South pacific underwater medicine society

Journal

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EDITORIAL

This issue has as its theme Hypothermia. At first sight this might seem to be of little more than theoretical interest to a South Pacific group of divers, though the cold waters of New Zealand were the reason for the Society not holding its AGM there this year. Hypothermia is becoming increasingly recognised as a significant and world wide factor in diving operations. Although all would expect this to be true of diving under the Polar icefields, and would grant that the North Sea in winter is a cold and unwelcoming body of water, few would expect to have a case report from the shallow waters in a Victorian marina. Yet that is where Dr Knight has found the case that so greatly adds point to the discussion of this matter. While prevention is important, so also is treatment. Until recently there has been a high risk of death after rescue of victims, due to the advised rewarming methods of hot baths. The theoretical idea1 method is to warm the vital body core and leave the cold stagnant shell of body fluids still cut off by vasoconstriction: Drs Hayward and Steinman have suggested a method that has in its favour low cost, portability, safety, logic and tested effectiveness. It is in use by Mountain Rescue Services and therefore is of special interest to New Zealand, mountaineers as well Poor Knighters. Many professional diving organisations, and some amateurs, could benefit from considering the apparatus as part of essential First Aid and Rescue equipment. It is of interest that the coldness of the water was considered to be significant in 5 of the diving related deaths in Australian waters, reaching an Inquest in the last 8 years (of 76 total). Lest the tough professional divers think themselves invincible, consider the experience of Barry Cannon. Because expense was spared, the whole Sealab III project was lost, as was his life. There was here the additional lesson that there must always be someone in overall Charge of safety on any dive: this is the theme of a paper by HJ O'Neill in a later issue. The CSIRO is commended for bringing Dr Hayward to visit Australia, where he is at present.

It is with pleasure that I can announce that many admirable papers are now ready for later issues, but with regret acknowledge the necessity to hold back from this edition a further extract from "Diving and Subaquatic Medicine" and the promised papers from the Melbourne meeting. There are also some interesting case reports and new members to introduce.

The next major event of the Society is the AGM at Mana Island. Those who have ever visited Fiji will wish to attend from memories of the Fijians and the diving. Those to whom this will be a first visit have a pleasure of first savour. Add to this the Conference itself and attendance becomes a welcome sacrifice to Further Education in Diving Medicine: add to this the New Zealand meeting and you will see how great has been the progress of interest in this aspect of medicine in recent years.

Members are reminded that their suggestions, annotations, case or incident reports and general involvement are not only welcome, but indeed the lifeblood of SPUMS and are urged to use the newsletter for such purposes.

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R E M E M B E R: SPUMS - AGM - MANA ISLAND, FIJI
Full particulars on page 18

SUBSCRIPTIONS

Members pay $15 yearly. Associate membership for those neither medically qualified nor engaged in hyperbaric nor underwater related research is available for $10. The journal is sent up to four issues yearly to both full and associate members. Those resident outside the immediate Australasian area should write for the special terms available.

Treasurer: Mr Phillip Rubenstein, 4 Highfield Crescent, Kew, Victoria 3101.

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Notes to Correspondents and Authors

Please type all correspondence and be certain to give your name and address even though they may not be for publication. Authors are requested to be considerate of the limited facilities for the redrawing of tables, graphs or illustrations and should provide same in a presentation suitable for photo-reproduction direct. Books, journals, notices of Symposia, etc will be given consideration for notice in this journal.

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All opinions expressed are given in good faith and in all cases represent the views of the writer and are not necessarily representative of the policy of SPUMS.

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NOTICE OF MEETING

An Underwater Medicine Seminar, sponsored by the New Zealand Federation of Sports Medicine in conjunction with OCEANS 76 and the Reefcombers Club, will be held at the Intercontinental Hotel in Auckland, May 21-22. Guest speakers will be Dr Andrew Pilmanis (Los Angeles), Dr Ian Unsworth (Sydney) and Surgeon-Lieutenant Bart McKenzie (SUM, HMAS Penguin).

The provisional program is as follows:-

Saturday May 21	Keynote opening to OCEANS 76	
	The Future of Underwater	Dr Pilmanis
	Science Balance disturbance in divers	Dr McKenzie
	Inhalation accidents	
	Pulmonary Barotrauma	
	In vivo ultrasonic bubble detection and its application to diving	Dr Pilmanis
	Coagulation defects in DS	Dr J Clelan
	Lung function in those with bends	Dr P McN Hill
	Recent changes in treatment procedure	Dr Pilmanis
	PANEL DISCUSSION on treatment.	
Sunday May 22	Keynote opening to OCEANS 76	
	Work Performance in open oceans diving	
	Medical Standards for diving	Dr A G Slark
	Breath-hold diving	Dr P McN Hill
	Dysbaric Osteonecrosis	Dr I Unsworth
	NZUA Instructor refresher course (to be arranged)	

For further information and to receive registration papers, write to:

Underwater Medicine Seminar
PO Box 26179
Auckland 3
NEW ZEALAND

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AIR FOR SOLO DIVER

The intrepid divers who went seeking the Loch Ness Monster tried to be prepared against every eventuality, even the rather unlikely one of actually finding their quarry. Although the search was cluttered with sophisticated electronic equipment, there were still some nice human touches. Divers involved were issued with tiny harmonicas that would fit into their breathing tubes (sic), so that if the monster suddenly appeared and was unfriendly they could soothe it with an instant imitation of Larry Adler.

