

HISTORY OF THE R.A.N.

SCHOOL OF UNDERWATER MEDICINE

1963 - 1969

by Keith Gray

PROJECT 2/69

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## HISTORY OF THE

### R.A.N. SCHOOL OF UNDERWATER MEDICINE

For years, the Diving Branch of the Royal Australian Navy was a poor relation, until it became policy to expand and encourage the growth of the new form of free swimming diving.

As diving training expanded, it became apparent that many problems concerned with existence in the underwater environment had not been appreciated, and that the medical hazards met by the old fashioned standard dress diver were both inherited and emphasised by the new underwater swimmer with his increased mobility.

Within the R.A.N. there was no store of specialised medical knowledge, and such terms as "shallow water blackout", "squeeze", "O<sub>2</sub> poisoning", "proto cocktail", "CO<sub>2</sub> build up" and many others were part of the divers' jargon that did not neatly dovetail with the general consideration that divers either suffered from the classical "Caisson disease" or required rescue from maneating sharks, squid and groper.

During this early period, in Sydney, medical support for the Diving Section of H.M.A.S. WATSON was afforded by the District Medical Officer, Surgeon Lieutenant Commander S.A.C. Watson, D.S.C., R.A.N.V.R.. Dr. Watson developed a keen interest in diving and divers, and realising the need for a greater understanding of the physiological aspects of diving, became a diver himself.

Shane Watson's first interest, however, was in the study of sharks and rays, including the private development of a device to inject these creatures with a rapidly acting poison.

The Medical Director-General of the Royal Australian Navy, Surgeon Rear Admiral Lionel Lockwood, C.B.E., M.V.O., D.S.C., recognised the developing situation and acted accordingly. An anaesthetist, and Surgeon Lieutenant Commander in the R.A.N.R., Rex Gray, was invited to consider the prospect of full time service in the R.A.N., in Underwater Medicine, bearing in mind that his specialist training in anaesthesia would be of great value in the diving field with its emphasis on mechanical devices for the control of respiration.

Dr. Gray found the prospect of involvement in this new field very attractive, applied for a Short Service Commission, was accepted, resigned from his practice and was commissioned as a Surgeon Lieutenant Commander on a Short Service commission on 20th February, 1961, being appointed to H.M.A.S. WATSON, the parent establishment of the Diving Section, which was located at H.M.A.S. RUSHCUTTER, a R.A.N.R. training establishment.

On his first day in RUSHCUTTER, the new Medical Officer became involved in the aftermath of a diving tragedy, when a sailor was brought to the Recompression Chamber after having suffered a burst lung during free ascent training from his ship at Garden Island. The young man, unfortunately, was dead on arrival.

Whilst still "green", Lieutenant Commander Gray was required to provide the medical support for the diving team working on the Lake Eucumbene Dam job, where R.A.N. divers were required to work under hazardous and extremely uncomfortable conditions at a greater working depth than previously attempted in the Southern Hemisphere. The experience certainly encouraged concentrated study of all the available literature on diving physiology and habitability.

In order to fully appreciate the environment and reactions of the divers this new medical officer commenced - and completed - a C.D.3 course, consisting of three weeks of the standard Shallow Water diver course, followed by six weeks training in the use of the Clearance Diver Breathing Apparatus. Then in his middle thirties, on this rigorous course he kept pace with much younger men and left no doubts as to his own physical fitness, particularly as the course was held in mid-winter.

It was decided to send Surgeon Lieutenant Commander Gray to England to study the latest developments and technical advances in Underwater Medicine. He attended the Royal Naval Medical School at Alverstoke, the R.N. Physiological Laboratory, the Submarine Training School at H.M.S. DOLPHIN, Diving School H.M.S. VERNON, and the R.N. Air Medical School at Seafield Park. In addition he managed to join H.M.S. RECLAIM in Scotland, where a team under Sub Lieutenant A.A. Davis, R.A.N., was determining the bends percentage of dives on Table 2. Dr. Gray also became one of the guinea pigs.

Completing seven months of furious study, literature collection and cementing friendships, the student moved on to the United States, where he spent two weeks each in the Experimental Diving Unit, Washington Navy Yard, and with the Medical Research Laboratory, Submarine Base, New London, Connecticut, returning to Australia in July, 1962, aboard H.M.A.S. SUPPLY.

Vast quantities of handouts, copies of articles, manuals, photographs - anything and everything was grist to the mill that was to be a reference library, poured into RUSHCUTTER by divers (sic) means, following Rex Gray's return.

1963. The first School of Underwater Medicine Report, covering the period 21st January, 1963, to 11th April, 1963, gives indication of the solid spade work that had been put into the establishment of liaisons with many medical and paramedical organisations with common interests

in such things as resuscitation, gas analysis, Carbon Monoxide poisoning, civilian hospital recompression chambers, an animal recompression chamber to be manufactured at NIRIMBA, laboratory apparatus - the list appears endless.

The creation of an adequately indexed reference library, including a vast store of reprints of medical and scientific articles, was also a labour which consumed a great amount of effort, involving as it did the need to continually update the original matter.

Although the Officer in Charge of the young School had been providing lectures in physiology and resuscitation for diving training courses, the first official course in Underwater Medicine was commenced in May, 1963, when Surgeon Lieutenant Commander A.A. Reid, R.A.N.R., commenced an eight day course. He was closely followed by Surgeon Lieutenant Commander B.M. Wadham, R.A.N.R., who carried out 13 days A.C.T. from 3rd June, 1963.

