**May 1966**

I have great pleasure in publishing our first 'Letter to the Editor' written regarding last months apparently 'not too clear' editorial concerning the ability of marine mammals to remain submerged for long periods by conserving oxygen.

Having apparently lislead Dr. Edmonds, I should apologise - however I don't, for this way we have the benefit of his efforts so far and now he may be interested in the oxygen conservation aspect of the diving reflex.

Editor

In a recent editorial in the U.R.G. you raised the issue of certain mammals being able to remain under water for 30 minutes or more, maintaining their deep body temperature by means of a reflex vasoconstriction of their peripheral skin vellels, the afferent part of the reflex (the 'sensitive' part) being the nasal area. It was postulated that perhaps humans may have retained this primitive reflex, and that leaving the nose exposed to the cold water may increase our adaptability to low temperatures in the water, thus imitating our aquatic ancestors.

The Editor must be well aware of the unwarranted assumptions in this conjecture, however as the idea is easily able to be tested, and as fact is more impressive than theories, we performed the following experiment.

An electric thermocouple was connected to the skin over the palm of the right hand with adhesive tape. This was to estimate the blood flow, and thus the tendency to lose heat. Continuous readings were made, at a rate of 40 per minute, and with an accuracy of 0.1° C. After the skin temperature had become constant, the left hand was immersed in iced water (0°C), and continuous readings were again taken on the right hand. At the end of 3 minutes the left hand was withdrawn and dried. The readings were continued until the right hand had regained its normal temperature. The whole experiment was then repeated, with the nose and upper face replacing the keft hand, in iced water. Two experimental subjects were used.

If the reflex mentioned above was still present in humans, then one would expect a far greater drop in skin temperature of the right hand when the face was immersed, than when the left hand was immersed.

The average temp. drops were 0.9°C and 0.8°C when the left hand was immersed (max. = 1.4C, 1.2°C), compared with 0.9°C and 1.3°C (max. = 1.3°C, 2°C) when the face was immersed. It took about 15 minutes for the normal temperature to become re-established.

These figures suggest that the reflex discussed is either absent or insignificant in humans, and any 'field' experiments that may be attempted to utilise the reflex will fail.

The conventional methods of maintaining warmth by protective clothing are unlikely to be superceded, by physiological ones.

If there are any other ideas which are worth while testing, I would be only too willing to co-operate to evaluate their worth.

Yours sincerely

SGD. DR. CARL EDMONDS.

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## SOME NOTES ON THE DIVING PHYSIOLOGY OF WHALES

C.J. Lawler

In last month's Bulletin reference was made to the 'diving reflex' and its aid, particularly to marine mammals, in oxygen conservation. This reflex is most well developed in the deepest diving of all mammals, the whale. Direct scientific evidence of the depths attained by whales has been obtained by fitting pressure guages to harpoons and firing them into fin whales. Depths of 444, 756 and 1,164 feet have been recorded. Other evidence comes from cases of whales entangled in deep sea cables. Fourteen of these cases have been listed, six coming from the 3,000 feet level and one from 3,700 feet.

At 3,000 feet a whale would have been subjected to a pressure of 1,500 lb p.s.i. Why aren't the thoractic cavity and the lungs filled with air at atmospheric pressure not crushed by these tremendous increases in pressure? Part of the answer to this is in the very flexible construction of the rib cage and the position of lungs and diaphragm. In addition the whale's lung capacity is small in comparison to land mammals, making it possible for the chest cavity to be reduced in size under pressure without structural damage.

If then, there is a reduced lung capacity how can whales obtain enough oxygen to stay submerged for up to 1 1/2 hours as is the case in the sperm whale? A series of physiological adaptions make long submergence possible.

A whales rate of oxygen consumption at the surface is about the same as that of land mammals, but when diving its oxygen consumption is greatly reduced. This is associated with a marked slowing of the heart beat. Generally small animals have fast heart beats; in cats it is 150 per minute, in mice 650 while in larger animals the heart beat is slower, with man averaging 70, horses 40 and elephants 30. Because of obcious difficulties no one has satisfactorally taken the pulse of a large, swimming whale, but from readings taken of stranded whales a heart beat of about 5 to 8 has been assumed. It has been found thet the heart beat of all animals slows when the animal is beneath the water (see last month's editorial) and the slowing is most marked with marine animals. for example the heart beat of the penguin drops from 240 on the surface to 20 submerged, the seal from 120 to 10 and a dolphin 110 to 50. From these examples it may be assumed that the heartbeat of the whale also slows, but to what degree is not known.

