

The Editor's Offering

This issue of the Journal is different from all others. It is the first one that has had a theme. The theme, explained below by Dr John Williamson, is the Great Barrier Reef (GBR). This was the theme of the Annual Scientific Meeting (ASM) in 1992, held at Port Douglas.

Readers have already seen most of the papers presented at the Symposium on Diving Safety on the Great Barrier Reef. We have held off printing the marine scientist's papers until now so that we could try out the idea of a theme issue on our readers. One of the reasons for the delay was that some of the speakers at the ASM were less than prompt in providing the texts of their papers. Some still have not done so. This means that the majority of members, who cannot attend the ASM, will miss out on interesting and informative papers. It does have its good points though. If we had more material to print the cost of postage of this issue would have increased as the Journal, with the Diving Doctors list and envelope, is only just under 250 g in weight. Another 4 printed pages, the minimum increase, would take it over 250 g and then postage costs double.

As a result of putting all the available Barrier Reef papers into one issue there is little room for anything else. We just had room for a fascinating paper by Brian Hills, suggesting that it is surfactant, acting as a flap valve, that keeps air out of pulmonary blood vessels and allows oedema fluid into alveoli. Surfactant used to be considered as the material which stopped our lungs collapsing when we breathed out. Since Brian Hills showed, many years ago, that it really kept fluid to the corners of alveoli, so reducing the distance oxygen has to diffuse, it has been found in many unexpected places including the stomach and in joints. A truly versatile molecule.

However we have not given up hope that some, and hopefully most, of those who have not yet sent in their GBR manuscripts may achieve it one day. In the meantime we have put into this one issue enough material to have provided three issues of the Journal if it had been combined with our usual amount of reprinted articles and abstracts from medical Journals.

As always we need more papers if we are to keep up the standard of the SPUMS Journal. We need letters to the Editor about topics of interest, about diving safety and medical problems of diving. We need case reports and opinions. This is not a plea for instant papers of doubtful quality. It is a restatement of a SPUMS point of view. SPUMS needs more members who contribute more to diving medicine than just doing medicals. Sharing one's knowledge or ideas, even if they are a bit unclear, is a great way to contribute to the growth of knowledge. Even if no one else thinks the same way as you do, you may be right and the others wrong! Every paper submitted to the Journal is peer reviewed. If it is accepted the editorial staff help the writer express his or her meaning clearly and, we hope, concisely. No one doctor will see all the problems of diving, but collectively, if we work together, we can provide case reports which cover everything. Then the information can be co-ordinated by someone as Douglas Walker has done with diving deaths for nearly 20 years and Chris Acott is doing with diving incidents.

The Australian Medical Association (AMA) Federal Secretariat has not, as yet, replied to the Editor's letter of late March. Their secretariat requested an article, about the reasons for having training in underwater medicine before doing diving medicals, for their publication *Australian Doctor*. Dr Wilkins was to present the reasons why training was unnecessary. Although provided two months ago this article has yet to appear. The Editor has been informed, via the grapevine, that the Queensland Branch of the AMA has recently voted to rescind their opposition to the need for training before undertaking diving medicals. We hope that the Federal AMA will soon feel in a position to support SPUMS' efforts to provide better care for trainee divers. After all their Code of Ethics says that doctors should not work outside their field of expertise.

The workshop held at the recent ASM in Palau on Emergency Ascent will be the theme for a later issue. This should generate a number of Letters to the Editor as there are so many views on what is the right way to organise one's rapid return to the surface.

The diver, the Great Barrier Reef and our planet

There would scarcely be a diver who has not heard of "Australia's Wonder of the World", The Great Barrier Reef (GBR). Indeed thousands of Australian (and hundreds of thousands of visiting international recreational) divers have already dived safely on it.¹ Many have come away from this experience awe inspired.