1964. The Medical Officers of H.M.A.S. WATSON, notably Surgeon Lieutenants J. Palmer and W.A. Kemp, R.A.N., displayed interest and assistance to the School, particularly during those periods when the Officer in Charge was absent on anaesthetics and other duties. Indeed, their work eventually justified the appointment of Surgeon Lieutenant G.J.A. Bayliss to the School full time on 8th June, 1964.

In preparation for the role of the School of Underwater Medicine primarily as an instructional centre, effort had been poured into the production of a series of "handouts", ranging in scope from elementary physiology and anatomy to an advanced instruction for medical officers on the application of hyperbaric medicine.

On 4th May, 1964, Dr. Bayliss and Wardmaster Sub Lieutenant K.L.G. Gray commenced diving training. Sub Lieutenant Gray was withdrawn medically unfit before entering the water, but his classmate successfully completed the course, joining H.M.A.S. RUSHCUTTER the following week as Medical Officer.

This arrangement enabled Dr. Rex Gray to devote more time to instructional matters and to consolidating the progress made in building up reference facilities. The spirited enthusiasm in which correspondence was entered into continued to such diverse bodies as the Snowy Mountains Authority; Australian Red Cross Society Blood Transfusion Service; West Australian Department of Primary Industry; Shark Research Society of N.S.W., City Coroner, Perth, W.A.; The Department of Civil Aviation; the Prince Henry Hospital; the Royal Adelaide Hospital, and the Peter MacCallum Clinic, Melbourne. These last three hospitals have installed pressure chambers in which patients are treated with high oxygen tensions for a variety of conditions.

On 8th October, 1964, Lieutenant Commander Gray wrote "The School of Underwater Medicine continues to progress, although at a rate less than optimum due to a combination of factors such as staff shortages and absence of laboratory furnishings. The Medical Officer appointed to assist in the work of the School is continually being taken to relieve at other establishments, and this is particularly frustrating at this stage of initial development.

"Nevertheless, there have been compensations such as the opportunity to be of assistance to civilian hospitals and university departments who are beginning to take an interest in high oxygen tension from a therapeutic viewpoint.

"Diving safety continues to be uppermost in everyone's mind and all activities taking place within the School are directed towards this end. The extremely low diving incident rate is a reflection of this interest."

Student Medical Officers at the School were invited to criticise the course and its presentation, and a fair sample of this was given by Surgeon Lieutenant Commander A.C. Kingsbury on 20th November, 1964:

"1. Outline

The course occupies ten days and includes instruction in the theory of diving, physiology, anatomy, pathology and psychology. Time is spent on physical training, practical work in diving, submarine inspection and a museum visit.

2. Theoretical Instruction

This naturally occupies the bulk of the time available.

I personally found this very instructive, although there was only space for a general outline of the subject. The student was made familiar with many physical and physiological facts and theories omitted or neglected in his earlier training, and encouraged to continue his studies in greater detail on selected problems.

Extensive use was made of printed "handout" sheets, which were detailed and up to date. Obviously much thought had gone into their preparation, and useful references were tabulated.

Didactic lecturing was used sparingly, but there was considerable tutoring and discussion, in accord with the individual nature of the course.

Some films were used, and proved helpful. I understand that others are on order, and think their use could be extended.

### 3. Reference Library

This is excellent. For such a small establishment to seek out and obtain the amount of material was an achievement in itself. The only complaint is the impossibility of devouring all its contents in the time available. Medical Officers in the Sydney area are fortunate in that they can return to it from time to time.

### 4. Demonstrations

This part of the course is weak. The need for a museum of photographic slides, pathological specimens, and experimental demonstrations is obvious. Time and finance appear the inhibiting factors, and it is to be hoped that the situation will be corrected.

### 5. Practical Diving

This was in the nature of an introduction to the subject. Medical Officers are given an insight into the physical and physiological aspects of diving, together with the wartime application. Encouragement is given to the officer to return and qualify as a compressed air diver at a later date. Under the circumstances, few would wish to miss this opportunity.

Personally I found the instruction in use of recompression chambers and compressed air adequate, but wondered whether practical instruction in other gas mixtures could be enlarged in the future. Naturally one is bound to the needs of this particular diving establishment, but such instruction would round off one's appreciation of the subject.

### 6. Submarine Medicine

Theoretical instruction was given, and a visit to H.M.A.S. TACITURN conducted.

This was very informative, especially with the future use of submarines in the R.A.N. in mind.

Unfortunately, a trip to sea could not be arranged, but obviously would be instructive of the practical problems of habitability.

## 7. Research

For a School of this type to take its place in the international field of Underwater Medicine, facilities for research must be provided.

In addition, teaching of the subject will depend on the appointment of a Medical Officer who can keep up with the world literature, spend time on practical diving and research, and pass on his knowledge to students.

It seems unlikely that this ideal can be achieved if the Medical Officer is hampered by other duties in the depot.

### Summary

I found the course very profitable, and feel that when staff and facilities are available to correct the above deficiencies, the School will have a vital role in the R.A.N.

Having had a previous acquaintance with the subject, I obtained a great quantity of information. A non diving Medical Officer should spend the extra time to qualify in diving, or acquire this additional material."