This slowing of the heart beat is thought to be made possible by the involuntary cutting off of blood supply to the non-vital organs. In whales a ring of muscle surrounds the big artery in the diaphragm.

Another factor in breath holding capacity is the manner of storing oxygen. In man 34% of the oxygen is stored in the lungs, 41% in the blood, 13% in the muscles and 12% in other tissues. In whales lungs are of less importance in oxygen storage holding only 9%, while 41% is stored in the blood, 41% in the muscle, and 9% in other tissues. In muscle the oxygen is stored in a substance called 'myoglobin'

The amount of myoglobin in the muscles of diving mammals is very high, seals having over seven times as much as a cow. Myoglobin also accounts for the very dark red colour of whales flesh.

The blood corpuscles of diving mammals are also very large with a proportionate increase in oxygen carrying capacity. A seal's hemoglobin carries almost twice as much oxygen as a man's.

The only question remaining is how, after such a long stay in deep water, the whale avoids compression sickness or 'the bends' as it is more commonly known. It will be recalled that the whales lung capacity is small, therefore the total amount of nitrogen available for dissolving in the tissues would be a great deal less than the amount coming to a human diver with a continuing high pressure air supply. High pressures of the depths would also force the air into the less compressible windpipe and nasal passages where much less absorbtion of nitrogen would take place.

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## DIVING AT BARE ISLAND - CONGWONG BAY

A dive by Group members around Bare Island reef was the first in this area since February '65. Dredging operations in Botany Bay for the extensions to the runway of Kingsford Smith airport had reduced visibility of the water around Bare Island considerably so diving in this area was abandoned until conditions improved. With dredging ended we returned to our old familiar reefs with some enthusiasm.

Diving from the east face of Bare Island, the Bare Island reef was followed in a northerly then westerly arc ending in the channel between Bare Island and the mainland. The sand and silt suspensions from the dredging, although previously reducing water clarity did not seem to have adversely affected marine life or bottom siltation in the area traversed.

The two huge six feet wide growths of 'Coscinaraea meneilli' coral were apparently still in good health and a smaller separated growth appeared to have increased slightly in size.

Further along the reef in a hole at the base of an isolated pinnacle of rock were seen a pair of banded coral shrimps (Stenopus hispidus). A pair of these shrimps had been seen inhabiting this same hole during May-June 1964. either these were the same two shrimp or else this hole is a favoured habitat for this species of shrimp.

During a second dive near the beach end of Congwong Bay reef, another pair of 'Stenopus' was seen. One of these was captured for aquarium study. Also collected in this area was a very small speciman of the blue streak cleaner fish (Labroides dimidiatus), a thin black fish with a vivid blue to white longitudinal stripe from nose to dorsal tip of tail. This fish cleans and eats small parasites from other fish of the coral reefs. Often the fish being groomed is very much larger than the cleaner, which only grows to about 3 1/2" in length, and the cleaner will actually be seen completely entering the gill chamber in search of the parasites on which it lives.

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## DIVE AT BARE ISLAND LA PEROUSE - 17.4.66

K. Bicknell

Club Divers: C. Lawler, F. Davis, K. Mullard, K. Bicknell, L. Grimshaw.

Visitors: Phil Morrison, Ken Mather, Dick Johnson.

Meeting at La Perouse at 9.00 a.m. we donned our gear and were in the water by 9.30. Starting our dive mid-way on the eastern side of Bare Island we made our way north following the reef to fimally finish at the bridge.

We found the water off the Island to be quite clear having about 15' visibility. It was intended to photograph a large coral growth, but the club camera did not function due to moisture in the flash connection. Visibility deteriorated around the bridge and closer to Congwong Bay shore.