(The Australian, 16 November 1970)

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MAN IN THE DEEP
Surgeon Commodore John Rawlins, OBE, MA, RN
(Oceans 2000 1973)

It was a great honour to be invited to Chair a panel of such distinguished and internationally recognised diving physiologists and I accepted without hesitation. The task of Chairman is not an onerous one; it has been likened to that of a procurer, namely to introduce the parties, see to the arrangements and then take no further part in the action. But when I received a programme just recently I saw to my alarm that I was also billed to introduce this session on Man in the Deep with a talk on "The Survival of Man in the Extremes".

Survival conjures up a picture of a man marooned on a desert island, or adrift in a small boat, or lost in the Arctic waste; it is the business of staying alive after the equipment or the organization has failed. But, in deep diving, when there is a failure of either the man, his equipment, or organization, his survival is limited to a matter of minutes at the outside and hardly forms a subject for a 15 minutes presentation. Indeed, the whole business of diving, whether shallow or deep, is of avoiding the survival situation.

As for embracing the presentations of the other speakers: how do you bring together Swallowable Radio Transmitters (a somewhat uneuphonious term) and How to Dive to 2,000 feet and Return Within the Hour? It is impossible. So, in the face of these imponderables I propose to look at some of the stress-producing problems of deep diving; to consider their interactions and their physiological implications, and then to give some thought to the way ahead.

Owing to the success of the Unites States Navy in planning working dives to 1,000 feet, I think we are all confident that in the future we should be able to dive within the whole region of the Continental Shelf; but the problems of deep diving are basically those of the first 50 or 100 feet of pressure, respiratory gases, temperature, visibility, psychological stress.

First of all, let us look at the effects of pressure. We know from observation from deep submersibles that quite complex creatures exist in the very depths of the ocean and this would indicate that pressure does not have too much effect on biological cells, and I doubt very much that the effect on mammalian and human cells differs greatly from that of other biological species. But pressure is important when considering creatures with gas-containing cavities, such as man, diving mammals, and indeed fish with swim bladders, because then you get volume changes and the appearance of pressure differentials and physical changes in gases themselves, which brings me to the subject of respiratory gases.

As you all know, pressure affects the behaviour of the respiratory gases as far as the physiology is concerned, so that oxygen becomes toxic as we get deeper, and nitrogen narcosis may be detected at depths as shallow as 50 feet, and by about 300 feet most of us are rendered incompetent either physically and/or mentally. Carbon dioxide under pressure does not in itself affect us physiologically, but since the significant partial pressure of carbon dioxide remains the same, when one is diving at great depths and using large volumes of gas, the significant proportion of carbon dioxide is very small and therefore extremely difficult to eliminate, which we have

often found to our cost. I might add that pressure increases the density of a gas so that at 60 feet a helium/oxygen mixture is four times as dense as air at the surface, and this doubles the airway resistance which, in turn, increases the effort of breathing, increases oxygen consumption and depletes our oxygen reserves.

Visibility at 1,000 feet is usually zero, but then we can get zero visibility in shallow water where there is much suspended matter - for example, in a harbour like Portsmouth, or a flooded coal mine - and visibility contributes very largely to psychological stress. However, the human physiology is a flexible one and is capable of adaptation and acclimatisation, and is responsive to training. For example, one can work very efficiently in conditions of zero visibility, probably the most classic case being that of the diver walker who, over a period of five years, worked in nil visibility beneath the foundations of Winchester Cathedral and to whom that edifice probably owes more than to anyone else.

Temperature at 1,000 feet is pretty constant at between two and four degrees Centigrade, say 35/40 degrees Fahrenheit. The reason I want to talk about temperature is, partly because it is my personal interest, partly because it illustrates very well the interaction between different problems of depth, and partly as an example of the hazards that are superimposed on man at depth because of his diving system - it does not have an effect as such on diving mammals.

As a response to cold, shivering is significant to my talk because it has metabolic cost; it is the primary method of thermogenesis in a human and it costs oxygen, increases carbon dioxide output and increases ventilation. It is significant in the case of the Ama who dives naked throughout the summer to depth of between 60 and 80 feet. She demonstrates remarkable physiological adaptation to cold: she can tolerate a lower skin temperature than you or I without shivering. She can also tolerate a lower deep body temperature: this is very important because if she were to shiver she would lose her vital oxygen supply and so shorten her breath-hold dive. Indeed, in the winter she pays some lip-service to insulation by wearing an all-enveloping cotton garment which, by trapping a layer of water somewhere near the skin, may have some effect, but is not an efficient method of insulation .