However, fewer divers will be aware of the Australian Institute of Marine Science (AIMS), located at Cape Ferguson, just south of Townsville in North Queensland. This body of internationally renowned scientists, of many different scientific disciplines and nationalities,² studies the complex combinations of geological, palaeontological,

physical, chemical, oceanographic, climatic, biological, ecological and environmental elements that make up the GBR. These studies have had profound influence, and in a partially unexpected way, even to the scientists themselves, are causing Australians, and the world, to look at the GBR and all world reefs and their environs in a more respectful light. The work of AIMS is bringing us to understand that coral reefs and their environments are important, even crucial, ecological treasure stores for mother earth and its inhabitants. Two examples are Dr John Veron's work on corals,³ and the AIMS research that is revealing the previously unappreciated and pivotal biological role played by mangroves.

The South Pacific Underwater Medicine Society (SPUMS) believes that divers are sensitive to the gathering momentum of influence which says we must stop destroying our environment like imbecile children and protect our planet, or die. Divers, by selection, tend to be an environmentally conscious group of people anyway, if not before they undertake diving, then very soon afterwards. Apart from the threat to our very existence of our race's destructive behaviour towards the earth's natural resources, what diver would argue against preserving the opportunity for ourselves and our children to witness the exquisite Ming-blue of a pollution-free coral sea, or the almost spiritual, cathedral beauty of an underwater living reef ?

So it is hardly surprising, and indeed perhaps past time, that the 1992 Annual Scientific Meeting (ASM) of SPUMS held at Port Douglas, Far North Queensland, from the 30th May to the 6th June, was devoted to the GBR, and that the scientific program involved the participation of many leading scientists from AIMS, the Great Barrier Reef Marine Park Authority (GBRMPA) and the James Cook University of North Queensland (all located in Townsville). Leading this cohort of some 17 internationally respected researchers was Dr Michel Pichon, DSc., the Deputy Director of AIMS and a leading coral taxonomist and ecologist. Several of the speakers discussed new research findings never before presented, and many showed original slides and films of breathtaking quality. All conveyed their own deep respect for the intricate and beautifully balanced complexity of the GBR, and appealed to us all to preserve and learn from it. To conclude the program there was a short symposium on Diving Safety and Diving Medical Management on the GBR to which both diving doctors and representatives of the diver training organisations contributed. This included a consideration of the difficult area of Queensland's legislative efforts to increase safe diving workplace practices presented by Mr John Hodges, Director of the Division of Workplace Health and Safety, of the Queensland Department of Employment, Vocational Education, Training and Industrial Relations.

This issue of the Journal is a theme issue based upon some of the outstanding presentations at Port Douglas. It provides a feast of information. For example, read the description by Martin Jones, Curator of the Great Barrier Reef Aquarium in Townsville, of the amazing learning curve involved in the creation of that Aquarium's, now internationally renowned, artificial living reef. A paper which will excite those interested in venomous marine animals are by Dr Jacquie Rifkin, PhD, on jellyfish nematocyst structure and function. The contribution by Dr Ed Drew, PhD, on *Halimeda* banks is also fascinating. In fact the Port Douglas program featured so many "world authorities" on their respective subjects that they became almost common place at the Meeting, to the delegates!

All who attended Port Douglas were, and all those who read the papers in this issue will be, left with a heightened appreciation for the beauty and delicacy of the interplay of marine life on the GBR. More than that, diving delegates to Port Douglas looked through the different eyes of enhanced understanding, as they dived from MS "Quick-silver" during 3 days of diving on the outer Reef and they clearly showed greater care for the coral and fish life.

What can divers do to help preserve this mightiest and most beautiful of the world's living structures and halt the damage and pollution that still occurs (although decreasingly of late, thanks largely because of the work of GBRMPA, with its development of the marine park concept)? When asked this question at Port Douglas, Dr Joe Barker OBE, PhD, the Director of AIMS replied, "At least three things! First, divers should avoid passing urine while diving on the reef. The chemical composition of human urine is hostile to the delicate coral and fish life. Second, never stand upright on a living coral reef wearing fins. Extensive reef damage can result. Third, if you witness first-hand an unusual or unexpected Reef phenomenon while diving, report it. If possible, and it is safe to do so, photograph the event as well." Both AIMS (077-789 3211) and the Hyperbaric Medicine Unit at the Royal Adelaide Hospital (08-224 5116) would be pleased to receive such notifications. Of course, suitable events could be submitted to the Editor of the Journal (see "Instructions to Authors" on the inside of the back cover of this issue), and if accepted for publication, could reach a wide audience.