The weather was fine with very smooth seas making this an ideal diving spot particularly for beginners, who like Ken Mather was able to get out of the water earlier than the more experienced divers. A profitable day had by all, the catch being 1 crayfish, 1 scorpion fish and about 20lb of lead.

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## WEALTH AND FOOD FROM THE SEA

M. Wyeth

Being the lowest portion of the surface of the earth, the ocean is the catch basin into which chemical substances of every kind have been dumped by the many moving forces in nature. Materials are carried by wind and water to the sea, where they are caught as it were, in a trap and made permanently available to the life in the sea. Thus has the ocean become a reservoir of accumulated wealth in chemical materials, which makes the resources of the land appear insignificant by comparison. This accumulation of useful materials is a direct challenge to chemists all over the world. It seems safe to predict that coming generations will learn the inexhaustibility of the ocean's hoarded wealth, and how to make priceless use of the complete assortment of chemicals it includes.

The surface of the earth is 196,950,277 square miles. of this area 70.73% or 139,295,000 square miles are occupies by the ocean.

Everything that exists anywhere in the earth finds its way at last into the sea. Every element necessary for life is present everywhere in the sea.

Sea water and healthy human blood have an almost identical chemical constituency. Sea water is a most complex liquid containing about 3.5% of dissolved inorganic compounds, kelp growing in the sea converts these inorganic compounds into organic form. The plant commonly known as kelp, botanical name Macrocystis Pyrifera, is often referred to as a sea vegetable and serves well as a food supplement.

Some maritime nations, like the Japanese and the Irish have been large consumers of edible sea weeds for many years.

Kelp contains the following elements:-

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| Sodium | Potassium | Calcium | Iron |
| Aluminium | Manganese | Strontium | Silicon |
| Manganese | Copper | Tin | Lead |
| Vanadium | Chromium | Barium | Silver |

Vitamin content is A, E, B and D.

Kelp is just one of the many foods which may be harvested from the sea.

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## U.R.G. DIVE - SHIPROCK - 8TH MAY 1966 - 9.30AM

C. J. Lawler

This dive was very well attended, fifteen divers being present. Divers were K. Mullard, K. Bicknell, F. Davis, C. Lawler, R. Inder, of the U.R.G. plus applicant members L. and Mrs. F. graham, P. Morrison, J. Innes, L. Rouessart, also visitors Miss D. gunner, D. Baker, N. Coleman, R. Doyle and W. Deas.

Weather was cool but sunny with virtually no wind. Entering the water at about 10.15 there was still some current running as high tide (4') was not due till approximately 10.54. Visibility was not very good, averaging about 15' - 20', all the 'Telesto smithi' soft alcyonarian coral polyps were in the expanded position making a beautiful sight for the first time divers at Shiprock.

Ten photographs were taken with the Group's Nikonos camera all without using flash as we were testing a new colour film with an ASA rating of 400. Mostly close-ups were taken due to the absense of very clear water. Photographs were taken of sponges, ascidians, soft corals and fish.

Visiting diver, Neville Coleman, was mainly interested in the shell life of the area, which in spite of the richness of other marine life is not particularly varied. He was lucky in collecting several murex shells (3 Torva murex denudatus extraneus and 11 Poropteron angasi) as well as the common bivalves of the area which include 3 species of Pecten (scallop).

another visiting diver, Wally deas, using a Rolleflex in a Rollemarin housing and flash shot off a roll of colour film.

Fish collecting was poor for our divers, none of the exotic species seen in previous weeks were sighted. Perhaps due to the colder water now moving in. Temperature of the water was 60°F both at the surface and at 60'. Some small blue colonial ascidians were collected for Miss E. Pope of the Museum and the presence of two Pseudobolitea indiana and one Temnopleurus alexandri sea urchins were noted.

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The May Group dive will be at Shiprock, Sunday May 22nd meeting at 9.00 a.m. - for details phone C. Lawler 579.1435.

We remind members and visitors that dives are undertaken weekly - the contacts for various groups are:-

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|---|---|
| C. Lawler | 579.1435 |
| C. Trounce | 524.8522 |
| D. Landor | 42.5986 |

F. R. Davis,
Hon. Editor
167 Karimbla Road,
MIRANDA

PH. 524 .2661