However, insulation at its best won’t get us very far . In an attempt to find out whether by insulation alone one can prevent heat loss, a man wore a total of one inch thickness of foam neoprene, and was unable to maintain his deep body temperature in 40°F water. One has to do something more; one has to add heat to replace that which has been lost: either by an electrically heated undersuit, by a closed-circuit warm water circulating suit similar to the cold water cooling suit used by astronauts, or by using the free-flooding warm water suit now largely used by commercial divers, and available off-the-shelf.

However, as you all know, deep diving requires a helium/oxygen atmosphere, and helium has six times the thermal conductivity and six times the heat capacity of air. Thermal conductivity is not affected by pressure, but density is, and hence heat transfer. Now I have already said that at 600 feet the density of a helium/oxygen mixture is four times that of air at the surface; at 1,000 feet or 40°F, the increase in density and the thermal properties of the gases raises the convective conductance from the skin - that is, the way in which the surface loses heat to a gas - to about 20 times that of air at the surface. These facts not only dictate the atmosphere in a submerged

habitat, PTC, lockout chamber or submersible, must approximate that of the preferred mean skin temperature of 93°F, it also means that although the diver in water may be wearing an efficient heated suit, he will still lose heat steadily unless his gas supply is also heated. During experiments in the USA one of our subjects breathing 43°F oxy/helium at 860 feet lost 3°F deep body temperature in two hours, and that is very serious. Another subject produced such a copious flow of secretion from his upper respiratory tract that he had to spit out his mouthpiece, and in an actual dive this would of course have proved fatal.

For man to operate at great depth it is essential to heat both the skin and the gas supply, but this necessary equipment adds to the diver's load. How deep is a man going to be able to work effectively as his equipment becomes increasingly complex? Man functions best in an optimum environment, which is why we have centrally heated, pressurised aircraft and, some of us, air-conditioned cars. I believe that in order to exploit the depths, man will need to take his environment with him in the form of sophisticated submersibles with great manoeuverability, navigational efficiency, manipulative skill and strength.

I give you this thought: Man achieves his greatest domination over Nature when he uses his ingenuity to design and build machines. Man has long shown that he has the strength to move mountains - although not always the faith. Bulldozers have proved a great substitute for sweat the of man's brow, and they are a good deal easier to come by than Faith ......

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Brief Profile

Surgeon-Commodore John Rawlins is Director of Health and Research (Naval). In 1955 he was awarded the MBE for his work on protective helmets while with the RAF Institute of Aviation Medicine and in the same year began work on the problem of escape from sinking aircraft.

In 1961 he was awarded the OBE for this work which culminated in the introduction into Royal Navy aircraft of an automatic underwater escape system.

Two years ago he was awarded the Gilbert Blane Medal of the Royal College of Surgeons for his work on the problem of cold in diving.

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DON'T FORGET ! 5 - 13th June 1976
SPUMS - AGM MANA ISLAND - FIJI

TREATMENT OF ACCIDENTAL HYPOTHERMIA
(An Experimental Study of Inhalation Rewarming)

John S Hayward and Alan M Steinman*

INTRODUCTION

Accidental hypothermia in man is a common, but serious problem in cold air and water environments. The rapid rate of cooling which occurs in cold water immersion[12] and in mountain accidents[10, 23] can readily progress to a medical emergency. Hence immediate recognition and therapy of this condition are necessary to overcome its high mortality[6, 22].

Many current articles[9, 10, 16], medical texts[2] and military survival publications[8, 32] recommend rapid peripheral rewarming as the treatment of first choice for hypothermia. Indeed, this has been shown to be effective even in the profoundly hypothermic victim[1]. Many modalities are used to accomplish this, including immersion in hot water baths, wrapping in electric blankets, application of heated objects to the skin surface[3], and recently, circulation of warm water through special garments fitted to the victim[33]. These methods are all effective in treatment of rapid-onset hypothermia, but certain physiological problems may arise with active, peripheral rewarming of the slow onset, unconscious, profoundly-hypothermic victim. The well-described “afterdrop” of the core body temperature following removal of the cold stress can be increased in magnitude by peripheral rewarming. This occurs through vasodilation in the cold periphery and subsequent return of cooled blood to the body core, further chilling the myocardium[33] and potentiating the possibility of ventricular fibrillation[1, 17,33]. Furthermore, in hypothermia of long duration, in which intravascular volume is decreased secondary to fluid shifts, rapid rewarming may precipitate hypovolemic shock as peripheral vasodilation further diminishes central blood volume[17, 33].

To obviate these problems, some authorities[17,31] recommend rapid rewarming for rapid-onset hypothermia, and slow rewarming for slow-onset hypothermia. The difficulty in many accident situations of ascertaining the degree of hypothermia and its duration, complicates the decision of which type of therapy to apply, at a time when delay decreases the chance of successful resuscitation.