By 29th December, Dr. Gray wrote: "The School of Underwater Medicine has now completed Phase I of its development, which consisted of the establishment of a comprehensive reference library, and the assumption of its teaching role. It is particularly pleasing to note that increasing advantage of these facilities is being taken by civilian bodies, the School being recognised as providing a unique service.

"Phase II, which consists of the development of the research function, is being hindered markedly by the lack of a technical officer and by delays in equipping the laboratory space with such essentials as benches, lighting, etc.. Nevertheless, there are signs of slow progress in these directions."

Due to the size of the School of Underwater Medicine, its progress and the direction of its progress of necessity reflect to a very marked extent the personality of the Officer in Charge. It may well be said that, with the change of O.C.S.U.M. on 8th February, 1965, the direction of Phase II fell to a man well equipped to consolidate and correlate the work of his predecessor, and to set into motion the research facility, so dependent on staff and equipment. Dr. Bayliss took over from Dr. Gray.

1965. Following the departure of Surgeon Lieutenant Commander Gray in February, Wardmaster Lieutenant Gray was appointed to the School in March. This appointment served the purpose of relieving the administrative load from the shoulders of the Medical Officer, enabling him to concentrate more on medical aspects.

Not previously mentioned was LSBA T.A.M. Roberts, who had been ministering to the wants of divers during the whole of the period under review. With Robbie there was no question of the Medical Department not being accepted by the divers. A very capable diver himself, extroverted, interservice Water polo and swimming representative, good all round sportsman, he held the divers' complete confidence and was invaluable in the Sick Bay. Although his storekeeping and administrative knowledge was perhaps a little extraordinary, to quote him: "You can't win 'em all".

By June, six civilians had been treated in the Recompression Chamber, including five cases of Carbon Monoxide poisoning and one of a severe crush injury to the foot. Three CO victims recovered, and the foot injury showed marked improvement.

In his quarterly report to the Medical Director-General, the O.C.S.U.M. stated:

"This has been a busy quarter for the School. The main items of interest have been: staff changes; treatment of civilians with hyperbaric oxygen; completion of the Laboratory and the completion of the lecture notes for the Underwater Medicine Course.

"While the main roles of the School will continue to be the overall adequate medical care of divers in the Navy and the instruction of Medical Officers in Underwater Medicine, the following important subsidiary roles have emerged:

- (i) the maintenance and improvement of a sound reference library
- (ii) the need for a planned research programme.

"At present it seems there are three lines of research which can be undertaken. Firstly, investigations into the prevention and also more efficient treatment of the more common ailments of diving - e.g. aural barotrauma. Secondly, the investigation into the more serious medical conditions afflicting divers, e.g. oxygen toxicity and nitrogen narcosis. It is in this field that the laboratory facility comes into its own. Thirdly, field work involving such things as dangerous marine animal studies and Decompression Illness studies in pearl divers. Having in mind the resources available, it is intended to dwell upon the first and second lines of enquiry in the first instance, while continuing to maintain the already established functions of the School."



During April, the question of an animal Recompression Chamber (first discussed between NIRIMBA's LCDR Berlyn and Dr. Gray) for research purposes, was discussed in detail. Enquiries elicited that such a device could be manufactured as a project for boilermaker/welder apprentices at H.M.A.S. NIRIMBA, and a meeting was held to discuss the various aspects of the proposition. Consequently the project was adopted and the design study commenced for a Chamber approximately twenty four inches long and fourteen inches wide.

Surgeon Lieutenant John Miller, R.A.N.R., now enters the picture. In conjunction with Surgeon Lieutenant Commander Shepherd, Dr. Miller completed a two weeks course in underwater medicine from 22nd March to 2nd April, 1965. A Research Fellow engaged on a programme of metastatic tumours in mice which involved the use of a small animal R.C.C., it was obvious that his laboratory experience could and should be used to help set up the S.U.M. Laboratory. Naval Board approval was obtained for Dr. Miller's part time employment on research in the School, and on 1st September he submitted a report relating to general laboratory equipment, laboratory animals, and specific laboratory equipment to enable research into common diving accidents, investigation into the physiological performance of existing diving equipment, and for providing demonstrations of physiological and pathological phenomena peculiar to underwater activities.

Courses in Underwater Medicine continued to be conducted, and by the end of the year, a total of twenty medical, dental and wardmaster officers had completed the two week Reserve Officers' Course, which, by practice, had become the standard course, due to the unavailability of serving medical officers.

The first project in research work was commenced during August 1965 - a joint survey by Surgeon Lieutenant Bayliss and Surgeon Lieutenant Miller into aural barotrauma of divers. A great deal of planning was put into a statistical survey. A preliminary scan based on records kept in the Diving School over the previous ten years had shown that up to 34% of trainees fail for medical reasons, the most common being aural barotrauma and upper respiratory tract infection. The ultimate aim of the survey was to find the most effective way of preventing aural barotrauma, and secondly the most efficient way of treating it once it has occurred. The advice of Dr. G. Scott, an epidemiologist from the University of Sydney was obtained so that the survey would be planned in a valid scientific method.

An excerpt from the S.U.M. quarterly report ending 30th September, 1965, states "During this quarter a statistical clinical survey has been commenced. In practice, a daily Barotrauma Clinic is organised and

divers with this complaint are examined and the results of the examination and treatment are recorded on the proforma designed for the computer evaluation of the survey.

