, the recent attempt to break the two-hour marathon barrier, missing it by 26 seconds by utilizing the genetic gifts of a Kenyan [6, 7], thereby reducing the risk to the heart from high spaceflight adrenaline levels [4].

Heart threat

Dr Robert Hitchcock, Adjunct Professor of Anthropology at the University of New Mexico, has witnessed repeatedly, the extraordinary feats of these Bushmen. Having been to Africa eight times on safaris, with 4 on foot in Zambia, and having flown over the Kalahari Desert, I can well appreciate the significance of Dr Hitchcock’s observations. Man survived with this gift. Why not take advantage of it for a Mars mission, even without considering the unknown degree of radiation? [9-12].

It has been known since the mid-nineties that with space flight, there is a considerable problem with thermoregulation during exercise [13, 14]. Since there are invariable deficits of magnesium (Mg) because of impairment in gastrointestinal absorption and loss of storage sites of Mg in skeletal muscles beginning in a week or so and in bone, with 1-2% loss per month, this Mg deficit is intensified by the exercise loss with sweating and via the kidneys [15]; the lower the Mg levels, the higher the cardiac risk.

This Mg loss will continue throughout the mission and in turn, there will be progressive injuries to the lining of blood vessels (endothelium). There is no subcutaneous replenishable device to compensate for the invariable microgravity induced malabsorption or to administer minerals, primarily Mg and calcium as well as pharmaceuticals; furthermore the latter may deteriorate in space, possibly due to radiation. After the age of 30, it has been well established, that the blood vessel repair mechanism is inadequate; there is a strong case for returning from Mars before age 30 [16].

With leaking of plasma, which consists mostly of water, along with impairment of the thirst mechanism, there is progressive dehydration which cannot be completely corrected. With dehydration, the problem with high adrenaline is intensified; this, in turn can trigger heart failure [17]. This is exemplified by Neil Armstrong, who developed probable heart failure on the Moon only four days after lift-off. Similarly, James Irwin had symptoms of heart failure with severe shortness of breath during Earth re-entry at 7g forces. Irwin stated that during the radio blackout, with the necessity of making a recording, he was so short of breath, he couldn’t say a single word; in addition, he experienced classic angina with his description of pressure as if an elephant was standing on his chest [4]. However, these symptoms would have been intensified by his inhalation of highly toxic iron-laden dust, brought into the habitat, whereas Armstrong’s lunar heart failure occurred prior to his entry in the Lunar Module. Irwin’s in-
suit water device didn’t function and he had no access to water during his three lunar excursions. I believe that this contributed to his first heart attack 21 months after his mission and triggered my own interest in space medicine research.

Bushmen in space

Armstrong developed lunar heart failure because, as I postulated, the major heart chamber (left ventricle) would not expand sufficiently in the presence of severe dehydration; this would intensify the degree of obstruction in this chamber [4, 17, 18]. Another problem with dehydration is that two blood vessel dilators would not be released from the heart in adequate quantities, conducive to angina, clotting, a heart attack or heart failure; furthermore, one of these vessel dilators (ANP) requires Mg for its synthesis and invariably diminished.

On return from space, the crew requires assistance in standing not only because of muscle loss but because of this critical loss of plasma volume [18, 19]. With the Kenyan’s recent failure to finish a marathon in two hours by only 26 seconds [7], to consider breaking this record with a Caucasian would be absurd; similarly, a Mars mission would apparently be far more likely to be successful by utilizing the genetic gifts of an African such as the Bushmen of the Kalahari.

However, the Navajo of America, the Aborigines of Australia, and the Tarahumara of Mexico, have all survived chasing an antelope for up to two days until the animal drops from exhaustion, throttled and eaten; importantly, the Bushmen need no water. Since water is stored primarily in skeletal muscles, Bushmen apparently have extraordinary muscle water storage sites despite their small size [21].

References