Theoretically, core rewarming of the hypothermic victim avoids the physiological hazards mentioned above, through delivery of heat directly to the central circulation and tissues, leaving the limbs and peripheral tissues to warm air alone[28] and in combination with heated, intravenous fluids[27]. Although all of these techniques have proven successful in many instances, they are clearly limited to the hospital environment.

Recently, Lloyd[20] has described a means of core rewarming through the airway using warmed oxygen. He presents case histories showing its effectiveness in the hospital treatment of hypothermic patients, and in addition, describes a portable apparatus based on this principle[21]. Inhalation rewarming is also receiving the interest of

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mountain rescue organizations[26] and of physicians associated with mountaineering medicine[15, 29].

Therefore, inhalation of heated, water-saturated gas (such as oxygen) by the hypothermia victim may best combine the merits of core rewarming and first-aid applicability at the accident site.

The purpose of this experiment was to compare the effectiveness of inhalation rewarming (using heated, humidified oxygen) to peripheral rewarming in a hot whirlpool bath. In order that the results be most relevant in accidental situations, immersions were conducted in the sea using persons of average build, who wore standardized clothing and life-jackets. In addition, a rewarming apparatus was selected so as to be compatible with rescue aircraft and vessels, such as those of the US Coast Guard.

MATERIALS AND METHODS

Immersions were conducted in the sea near Victoria, British Columbia, from on board a research ship which provided laboratory space for recordings and rewarming procedures. Sea temperatures were between 7 and 8°C and a slight current and small waves prevailed for the 4 days of immersions.

Ten healthy, male subjects (all athletically active) volunteered for the study and satisfied rigid, medical selection criteria described elsewhere[12]. Their characteristics (means and ranges) were: age 29 (20-48); weight 83 kg (75-105); height 1.84m (177-191); and percent body fat 15.4 (9.3-25.7) based on standard measures of skinfold thickness.

Core temperature was measured as follows. A fine, padded thermocouple was placed gently against the tympanum, and the auditory meatus sealed with a was plug. Rectal temperature was monitored with a thermistor inserted 15cm beyond the anus. In one subject only, oesophageal temperature was obtained using a thermistor inserted nasally and positioned to lie at about the level of the cardiac atria.

Production of hypothermia. Each subject wore an outfit of typical seaman's clothing and a personal floatation device. With tympanic and rectal temperature being continuously monitored, 10 minutes of pre-immersion values were recorded. The subject then entered the cold sea water and remained motionless beside the ship while clinging to a life-ring. Constant visual surveillance of the subject was maintained. The immersion was terminated when the core temperature declined to 35°C or when the subject became too uncomfortable to continue. The range of immersion times was 45 to 120 minutes. The subject then climbed out of the water up a 3 meter ladder to the deck, removed his wet garments with assistance, and walked 20 meters to the rewarming site in the laboratory of the ship. The time interval from leaving the water to initiation of rewarming was 3 - 4 minutes.

Rewarming procedures. Each subject was cooled twice (on separate days) and rewarmed once by each of the two procedures. The older of use of the two rewarning procedures was randomized for the different subjects.

