

*The Contribution by the Royal Australian Navy to the Development of Underwater Medicine in Australia**

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IN 1939, COUSTEAU AND GAGNON DEVELOPED THE FIRST WIDELY ACCEPTED self-contained underwater breathing apparatus. By the end of World War II, sufficient developments in carbon dioxide absorbents had led to the viable use of closed circuit breathing systems allowing divers to work underwater without links to the surface. The Royal Australian Navy (RAN) formed a clearance diving branch in 1951 following the lead of Britain's Royal Navy. However, with the adoption of British equipment and procedures the RAN found that it had also inherited many of the problems already experienced in the United Kingdom.¹

At that time, such underwater medical experience as existed in Australia was very limited. The Navy considered other areas to be of higher priority although it had considerable concern about the high failure rates of diver candidates in their initial training. At various stages, the failure rate was as high as 65 per cent and rarely less than 30 per cent. Furthermore, at least one diver every fortnight lost consciousness while diving. There was virtually no understanding of the causes of this unconsciousness, although the term 'shallow water blackout' was generally applied when an incident of this nature occurred.²

The early 1960s saw the Navy plan the reintroduction of a submarine squadron. This in turn required some in-house proficiency in underwater medicine in the selection, training and treatment of submariners and the support and rescue of disabled submariners.

Rear Admiral Lionel Lockwood, the then Medical Director General of the RAN, convinced Lieutenant Commander Rex Gray, a Reserve specialist anaesthetist, to transfer to full-time service in the capacity of consultant in underwater medicine. On the first day of Gray's post-

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ing to HMAS *Rushcutter* in February 1961, a compressed air diver undergoing free ascent training suffered an air embolism. Gray entered the chamber with the diver but was unable to resuscitate him.

A further incident had a more fortunate outcome despite being potentially far more dangerous. In June 1961, Gray accompanied a clearance diving team to Lake Eucumbene in the Snowy Mountains. The job they had been assigned to do required removing a considerable number of steel beams (weighing up to 5 tons) that were obstructing the intake tunnel at the base of the dam wall. No commercial diving firm was prepared to take up the job due to its degree of difficulty. At that time, Navy clearance divers had rarely dived deeper than 100 feet; this operation was to be conducted at 265 feet and also at altitude, although the significance of the latter was not realised at the time. The difficulties were considerable, and included decompression stops of 1 _ hours for a fifteen-minute task, hypothermia, breathing resistance and severe nitrogen narcosis. At one stage, the Navy considered calling off the operation but in the end the team completed the task.³

After such a demanding job, Gray realised that he needed to gain more underwater medical experience. He did this firstly by completing a clearance diving course and then by undertaking specific training in the United Kingdom and the United States. In January 1963, Gray returned to HMAS *Rushcutter* where he formed the School of Underwater Medicine (SUM). It was clear to him that the school should be a research and resource centre for both the civilian and defence communities. As such it would be required to address the high failure rate in diver candidates and, ultimately, to conduct preliminary submariner selection. Additionally, it would have to expand its base of expertise by training other Navy personnel in underwater medicine.⁴

In 1965, seven servicemen and fourteen civilians were treated in the school's recompression chamber, a proportion of service-to-civilian patients that was to become the norm in subsequent years. The experience derived from the treatment of civilian patients was greatly appreciated both by the school and the civilian casualties.⁵ However, the problem of improved diver trainee selection still remained with the failure rate on course averaging 45 per cent.

Before this task could be addressed another incident occurred involving two clearance divers who failed to surface during a night dive in Jervis Bay. A number of suggestions fuelled speculation as to their fate, but it was not until their bodies were found two weeks later that a Naval Board of Inquiry declared the cause of death to be oxygen syncope.⁶ At that time, RAN divers on oxygen rebreathing sets lost consciousness at the rate of about one per week, with the diver being resuscitated quickly and the incident going unreported. It was thought that the two divers in Jervis Bay had suffered the same condition or

had descended below the ten-metre safe limit. Experiments using divers as guinea pigs quickly disclosed that such blackouts were not a function of gas affecting the body under pressure but of a flaw in the carbon dioxide absorbent system of the equipment being used.