"The arrival of the audiogram referred to in Medical Director-General's letter 1002/60/75 of 24th September, 1965, will greatly assist in the conduct of this trial. By the end of the next quarter, this trial should have given some information on this problem of Aural Barotrauma.

"As soon as the Technical Officer arrives it is intended that he devise apparatus to take samples of respiratory gases from the U.B.A. set at present in use in clearance diving. The aim being to get a sample of gas that the diver is actually breathing quickly and easily when the set is in use. This sample will then be analysed. Work along these lines will help to elucidate the problem of CO<sub>2</sub> intoxication.

"In view of the difficulty in distinguishing between pulmonary barotrauma, drowning and chest infection in a diver surfacing unconscious after a free ascent, it is proposed to undertake animal studies in this direction using the small animal recompression chamber which is being built for the School of Underwater Medicine by H.M.A.S. NIRIMBA. It is proposed to approach the University of New South Wales for experimental animals to use in this work. Due to the development of the Hyperbaric Unit at Prince Henry Hospital (the teaching hospital for University of N.S.W.) it is considered that it would be most worthwhile to establish a liaison between the School of Underwater Medicine and that University."

Dr. Victor Hercus visited the School on 25th August, 1965, and during his visit the type of equipment for use in blood gas studies in hyperbaric work was discussed. Dr. Hercus had been, until recently, in charge of the respiratory unit at Prince Henry Hospital, and had had experience in hyperbaric work overseas. He was also in charge of the development of the Hyperbaric Unit at Prince Henry Hospital.

At the request of Professor Loewenthal of the Department of Surgery, Sydney University, a patient with a history of 18 years Paget's Disease of the mandible was accepted for hyperbaric oxygen treatment in the R.C.C., following the reported success of similar treatment in the United Kingdom. After a period of twenty hours treatment in two hour doses, no definite alteration in the state could be observed, either radiologically or clinically.

Submarine suitability tests continued to be a responsibility of the School since its inception in 1963. Designed to eliminate personnel who are medically or psychologically unsuitable for compressed air work, the test consists of a psychological interview, a lecture and demonstration by a submarine escape coxswain, a medical document review and medical

examination prior to a "dive" in the Recompression Chamber to a depth of 100 feet. The examination appears to have weeded out a number of members who otherwise might not have made the grade when they reached Submarine Escape Training in the United Kingdom.

By the end of 1965 it was possible to report that the Aural Barotrauma survey continued, with about 140 cases collected, and the intention of despatching the first group of proformas in January to be analysed by computer. A Computer Technician had been consulted and it was considered wise to make a pilot study of the first hundred cases or so, so that corrections could be made if required before mistakes accumulated.

The Technical Officer, Mr. Dan Quick, joined the School on 1st November, 1965, and spent the first few weeks visiting the Dockyard Laboratory, The Hospital Laboratory at H.M.A.S. PENGUIN, and the Defence Standards Laboratory at Alexandria, N.S.W.. The laboratory at the School by this time was reasonably well stocked with the common reagents and the basic items of laboratory glassware and equipment.

An advance in therapeutic recompression was becoming possible with the approval to fit a multi channel plug to the large Recompression Chamber at RUSHCUTTER, so that Electrocardiograms may be taken of dangerously ill patients while undergoing Hyperbaric Therapy. This also would allow greater scope in monitoring healthy subjects undergoing recompression.

The statement by O.C.S.U.M., Surgeon Lieutenant Geoffrey Bayliss at the close of the year was as follows: "Considerable progress has been achieved this year in the School of Underwater Medicine.

"During the year ten civilians were treated with Hyperbaric Oxygen Therapy, seven diving incidents investigated and reported on from the medical aspect, and eleven officers completed courses in Underwater Medicine. Sixty five personnel were tested for Submarine Suitability and three hundred and ninety two diving medicals were carried out.

"The year 1965 has seen the serious development of a research function for the School of Underwater Medicine, with the provision of a laboratory facility and of a civilian Technical Officer. In 1966 it is hoped that some worthwhile results from the Research Programme will be forthcoming. While the research function of the School is an important new development, it is not intended to neglect the already established functions of the School, the most important of which is the overall medical care of the Diver in the Service."

1966. During the first quarter of 1966 Associate Professor Johnston and Dr. Colebatch of the University of New South Wales were consulted on the problems of blood gas measurements in divers and the conduct of animal experiments in pulmonary barotrauma. Professor Johnston is a cardiovascular and thoracic surgeon with the Department of Surgery in the University of New South Wales. Dr. Colebatch is a clinical respiratory physiologist with the Department of Medicine. Both these gentlemen were very helpful and encouraging. They offered to give technical advice on the experiments planned under the S.U.M. research programme.

On 11th January, a meeting on Hyperbaric Oxygen was held at H.M.A.S. RUSHCUTTER, and the terms of reference of the Advisory Committee on Hyperbaric Oxygen of State Department of Health, N.S.W., were drawn up. Subsequently, Naval Board approval was given for Surgeon Commander Gray and Surgeon Lieutenant Bayliss to become members of this committee, Dr. Bayliss occupying the position of Secretary.

On 28th March, the O.C.S.U.M., in company with Lieutenant Commander R.M. Titcombe, M.B.E., a diving officer, attended a conference in Hobart, called by the Tasmanian Government, for opinion on the need for Recompression Chambers in Tasmania. Much helpful advice was given and useful contacts made.

