Letters to the Editor

The inner ear and diving

Dear Editor,

I refer to the letter to the Editor 'An additional mechanism for aural injury' by D Taylor and J Lippmann.[1] The authors propose an additional mechanism for aural injury while diving, ie., the cumulative effects of minor symptomless aural injury over a long diving career. They suggest that possible repeated barotrauma could lead to fibrosis and scarring, or that subclinical decompression sickness could lead to aural injury in analogy to the pathological brain lesions that have been found by Knauth et al.[2] To highlight the effects of diving on the hearing system in divers Taylor and Lippmann suggest a study where scuba divers are examined by pure tone audiometry using air- and bone-conduction testing.

We would like to add our own experience to this discussion. Before talking about aural injury one should distinguish between conductive hearing loss that has its origin in the outer or middle ear and sensorineural hearing loss that is represented by inner-ear or retrocochlear damage. Reduction of the hearing function in divers has been reported for more than 50 years. There are several publications that find reduced hearing levels in either professional divers who have to deal with very noisy working conditions or Abalone divers[6] with a history of multiple ear barotrauma and decompression illness.[3,4] These studies do not allow for the conclusion that there are possible long-term effects of diving to the hearing function independent of noise injury or residual hearing loss after acute inner-ear injury.

Skogstad et al compared hearing function in a cross-sectional study on 26 Norwegian construction divers and 26 workshop workers where both groups had been exposed to noise.[5] Auditory function was compared and, surprisingly, divers had less hearing impairment at low frequencies (0.25 and 0.5 kHz). Another study from Skogstad et al examined 54 occupational divers at the beginning of their diving career and three years later.[6] They subdivided the divers into a group of low exposure (less than 100 dives in three years) and one of high exposure (more than 100 dives in three years). For both ears combined, they did not find a statistically significant difference between the groups. Compared with an external control group the divers even had better hearing levels than the general population.[7]

To rule out the effects of noise and multiple acute inner-ear injuries we examined 64 sport divers and compared the results of the pure tone hearing threshold with the results of 63 non-divers.[8] We excluded three divers with a history of acute inner-ear injury and one diver with a tumour in the internal ear canal. We decided to examine sport divers because sport divers have no noise impact underwater and, therefore, the noise levels are comparable to a non-diving population (there were no statistical differences between the groups in terms of noise history).

We divided the participants into three age groups: 10–30 years, 31–40 years and 41–60 years. The sport divers had an average diving experience of 10 years and an average of 650 dives in their history (range 195–2000). We have not found any air conduction hearing loss in any diver or non-diver. Nor have we found any statistically significant differences in bone-conduction hearing function between sport divers and non-divers.

We conclude that in our study diving had no impact on the hearing ability of the tested sport divers who had a respectable diving experience. Notably in the age group 41–60 years we had a low statistical power in the high frequencies and therefore further research is certainly necessary. Until it is proven that diving itself harms hearing function we think it is too early to discuss whether there are subclinical effects of decompression illness or recurrent minor inner-ear barotrauma.

There is certainly a need for well-conducted studies that examine the amount of hearing function impairment and we would like to offer our help in planning such a study. Testing the high frequencies, especially in older divers (above 40 years), leads to high standard deviations with the need for large study groups. In the age group 41–60 in our study we would have needed a study group of 90 persons to achieve a statistical power of ninety per cent to find differences larger than 10 dB. For this reason we are planning a study design that keeps that fact in mind.

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Key words
Letters to the Editor, diving, ear barotrauma, inner ear barotrauma, inner ear decompression illness, hearing

Diving medicals

Dear Editor,

I am concerned to hear from divemasters and instructors returning from Queensland, principally having worked in the Cairns region, who report seeing dive medicals signed off for student divers as having been done to the AS4005.1 by registered medical practitioners on our Diving Doctor list. These medicals are all done in less than 15 minutes. Students get only a peak expiratory air-flow test instead of formal spirometry, and tuning-fork hearing tests instead of a formal baseline audiogram as per the Australian Standard. In other words, the proper standard investigations are not being done. Sharpened Romberg score tests are reportedly not being done either.

If these practices are occurring, they make a mockery of all the good work done by SPUMS and having a unified Australian Standard for the past 12 years. These types of medicals are now starting to occur in Victoria, with a doctor doing the "medicals" at the back of the dive shop.

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Book review

The art of living under water

Mårten Triewald

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Ph: +44-(1737)-249961; Fax: +44-(1384)-896079
Copies can be ordered by e-mail: <books@thehds.com>
Website: <www.thehds.com>
Price £24.00 plus postage and packing (UK £3.50, Europe £4.50, rest of world £5.50)

This enthralling publication is the fourth in a series of monographs published by the Historical Diving Society. Introduced by Michael Fardell and Nigel Phillips this monograph comprises Triewald's *The art of living under water* together with *Use of the art of living under water*. It is the first edition of either work since 1741 and the first edition to appear in any language other than Swedish.

Fardell and Phillips' introduction and commentary include a section on the life of Triewald based on an essay by the late Captain Bo Cassel of the Royal Swedish Navy. It is a well-written and informative section of the book with extensive footnotes and suggestions for further reading. It tells us that Mårten Triewald was born in Stockholm on 18 November 1691.

Born into an obviously intelligent family (his father was a master blacksmith and head of the Guild of Blacksmiths, while elder brother Samuel was a diplomat and politician who spoke and wrote nine languages), Mårten expressed considerable disdain for universities throughout his entire life. Instead he was a keen observer of natural phenomena with a seemingly insatiable curiosity and an almost innate ability to understand how things worked and make improvements based on the natural laws.

Before we get onto the subject of this monograph, it is worth looking at the variety of topics that aroused Triewald's interest. Like so many people of the period he had an interest in almost everything. He published a book about bees, researched and wrote on the ventilation of mines, the germination of old melon seeds, the heating of soil by steam, and the diseases of horses and reindeer. He also investigated treatments for lunatics, the elimination of newts from carp ponds, oyster fishing, and the cultivation of foreign fruit trees.

He devised a system for removing the foul air from large warships and supplying fresh air to the lower decks that was widely praised in Sweden and abroad. He also made