It is clear to all who attended Port Douglas, if it was not clear to them before, that divers have an on-going responsibility to use the new knowledge emerging from marine research, to dive more responsibly and to influence all people everywhere to preserve and protect the ocean and reefs of the world. No longer should divers stand idly by while greedy, short-sighted and just plain stupid corporate and political groups and individuals attempt to manipulate and legislate for reef, littoral and adjacent ecological de-

struction in the name of “progress”. It was a real pleasure to have Dr Lesley Clark, MLA, PhD, the Queensland Government Member for Barron, North Queensland, to open the SPUMS 1992 ASM. Dr Clark is not only an “intelligent greenie”, with a demonstrated practical support for conservation, but she had to deputise for the task of opening our Meeting at very short notice. SPUMS appreciated her support and her opening address.

The divers’ opportunity to play a key role in this drama of world conservation is in some ways unique. The wisdom of doing so needs to be made crystal clear to the diving “blind Freddie” and there are still a few of them around !

John Williamson
Convener, SPUMS ASM 1992

References

- 1 Wilks J. Scuba diving safety. *Med J Aust* 1992; 156: 580
- 2 *Australian Institute of Marine Science. Annual Report 1991-1992.* Townsville, Queensland: Australian Institute of Marine Science Publishing, 1992
- 3 Veron JEN. *Corals of Australia and the Indo-Pacific.* North Ryde, New South Wales: Angus and Robertson, 1986

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ORIGINAL PAPERS

PULMONARY BAROTRAUMA: A POSSIBLE ROLE FOR SURFACTANT IN OPPOSING THE ENTRY OF AIR INTO THE CIRCULATION

Brian Hills

Abstract

The alveolar wall of sheep lungs has been studied by electronmicroscopy, employing vascular fixation, i.e. “fixation from behind”, using a formulation designed to preserve any lamellated structure of surface-active phospholipid (surfactant). The electron micrographs (ems) show channels traversing epithelial cells, as reported previously, but the mouths of these channels are very close to the oligolamellar lining of surfactant which follows the alveolar surface, whether this is a fluid “pool” or the epithelium.

These findings are discussed as indicating a model whereby the relatively rigid surfactant “raft” can act as a flap-valve (non-return valve), allowing fluid to exude onto the alveolar surface under conditions which provoke oedema, while sealing the pores to prevent the entry of air if alveolar pressure exceeds capillary blood pressure.

Introduction

Pulmonary barotrauma is not a rare occurrence, and one of particular concern in view of the incidence of death or residual neurologic injury which can result.^{1,2} “Burst lung” will occur if the difference between intrapulmonary

and environmental pressures exceeds a threshold which has been placed at around 70 mm Hg, approximately 100 cm of sea water.³ Hence, in the training of divers and submariners undergoing submarine escape training, much emphasis is placed upon keeping the glottis open in order to avoid any significant gradient developing between intra-alveolar and lung tissue pressures. However, even after exhaustive practice of the correct technique, cases of pulmonary barotrauma still occur in fit persons⁴ and even in instructors particularly well trained and aware of the potential hazards. Cases have also been recorded¹ during the relatively slow decompression from a simulated dive performed in a pressure chamber, while even a cough or a sneeze under those conditions has been known to precipitate symptoms. In some of these instances it is difficult to believe that the pressure gradient for rupturing lung tissue had been exceeded. Such considerations raise the issue of what other means might be involved or what other pathways might exist by which air could enter the pulmonary circulation under much lower pressure gradients.

Fluid can pass from blood to air and accumulate on the epithelial surface as alveolar oedema, so some channels must exist. Moreover these must be large to enable macromolecular proteins to reach the alveolar surface from blood, the concept of “stretched pores” having been raised as early as 1934 by Landis.⁵ A review of current thinking⁶ states that, although the exact route by which fluid enters the alveoli from the intersitium remains controversial, there is currently general agreement that fluid enters by “bulk flow” through channels too large to permit any significant “sieving” of proteins. At the more selective capillary endothelial membrane, macromolecules of 255,000 have long