Contact was made with Government Medical Officers and Coroners in various states regarding reports on post mortem notes for cases of deaths of divers who have come to post mortem with pulmonary barotrauma or other conditions presenting with the same symptoms. Some excellent case histories have been added to the School's files as a result.

The first Sick Berth Attendant to commence a specialist course in Underwater Medicine started his course on 9th January, having qualified as a Compressed Air (C.A.B.A.) diver the previous year. He was SBA K.G.B. McTavish R58993. A recommendation that LSBAORA P.J. Davies R54652 be permitted to commence a similar or an abridged course was rejected by the Naval Board, on the grounds that each sailor was permitted only one specialist course during his career. From the viewpoint of the School, this was most regrettable, as LSBA Davies was extremely efficient and interested in the work of the School, in addition to his normal duties at RUSHCUTTER.

The matter was partially resolved by reporting him as having acquired a specialist knowledge in Underwater Medicine, thereby ensuring that in the absence of Underwater Medicine specialists, he would be considered in the future for return to duties in the School.

A number of patients had been treated in the Recompression Chamber with hyperbaric oxygen in the management of CO poisoning, and a new slant was given following enquiries by Mr. Bernard Bloch, an Honorary

Orthopaedic Surgeon at the Sydney Hospital. Mr. Bloch was interested in the reaction of the O.C.S.U.M. to the possibility of treatment of some of his cases suffering from chronic osteitis and osteomyelitis.

Approval was obtained from FOICEA to treat the initial case, and over the next year, a few chronic bone infections were treated at the request of orthopaedic surgeons with the FOICEA's approval.

Although there were no cures claimed, it appeared that all the cases obtained beneficial effects from the hyperbaric oxygen exposures.

During 1966, a paper entitled "Clinical Application of Hyperbaric Oxygen Therapy" by Drs. Miller and Bayliss was accepted by the Medical Journal of Australia. Another paper "Diving Fatalities in Australia, Illustrated Cases" was also prepared for the Medical Journal of Australia by Dr. Bayliss.

In research work, a clinical research work on aural barotrauma had progressed, and at the end of the year, the number of pro formas in the survey stood at five hundred and seven.

Efforts had been made during the year to obtain from various authorities records of civilian diving accidents in Australia and records of thirty one known civilian fatalities were held in the School.

Progress was being made at the Apprentice Training Establishment at NIRIMBA in the manufacture of the small animal recompression chamber, and blood and respiratory gas studies in clearance divers as a research project was being prepared. Unfortunately the IL Blood Gas Analyser which arrived early in December was damaged beyond repair whilst being unloaded from the ship in which it arrived from the United States.

In the meantime, Dr. Bayliss continued to obtain considerable experience in brachial arterial punctures at the Respiratory Unit at Prince Henry Hospital, in conjunction with Dr. Colebatch.

In summary, during the year steady progress had been maintained in all functions of the School of Underwater Medicine. During the year, nine diving accidents were investigated from a medical viewpoint, and five civilians were treated with hyperbaric oxygen in the recompression chamber. One of the civilian cases treated was the first case of Gas Gangrene to be treated in recompression chamber at H.M.A.S. RUSHCUTTER. The response to treatment was dramatic.

Nine officers completed courses in Underwater Medicine and one hundred and fifty seven people were tested for submarine suitability. SBA McTavish completed his Underwater Medicine course on 12th August and LSBA Roberts commenced his course on the same day. Progress was made on

the classification of the School of Underwater Medicine Library in accordance with the Dewey Decimal System and was designed to be used in conjunction with the Royal Australian Navy Experimental Laboratory Library.

1967. In May, 1967, Dr. Carl Edmonds, a specialist psychiatrist and physician, accepted a commission as Surgeon Lieutenant Commander in the R.A.N., with a view to assisting part-time in the S.U.M.. Surgeon Rear Admiral Coplans, the Royal Australian Navy Medical Director-General, had thus repeated the action of his predecessor in attracting a doctor from private practice into the naval underwater medicine field.

In June, 1967, Surgeon Lieutenant Commander Bayliss stated: "This quarter has been the busiest of the School of Underwater Medicine during the past two and a half years, and was due to the requirement of providing medical cover for H.M.A.S. WATSON from 5th April, 1967. As a result of this, it was not unusual for a complete forenoon to be involved with routine medical matters relating to WATSON and RUSHCUTTER. This meant that the time available for research work was seriously curtailed. Unfortunately, this has come at a time when the laboratory of the School was ready for research work to start.

"The frequent changes in the diving programme resulted in the need to change times for routine instructional lectures to divers and times to attend free ascent drills often at short notice. This, in turn, made it extremely difficult to arrange for a planned programme of instruction for Surgeon Lieutenant Commander Edmonds and the sick berth sailors."

Dr. Edmonds showed keen interest in the problems of Underwater Medicine, but unfortunately his duties at PENGUIN precluded him from spending more than about two half days per week at RUSHCUTTER. He joined the Service on 1st May, 1967, and commenced his association with the School very shortly after this date.