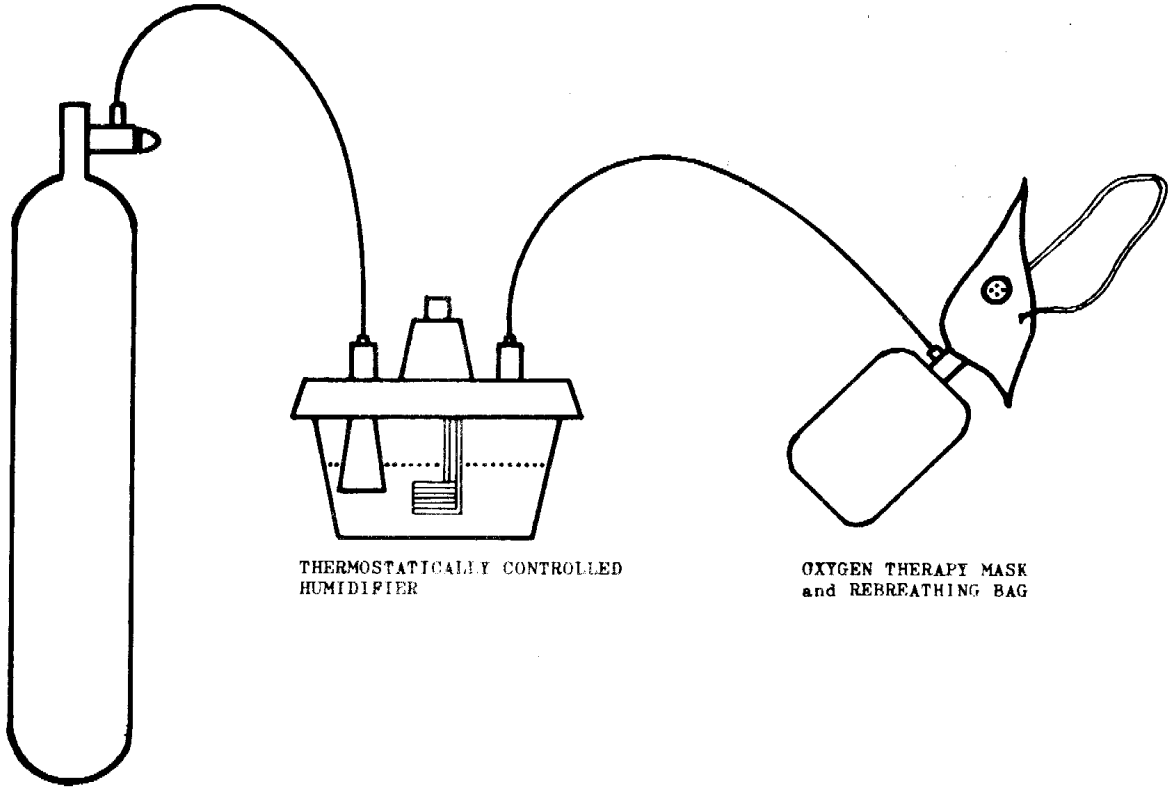


Figure 1 - Inhalation Rewarming Apparatus

Figure 1 shows the inhalation rewarming apparatus. Oxygen from the cylinder was passed at a variable rate through the heating and humidifying apparatus. It was a standard Bennett model heater and vaporizer commonly used on hospital respirators. It consisted of a 1-litre water bath with a thermostatically-controlled, electric, immersion-heater element. The oxygen was bubbled through the water and delivered to the subject via a loosely-fitted, ventilation mask. The mask was fitted with a rebreathing bag to act as a reservoir which helped conform the variable ventilation flow rate of the subject to the uniform flow of the oxygen. The water was heated to about 70°C such that the water-saturated oxygen flowed from the Bennett heater at about 55°C and arrived at the subject's mask at 40-45°C. This was the maximum temperature of inhaled oxygen that the subjects found to be comfortable. The flow rate of oxygen was regulated to maintain the 40-45°C temperature of the inhaled gas. This required high flow rates for the first 5-10 minutes, because the subjects had high ventilation rates associated with vigorous shivering thermogenesis. As shivering subsided, oxygen flow rates were reduced to 10-12 litres/min for the remainder of the rewarming. Inhalation rewarming was discontinued when the subjects had rewarmed about 1.5°C by tympanic recordings, involving a total period of about 45 minutes from initiation of the treatment. During the inhalation rewarming, the subjects lay prone on a foam mattress. Room temperature was 24-26°C. The subjects were exposed to the air until their skin temperatures in the trunk region reached air temperature, requiring 7-10 minutes. They were then covered with an unwarmed blanket for the remainder of the rewarming period.

R E M E M B E R : Diving safety is YOUR responsibility

Bath rewarming was accomplished using a 5 foot long, whirlpool bath. The subject reclined in the bath so that the water was at neck level. Initial water temperature was about 26°C and was then raised steadily to 42°C over the first 7-8 minutes. Vigorous stirring continued at this temperature for the remainder of the rewarming. The lower initial water temperature was required, due to the severe discomfort to conscious, hypothermic subjects if suddenly immersed at the higher temperature.

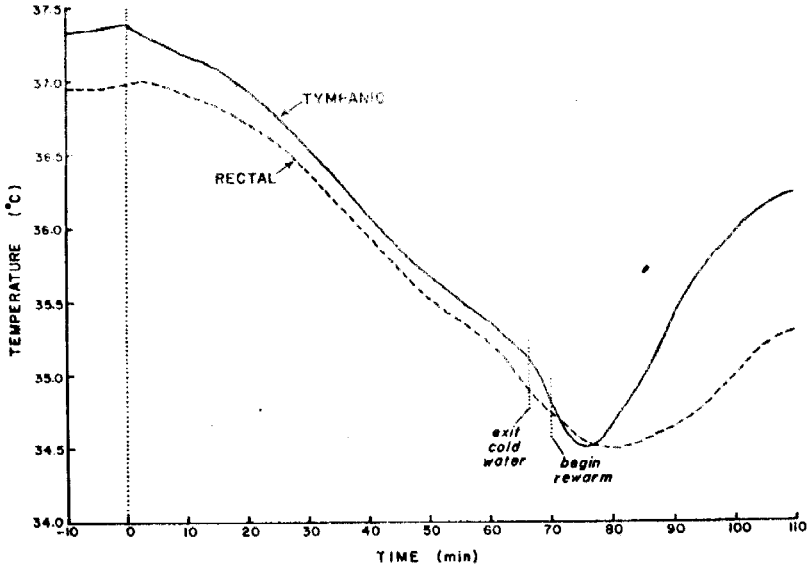


Figure 2 Typical recording of core body temperature during cooling in 7°C water and subsequent inhalation rewarming

