that bone islands or cystic areas are indicative of osteonecrosis, while the Japanese do. Some cystic areas clear over the years, which suggests that they are an on-going process of repair of damage.

The main problem with osteonecrosis studies is that the lesions are followed by X-rays, it is a diagnosis based on shadows which take months to appear. Experiments using glass spheres have shown that it takes over 3 months for the X-ray change to show up while the histological change is visible under the microscope in days. Not all areas damaged show the X-ray changes so the current techniques which show promise, estimation of the urinary hyxroxyproline and technetium scans (which often show areas which do not go on to X-ray change) have problems. Could one really tell a diver to give up his occupation on the basis of a urine test, only to find no X-ray changes ever developed?

The Japanese have a large experience in dysbaric osteonecrosis as they have diving fishermen who do not pay much attention to decompression. In one survey 268 of 450 divers had definite lesions (59%). The incidence was higher after 5 years of diving and in those who had been deeper than 30 metres. 73% of the men with lesions had been treated for decompression sickness. On the other hand, Sealey has reported that using the Washington State Tables his series of 86 men have only minimal bone changes in 6%, all in the youngest third of the men.

Whatever the causes of dysbaric osteonecrosis, and arterial blockage by bubbles (unlikely), gas induced osmosis (no longer favoured) and venous bubbles have all been postulated, there does seem to be an association with careless decompression. Navies which on the whole are careful about decompression have much lower incidence than other series. Sports divers used to be considered unlikely to develop the changes but in Williams and Unsworth's paper from Sydney there were three cases in 19 sports divers surveyed. What the real incidence in Sydney sports divers is anyone's guess as there are certain to be more than 19 such cases in Sydney.

One of the things that stands out in the literature is that the X-ray diagnosis is very dependant on personal opinion, which needs to be checked and checked again. More is being learnt about the progression and incidence, but why some lesions progress and others do not is still unknown.

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Physiology of Diving Mammals
John Knight

This paper followed that by Glen Egstrom on the physiology of immersion. It was a rapid review of the various adaptations by the marine and aquatic mammals to their environment.

The diving responses which are present in all mammals are, bradycardia, vasoconstriction, lactic acidosis and anaerobic metabolism. This is normally precipitated by putting the snout under water. The advantages of these responses are better perfusion of the heart and brain, decreased oxygen needs, increased oxygen extraction, energy production without oxygen and maintenance of the core temperature. The disadvantages of diving include an oxygen debt, tissue anoxia and hypothermia. Man is an inefficient diver, his pulse rate only drops from about 75 to 40-50 while that of the porpoise drops from 60 to 30, the whale from 100 to 12-24, the seal from 70-140 to 7-14, the hippopotamus from 100 to 10-20 and the beaver from 75-90 to less than 10.

With practice all mammals can improve their performance by acquiring increased oxygen stores, increased lung capacity, and increased efficiency of ventilation, better tolerance of hypothermia and of oxygen debt, a decreased shivering threshold and better subcutaneous insulation. These allow better resistance to thoracic squeeze, increased dive duration, and tolerance of cold water.

On top of this the specialised aquatic mammals have a rounded body contour which streamlines them, lungs which collapse so that at depth the air is in the major airways, special blood vessel adaptations to allow for filling the lungs and middle ears, and changes of renal function. As their air containing spaces are able to be filled with expanded blood vessels they avoid barotrauma. As the lungs are empty of air there is no extra nitrogen uptake so they avoid decompression sickness and nitrogen narcosis. They are able to maintain cerebral perfusion, and can use the venous oxygen stores. Due to their insulation and streamlining they have better tolerance to cold and excellent swimming powers.

While man can hold his breath for 3 minutes the beaver can last 15, the porpoise six and the seals from 20 to 40 minutes depending on species. The whales are the winners, with the bottlenose whale lasting 120 minutes underwater. On the basis of predicted oxygen stores man is only marginally longer than expected, but the porpoise, which is expected to breath hold for 2.5 minutes can actually dive for 6. While the bottlenose, which should in theory last 36 minutes underwater can last 120. When we consider depths, man has recorded to 305 metres, the Weddel seal to 550 metres, the bottlenose whale to 825 metres and the sperm whales entangled with submarine cables have been retrieved from the site of the break in this depth.

Turning to respiratory function, the aquatic mammals breath much less often than terrestrial but with a much larger tidal volume. Although the aquatic mammals have less lung volume per kg body weight than man, they use it more efficiently, and have a lower oxygen usage per kilo of body weight.

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Clinical Decompression Sickness
John Knight

Twelve cases of decompression sickness occurring on the island of Nauru were discussed. One died before decompression. Of the others treatment was successful in all except one, who had been treated two months before for pain in the shoulder and weakness of that arm. This time he emerged from two treatments a paraplegic and was then given six days hyperbaric oxygen without any improvement. He was later transferred to the Royal North Shore Hospital in Sydney, and by the time of the meeting was said to be walking again. The common feature of the Nauru cases was great depth, over 200 feet, and omitted decompression. The cause of this diving pattern is the overfishing, using scuba, of the redfish (a local delicacy) from the upper layers of the water. Now one had to go to 200 feet to find the large ones. The standard treatment in the Nauru chamber has been USN Table 5, which was in-appropriate in the presence of neurological symptoms (Table 6 should be used).

An interesting case treated at Truk during the last SPUMS Annual Conference was presented. This man presented on Sunday, having been diving on Wednesday and Thursday, omitting decompression. Following Wednesday's dive, he got a pain in his back, which was not affected by Thursday's dive. His main problem started on Friday afternoon, with sciatica and bladder problems. Being a true diver he treated this with beer. Although he had numbness below the knees, he continued the beer treatment through Saturday and Sunday. He had diagnosed his own condition and mentioned it