In the School Of Underwater Medicine Report dated 5th November, 1967, Surgeon Lieutenant Commander Bayliss stated: "During this quarter, the Medical Officers' Course which was due to commence on 13th November was cancelled, due to the sudden posting of Surgeon Lieutenant Commander Bayliss. The officers nominated for this course were Surgeon Lieutenant Commander C. Edmonds, R.A.N., of H.M.A.S. PENGUIN, Surgeon Lieutenant Grainger and Surgeon Lieutenant Myers. Although Surgeon Lieutenant Commander Edmonds has completed approximately half of the course during his part time attendance in H.M.A.S. RUSHCUTTER, time is not available during the handover period for him to complete the remaining sections of this course.

"POBBA Manley has completed nine lectures of his course of Underwater Medicine and has completed a progress examination on the subjects of barotrauma, drownings, decompression sickness and medical regulations relating to diving. He passed with a mark of 89%.

"During the week commencing 13th November, matters relating to the School of Underwater Medicine were handed over to Dr. Edmonds. Unfortunately, there was insufficient time to complete the remaining sections of the Underwater Medicine Course for him.

"In summary, the following activities have had to be curtailed or cancelled:

1. Two projects of the research programme
2. Treatment of civilians in the recompression chamber
3. Underwater Medicine Courses for Medical Officers
4. The physiological testing of carbon monoxide absorbent in co-operation with the Defence Standards Laboratories.

"It must be stressed that the curtailing of the above functions does not imply that they are non-essential, but rather that they are capable of postponement, whereas other functions, such as the day to day care of divers, are not.

"The research work which was underway at the School of Underwater Medicine during this period consisted of:

1. Clinical survey of aural barotrauma. This project has now been completed and a paper entitled "Aural Barotrauma in Naval Divers" reporting a survey analysed by computer, was forwarded to the Medical Director-General on 7th November, for approval for publication in the Archives of Oto-Laryngology.
2. A survey of naval and civilian diving accidents. The collection of reports from various sources of diving accidents and incidents throughout the Commonwealth has continued. Dr. Bayliss intends to critically examine the data collected so far, and prepare a report on the patterns of accidents that have occurred.
3. Blood and respiratory gas studies in clearance divers and the experimental study of pulmonary barotrauma. Due to the posting of Surgeon Lieutenant Commander Bayliss, work on these projects has been halted. There is

insufficient time to train Surgeon Lieutenant Commander Edmonds in the techniques of blood sampling required in this study. Supply of laboratory animals, guinea pigs from the University of New South Wales, also has had to be cancelled."

During this particular period in the growth and change of direction of the School, POSBA UM T.A.M. Roberts was posted to H.M.A.S. WATERHEN and SBA UM McFavish was discharged Below Naval Physical Standard. We were left with the strange position of having a School of Underwater Medicine with no specialist Underwater Medicine personnel.

However, in his first report, Dr. Edmonds was able to say, "POSBA Manley and SBA Moffatt remain on course in Underwater Medicine. Due to the very high standard of competence of POSBA Manley, it has been possible for his course to be merged with the duties of a part time instructor and research assistant without detriment to his Underwater Medicine Course.

"Academic liaisons have been made with Dr. Scott, Consultant Epidemiologist to the R.A.N., Dr. John Colebatch, a Respiratory Physiologist at the University of New South Wales, Professor Kiloh, a Psychiatrist at the University of New South Wales, Professor Blackburn, Physician, University of Sydney, and Professor Hamer, University of New South Wales.

"In addition, an excellent series of colour slides of dangerous marine animals has been collected through the loan of the original slides by Mr. Keith Gillett, an underwater photographer of international repute. A standard format of inviting a guest to lunch and drinks and intimidation in the wardroom at H.M.A.S. RUSHCUTTER proved fruitful for the School of Underwater Medicine."

A general statement on the future of the School of Underwater Medicine as seen by Dr. Edmonds was, "There is no reason why, given the assistance and understanding exhibited in the past, the School of Underwater Medicine should not be able to grow into a productive and exciting unit. There is no lack of ideas or concepts to be investigated and the only limits imposed are those of equipment and manpower, the latter being the more serious. Administration problems are kept to a minimum because of the activity of the Wardmaster, and the use of our own typist makes us independent of the secretarial blocks so common in larger institutions.

"It appears that the proposed move to H.M.A.S. PENGUIN will result in us obtaining more adequate accommodation and staffing facilities. The School of Underwater Medicine could, in a very short time, become a show piece for the Royal Australian Navy.



"In the distant future, and if numbers permit, it would be worthwhile considering the diversion of the Officer in Charge School of Underwater Medicine's duties to those of a permanent research clinical Co-ordinator, and a semi-annual post be given to a Surgeon Lieutenant to train in both Underwater Medicine and Respiratory Physiology, and to research."

By the end of July, 1968, Dr. Edmonds was firmly in the chair as Officer in Charge of the School of Underwater Medicine, and had lost no time in making contact with various scientific and medical organisations. Examples of these liaisons are quoted in his first report.

An agreement was made with the Underwater Research Group to supply the School with any specimens they may obtain at no cost to the R.A.N., and a small series of demonstration slides was added to the colour slides of dangerous marine animals previously obtained. The Underwater Research Group allowed the reproduction of their coloured S.C.U.B.A. demonstration slides for the collection.

An investigation into the likely causes of "Shallow Water Syncope" was made possible by the combined assistance of Mr. Paul Scully Power of R.A.N.E.L., Dr. J. Colebatch, Senior Lecturer, University of New South Wales, Mr. B. Van Dijk, Senior Statistician of the R.A.N., and Mr. Daniel Quick, of S.U.M..