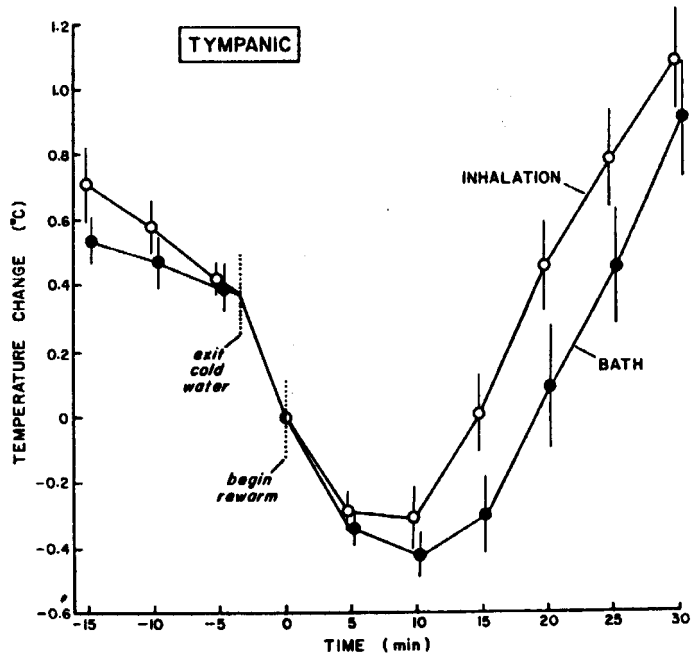
RESULTS

A typical recording of core temperature changes during cooling and inhalation rewarming of one individual is shown in figure 2. A fairly uniform cooling rate was established by approximately 20 minutes of immersion and the subject exited the cold water when the core temperatures were near 35°C. Temperatures continued to decline during the period before inhalation rewarming began, and this "afterdrop" continued for another 0.3°C ever the first 10 minutes of rewarming before being arrested. Temperature increase of the tympanic site proceeded at a faster rate than the rectal site.

For the ten subjects, comparison of the effectiveness of the inhalation and bath rewarming techniques is presented for the tympanic and rectal sites in Figures 3 and 4 respectively. Change in temperature before and after the onset of rewarming is shown. Tympanic temperature exhibited marked acceleration of cooling during the interval of physical activity that was associated with movement from the cold water to the rewarming laboratory. In this 3-4 minute period, tympanic temperature declined an average of 0.4°C. For the tympanic site, there was no significant difference in the amount of continued cooling with the two rewarming methods. Inhalation rewarming had a mean after-drop from commencement of rewarming of 0.38°C compared to 0.48°C for bath rewarming. The inhalation technique appeared to provide a slightly more rapid onset of increase in tympanic temperature. By 15 minutes of rewarming with each method, uniform rated of temperature increase were established, such that by 30 minutes of rewarming, a temperature rise of 1.3°C above the minimum was achieved.

Figure 3

Comparison of tympanic temperature changes occurring with inhalation and bath rewarming. Changes were calculated from the temperature at the beginning of rewarming (time 0). The mean tympanic temperature at time 0 was 34.5°C. The difference in cooling curves from 15 to 5 minutes before rewarming was due to clothing differences (being studied separately), and had no bearing on the afterdrop findings. Vertical lines denote standard errors of the means.



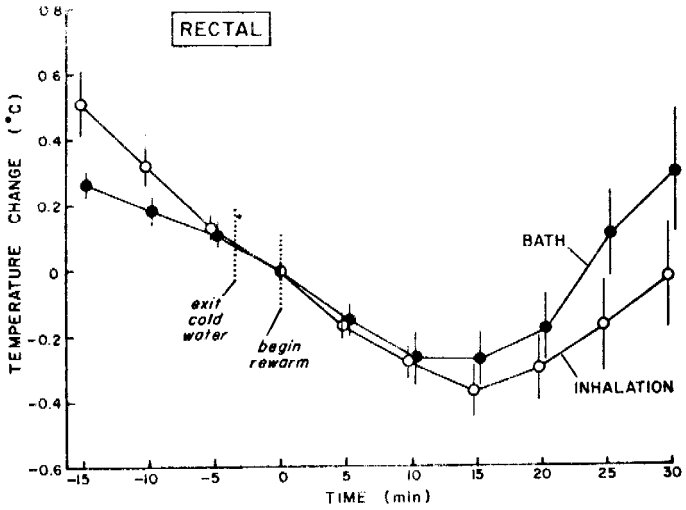


Figure 4

Comparison of rectal temperature changes occurring with inhalation and bath rewarming. The mean rectal temperature at time 0 was 35.3°C. Other conditions as in Figure 3.