This incident highlighted a number of characteristics of the SUM that helped make it into the pre-eminent organisation it was soon to become. Firstly, all the clinical staff at SUM were trained in the use of compressed air and oxygen breathing equipment. Secondly, the staff conducted experiments on naval divers and on themselves to determine the limits of equipment. This aspect, not practised today because of ethical and occupational health reasons, allowed the SUM to progress in an area that the Royal Navy had not then been able to master—any understanding of the mysterious oxygen syncope.⁷

In 1968, the school moved to HMAS *Penguin* on Sydney's Middle Harbour and entered a new phase of its existence. The new accommodation allowed for a considerable increase in the school's research capacity. It was during the early years at *Penguin* that the school created its reputation, both locally and internationally, not only in the area of illnesses such as decompression sickness but also in the treatment of injuries caused by dangerous marine animals.

From 1968 onwards, regional navies began sending their medical officers to SUM for training. However, by 1970 there was still no significant body of underwater medical expertise outside the RAN, so most civilian diving incidents were treated either directly by the school or remotely by the provision of telephone advice to places as far away as the South West Pacific. SUM's services were constantly in demand as the Navy was then undertaking a significant amount of diving, including a clearance diving team permanently based in Vietnam. This in turn led to a wealth of experience in the treatment of diving injuries that was unparalleled by any of Australia's allies with the exception of the USN facilities at Hawaii.⁸

In 1971, Prince Henry's Hospital in Sydney opened a hyperbaric oxygen unit, but as its chamber was not capable of significant depth the SUM retained responsibility for the treatment of diving accidents. At the same time civilian organisations specialising in underwater medicine began to appear, with the South Pacific Underwater Medical Society also formed in 1971. It was followed by the Diving Medical Centre in Sydney and the Underwater Research Group. These organisations were largely formed by former and serving Navy underwater medicine specialists.

The SUM's research programs concentrated on the problems with the oxygen breathing apparatus then in use. However, budgetary constraints and a lack of support from Navy Office reduced the school's research program to such an extent that the Navy decided to close its

treatment facilities to civilians altogether, with Prince Henry's Hospital having to take up the load.

During this time the civilian diving world had expanded enormously, with an increasing number of recreational divers visiting the Great Barrier Reef and other popular diving areas. To cope with the resultant increase in diving injuries former Navy medical officers founded the Diving Medical Centre in Brisbane in 1974, while two other centres were created in Melbourne and Adelaide by Navy reservists.

In 1982, the Navy's declining contribution to the broad area of underwater medicine was halted with the appointment of two medical officers from Britain's Royal Navy. Commander John Heydon, an experienced underwater medicine specialist, was followed by Lieutenant Commander Tim Anderson who had worked with a commercial diving operation in the North Sea and had also been trained in submarine escape techniques. Patient intakes were increased and firm links re-established with the civilian underwater medical community.⁹ In 1984, the Navy's two ten-man recompression chambers, which had been planned for in 1969, came on line at HMAS *Stirling* south of Perth and at HMAS *Penguin* the following year. They were the first chambers to have a mixed gas facility and their introduction gave some impetus to the Navy's research program.

Changes were also happening in the civilian community with the creation of the National Safety Council of Australia's Victorian Division underwater training centre at Morwell in Gippsland. A mobile eight-man chamber was supplied to the Royal Adelaide Hospital in 1986, where it became the nucleus of its hyperbaric medical unit under the guidance of Dr Des Gorman who had been recruited from the Navy. A hyperbaric medical unit was established at Fremantle Hospital in 1989 headed by Dr Harry Oxer, a former Royal Air Force medical officer, together with Dr Bob Wong, a Navy reservist.

The other significant development of the 1980s was the creation of the Diver Emergency Service, which was initially set up to facilitate the location and treatment of diving accidents in the Sydney area. However, with the extension of hyperbaric facilities in Adelaide and Melbourne, the service expanded to become a national network linking all the units and able to provide advice and referrals to victims of diving accidents. Thus, although the Navy no longer has a dominant influence on diving medicine in Australia it has every reason to be proud of its contribution to the development of the Australian diving medical community.

Canberra

1. R. S. Blue, *United and Undaunted. A History of the Clearance Diving Branch of the RAN*, Naval Historical Society of Australia, Sydney, 1976, p. 12.
2. M. Edmonds, *The Development of the Royal Australian Navy's Subaquatic Medical Support Facilities*, Thesis, University College, UNSW, 1992, p. 10.
3. *ibid.*, p. 12.
4. *ibid.*, p. 13.
5. *ibid.*, p. 16.
6. *ibid.*, p. 18.
7. *ibid.*, p. 19.
8. *ibid.*, p. 21.
9. *ibid.*, p. 33.