A number of research projects were completed, and four of these which had previously been submitted to the MDG were revised and resubmitted in a more presentable form, together with Projects 2/68, the Hypercapnic Syndrome by Carl Edmonds, Re-appraisals of a Diving Disaster, 4/68, by Carl Edmonds, and Modular Recompression Chambers, 4/67, by Carl Edmonds and W. Rogers. These were revised because of the vital importance of the subjects, and in an attempt to make their recommendations clear to both the diving fraternity and its medical officers.

Three civilian divers presented for recompression chamber treatment and were all treated in different fashion.

Mr. Oliver Knight, with a severe spinal bend, was treated on Workman's Oxygen Decompression Tables, and subsequently made an almost complete recovery.

Mr. Robert Ayre, an abalone diver, developed classical bends; arthralgia, skin changes of 2 days duration, etc.. He was given a trial on oxygen therapy without recompression and this was impressive in its rapid effect.

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Mr. Wayne Evans, of Disaster Bay / Submarine fame - presented for treatment of decompression sickness. He was not treated for this, but responded well in St. Vincent's Hospital to routine management for sea food toxin ingestion.

The move of the School of Underwater Medicine and Diving School from H.M.A.S. RUSHCUTTER was imminent, and the threat of having to move the laboratory and library of the School of Underwater Medicine to an unknown site was causing some concern. Otherwise the School of Underwater Medicine was functioning well, and continued to expand its research functions, though probably having reached the limit imposed by staffing, and had few internal problems.

Through the assistance of the Medical Director-General, liaison with the Royal Naval Physiological Laboratory, Royal Canadian Defence Research Laboratory, and the Experimental Diving Unit of the United States Navy, was consolidated with the exchange of research projects. Contact was also made with Mr. Van Dijk, Senior Statistician for the R.A.N., who was of assistance in formulating results of Project 8/68.

By use of the standard School of Underwater Medicine "be friendly" method, (to repeat, drinks and lunch in the Wardroom) liaison was made in the New South Wales State Department of Health with Mr. John Allen, who loaned the school a Bicycle Ergometer and a Max Plank Repirometer on a long term basis. This equipment was to prove invaluable in the studies of carbon dioxide absorbents and their efficiency, as well as the evaluation of diving equipment.

At the end of September, projects which were under way were:

- Shallow water blackout
- Protosorb activity of the standby diver
- Field trials of the Drager FGT I diving set
- Field trials of the Drager LAR III diving set
- An investigation of diving course failures
- Oxygen inhalation in decompression sickness susceptibility
- Airways resistance in divers
- Correlation analysis of diving incidents
- Physical fitness standards in divers.

With the Diving School, the School of Underwater Medicine transferred from H.M.A.S. RUSHCUTTER to H.M.A.S. PENGUIN at the end of July, 1968.

Due to extreme space limitations, the first attempt to set up a divers' sick bay within a borrowed caravan was quite unsuccessful. This was followed by acquisition of a small lay apart store whereby a patient, at least in summer time, could be examined in moderate comfort. It was extremely cold in the winter due to concrete floors, and unlined walls and ceiling. Lighting was supplied by two fluorescent units which were brought by the School of Underwater Medicine from its old home in H.M.A.S. RUSHCUTTER. There was no water or drainage laid on to the area, but fortunately, telephonic communication was available in a store next door.

The School offices, library and laboratory were installed in part of an old ramshackle wooden building on the Medical Hospital Road; that is, 200-300 yards away from the diving working area. The floors were bare, with gaping cracks. The walls and fibre roof were uninsulated and out of alignment.

Having had some expectation of a total lack of facilities being available in PENGUIN for a unit of this size, heaters, laboratory benches and even the laboratory sink had been removed from the old laboratory building in RUSHCUTTER and brought to PENGUIN.

By dint of much labour by the School and the ship's staff, these items were fitted in the area, and after a couple of months' delay, a cold water supply was fitted to the tap. The area was rewired, as the existing electrical wiring was considered a fire hazard.

The research programme took a rapid, but transient, decline. Fortunately, most of the work had been completed at RUSHCUTTER, before the move.

It was discovered that floor coverings were being renewed in H.M.A.S. ALBATROSS and an urgent telephone call managed to preserve the material which was being replaced. This cortisine lino was eventually despatched to H.M.A.S. PENGUIN where, by use of a patch work quilt technique, the floor was covered, thus excluding the majority of the draughts coming through the floors, and ensuring privacy from the insect world.

Some carpet scraps were obtained to put against cracks in the walls, a door was nailed shut to enable a desk to be fitted within a passageway, a window was removed to enable the laboratory air conditioner to be fitted, and although the conditioner cannot cope with the load intended of it, due to the lack of insulation within the building, and cracks and distortions in the windowframes, the School has grown used to the situation.

PO Manley and SBA Moffitt completed their courses in Underwater Medicine and SBA Moffitt took over the duties of running the Divers' Sick Bay. PO Manley was still fully employed in diver training and research work.

Three members of the Royal Malaysian Navy commenced courses in Underwater Medicine, Captain A. Thambirajah, LSBA Ng, and SBA Ahmed Bin Ali, together with SBA R.J. McGinley of the Royal Australian Navy. Captain Thambirajah's course was of three months duration, and the others were to complete a six months course.