Rectal temperature (Figure 4) showed less response to the physical activity during the transition from the cold water to the rewarming site (only a 0.1°C drop). Again, no significant difference occurred in the amount of after-drop between the two rewarming methods. With inhalation rewarming, there was a further mean after-drop of 0.40°C compared to 0.33°C with bath rewarming. At the rectal site, inhalation rewarming appeared to provide a slightly slower rate of temperature increase than bath rewarming. Approximately 20 minutes was required to establish a steady rate of temperature increase, such that at 30 minutes of rewarming, temperature rises above minimum of about 0.6°C and 0.4°C occurred for the bath and inhalation techniques respectively.

In comparing the rate of temperature increase of the tympanic and rectal sites during inhalation rewarming (Figures 3 and 4), rectal temperature increase was significantly lower than tympanic from 15 minutes of rewarming onwards.

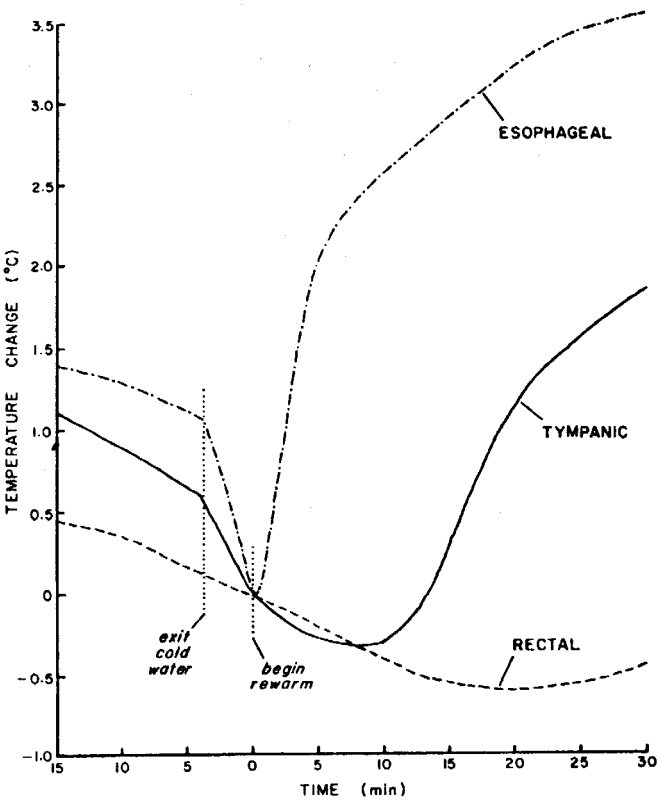


Figure 5

Changes in oesophageal temperature in comparison to tympanic and rectal temperatures in an individual being rewarmed by the inhalation method. The mean temperature of the three sites at time 0 was 34.1°C.

Figure 5 presents the temperature change curves for the one subject who has oesophageal temperature recording in addition to tympanic and rectal measurements. Oesophageal temperature showed essentially no after-drop once inhalation rewarming began. Furthermore, this site showed a rapid rate of increase in temperature, gaining 2.1°C in the first 5 min. Tympanic temperature showed a small after-drop of 0.3°C and onset of temperature increase in less than 10 minutes (similar to the pattern in Figure 3). Again, rectal temperature had a greater after-drop and slower onset of increase than tympanic when treated with the inhalation technique.

DISCUSSION

These experimental results confirm the theoretical expectation that inhalation rewarming can be an effective treatment for hypothermia in humans. The lack of difference in core temperature after-drop and rewarming rate between inhalation and bath rewarming allows the inhalation technique to be considered in “active” or “aggressive” therapy. Although cardiovascular variables were not measured, the lower rectal and skin temperatures, and the more persistent shivering with the inhalation method testify to less warming and consequently less vasodilation of the peripheral regions. Hence, the further advantage results that rewarming shock and induction of ventricular fibrillation by cold and aciduric venous return are minimized, despite rapid rewarming of the “critical core”. With the inhalation method, direct warming of the brain would occur by conduction from the nasopharynx, and by circulation

of warmed vertebral and carotid arterial blood. The more rapid rewarming of the brain would both reverse cold induced depression of the respiratory centres and more rapidly stimulate regaining of consciousness of the severely hypothermic victim.

With regard to the need to stop further cooling of the heart and begin its rewarming, the extremely rapid response of the oesophageal temperature to inhalation rewarming deserves emphasis. Previous studies have shown that a close parallel exists between oesophageal temperature and the temperature of the heart and great vessels[5]. The oesophageal recording would therefore indicate that inhalation rewarming facilitates rapid myocardial rewarming. Transfer of heat from warm, humidified gases to the airways is rapid[34]; and heat may then flow from the airways to other structures of the mediastinum. The heart would be warmed from the pericardium inward. Probably of greater significance, however, is the return to the heart of warmed blood from the lungs, leading to myocardial warming both. In cases of severe hypothermia, as you would not be moving the large pool of cold fluids in the peripheral regions, we assume that in a borderline survival case of hypothermia the inhalation rewarming would be superior to hot bath rewarming.