Project 8/68, Shallow Water Blackout, was completed and forwarded to those authorities concerned.

By the end of the year, continued concern about continuity in staffing was very evident. In the Divers' Sick Bay, LSBA Black, who transferred with the School from RUSHCUTTER, was exchanged with LSBA Davies, and he by LSBA Marsh. LSBA Marsh was replaced by LSBA Black, who was succeeded by SBA Moffitt. SBA Moffitt was posted to H.M.A.S. STALWART; his place was taken by LSBA Wilson. This last arrangement was unsatisfactory, and LSBA Wilson, in turn, was replaced by SBA McGinley, who had almost completed his Underwater Medicine course.

Detached duties with diving teams were required, and these were carried out by CPOSBA UM Manley, LSBA Wilson and SBA UM McGinley.

Captain Thambirajah of the Royal Malaysian Defence Forces completed his comprehensive Medical Officers' Course in Underwater Medicine, LSBA Ng and SBA Ahmed Bin Ali continued on their training in conjunction with SBA McGinley.

It was noted that the number of trainees in Underwater Medicine had increased remarkably, and that most of this training was under the control of CPOSBA UM J. Manley, without whom such a programme would have been impossible, due to the research commitments of the Officer in Charge of the School.

In his annual report, speaking of the research projects orientation for the School, Dr. Edmonds reported, "The plans for this year have been exceeded:

"The research commitment has increased to such a degree it now occupies most of the working time of the Officer in Charge, and of the laboratory technician. The clinical load has diminished since the move to PENGUIN.

"Wardmaster Lieutenant Gray controls administration and CPOSBA UM J. Manley conducts most of the training and assists in some projects."

A tentative move into a new field for the School, that of marine biology, was made on 4th December at the Australian Museum. Surgeon Lieutenant Commander Edmonds and Mr. Quick represented the School of Underwater Medicine, and Miss Elizabeth Pope and Dr. John Paxton

the Museum. Miss Pope is a world authority on marine biology, and Dr. John Paxton is the ichthyologist for the Museum.

The purpose of the meeting was to obtain information on methods of preserving marine specimens and advice and practical assistance, and this was assured by the Museum Curators.

Miss Pope suggested that the R.A.N. School of Underwater Medicine be used as the authority area for information on dangerous marine animals, and the medical treatment that the victims would require. She recommended that information be obtained from Dr. Langsford from the Public Health Office in Darwin, Dr. Barnes in Cairns, and Dr. Eudean in Brisbane.

Miss Pope assured us of her continual assistance and advice, and it was clear that she has a fund of knowledge regarding the first aid treatment of many of these illnesses.

During the year, seven civilians presented for emergency treatment in the recompression chamber. They consisted of two cases of carbon monoxide poisoning, two cases of decompression sickness, one of gastroenteritis, one of osteomyelitis, and one case of gas gangrene. With the exception of the case of gastroenteritis, all cases were treated with, and responded to, oxygen therapy. There were also eight serious diving incidents treated at the School.

1963 was the first year of the R.A.N. School of Underwater Medicine. Then it was only a name and an idea. 1964-67 represented the development of the School up to the point where research was able to be supported by a laboratory facility. 1968 saw the School uprooted from its base and transported to PENGUIN, where it now tries to function as a research unit in a Naval establishment, without stability of staff or conditions so characteristic of other research units.

Thus ended 1968, the most productive year of the R.A.N. School of Underwater Medicine - a very busy and very anxious period in its development. Doubtless the future will continue to provide the opportunity to be both as anxious and busy in its progression towards - what?

APPENDIX A.LIST OF RESEARCH PROJECTS COMPLETED BY THE S.U.M.  
UP TO THE END OF 1968.

<u>PROJECT NO.</u>	<u>TITLE</u>	<u>CONTRIBUTORS</u>
1/67	Diving Fatalities	Bayliss G.
2/67	A Report on the Computer Analysis of the Aural Barotrauma Survey	Bayliss G.
3/67	E.R.S.L.A.	Edmonds C.
4/67	Modular Therapeutic Recompression Chambers	Edmonds C. and Rogers W.
1/68	Safety Time Factor in the Use of the C.D.U.B.A.	Edmonds C. and Quick D.
2/68	Hypercapnoeic Syndrome	Edmonds C.
3/68	A Critical Analysis of One Aspect of the Companion Diving Drill	Edmonds C., Quick D. and Gray K.L.G.
4/68	Reappraisals of a Diving Disaster	Edmonds C.
5/68	Protosorb and the Standby Diver	Manley J.
6/68	Evaluation of C.D. Equipment (F.G.T. 1)	Edmonds C., Quick D., Gray K.L.G. and Manley J.
7/68	Evaluation of C.D. Equipment (LAR III)	Edmonds C., Quick D., Gray K.L.G. and Manley J.
8/68	Shallow Water Blackout	Edmonds C.
9/68	Mechanical Performance of C.D. Equipment (F.G.T. 1 and LAR III)	Colebatch J.
10/68	Oxygen Consumption in Divers	Edmonds C. and Manley J.

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R. Gray - Surgeon Commander, R.A.N.  
HMAS PENGUIN

G. Bayliss - Surgeon Lieutenant Commander, R.A.N.  
HMAS SYDNEY

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