This was shown by CM Shanks and HM Marsh in their paper “Simple core rewarming in accidental hypothermia; a case treated with heat infusion, endotracheal intubation and humidification” (British Journal of Anaesthesiology: 45:1973:522-525). The subjects lay prone on a foam mattress, room temperature at 24-26°C, exposed to the air until their skin temperature in the trunk region reached air temperature, at which time they were covered by an unwarmed blanket.

ACKNOWLEDGEMENTS

To those who cooled with us, our *warm* appreciation. We would also like to thank Lieutenant Larry Fulkerson of the US Coast Guard for suggestions and encouragement to do this study.

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REFERENCES

1. Alexander L. *The treatment of shock from prolonged exposure to cold, especially in water.* Report No. 250. Washington DC: Combined Intelligence Objectives Sub Committee, Item 24, Office of the Publication Board, Department of Commerce, 1946.

2. Beeson PB, and W McDermott. *Textbook of Medicine.* Philadelphia: WB Saunders Co., 1971.

3. Burton AC and OG Edholm. *Man in a cold environment.* London: Edward Arnold (Publishers) Ltd., 1955.

4. Callaghan PB, J Lister, BC Paton, and H Swan. Effect of varying carbon dioxide tensions on the oxyhemoglobin dissociation curves under hypothermic conditions. *Ann.Surg.* 1961; 154: 903-910.

5. Cooper KE, and JR Kenyon. A comparison of temperatures measured in the rectum, esophagues, and on the surface of the aorta during hypothermia in man. *Brit. J. Surg.* 1957; 44: 615-619.

6. Coopwood TB and JH Kennedy. Accidental hypothermic. *Cryobiol.*. 1971; 7: 243-348.

7. Davies DM, EJ Millar, and IA Miller. Accidental hypothermia treated by extracorporeal blood warming. *Lancet.* 1967; 1: 1036-1037,

8. *Cold injury.* NAVMED P-5052-29. Department of the Navy Publication, 1970.

9. Fernandez, JP, RA O'Rourke, and GA Ewy. Rapid active external rewarming in accidental hypothermia. *J. Am. Med. Assoc.* 1970; 212: 153-156.

10. Freeman J, L Griffith, and EE Pugh. Hypothermia in mountain accidents. *Internat. Anesthesiol. Clin.* 1969; 7: 997-1007.

11. Hayward JS, M Collis, and JD Eckerson. Thermographic evaluation of relative heat loss areas of man during cold water immersion. *Aerospace Hod.* 1973; 44: 708-711.

12. Hayward JS, JD Eckerson, and ML Collis. Thermal balance and survival time prediction of man in cold water. *Can. J. Physiol. Phermacol.* 1975; 53: 21-32.

13. Hegnauer AH., WJ Shriber, and HO Haterius. Cardiovascular response of the dog to immersion hypothermia. *Am. J. Physiol.* 1950; 161: 455-465.

13. Hicks CE, MC McCord, and SG Blaunt. Electrocardiographic changes during hypothermia and circulatory occlusion. *Circ.* 1956; 13: 21-18.

15. Hornbein T, MD. Personal communication. Dept. of Anesth., Uni of Washington, Seattle, Wash., 1975

16. Jessen K, and JO Hagelsten. Search and rescue service in Denmark with special reference to accidental hypothermia. *Aerospace Med.* 1972; 43: 787-791.

17. Keatinge, WR. Survival in cold water. Oxford and Edinburgh, Great Britain: Blackwell Scientific Publications, 1969.

18. Lash RF, JA Burdette, and T Oxdil. Accidental profound hypothermia and barbituate intoxication. A report of rapid core rewarming by periotoneal dialysis. *J. Am. Med. Assoc.* 1967; 201: 269-270.

19. Linton AL, and I Ledingham. Severe hypothermia with barbituate intoxication. *Lancet.* 1966; 1: 24-26.

20. Lloyd E Li. Accidental hypothermia treated by central rewarming through the airway. *Brit. J. Anesth.* 1973; 45: 41-47.

21. Lloyd E Li, NA Cunliffe, H Orgel, and PN Walker. Accidental hypothermia: an apparatus for central rewarming as a first-aid measure. *Scottish Med.* 1972; 17: 83-91.

22. Parton JF. *Accidental hypothermia: a matter of turning the scoreboard around.* Vol. 10, No.23. The Medical Post (Canada); Maclean-Hunter Publishers, 1974.

23. Pugh LG. Accidental hypothermia in walkers, climbers, and campers: report to the Medical Commission on Accident Prevention. *Brit. Med. J.* 1966; 1: 123-129.

24. Rose JC, TF McDermott, LS Lilienfield, FA Porfido, and RT Kelly. Cardiovascular response in hypothermic anesthetized man. *Circ.* 1957; 15: 512-517.

25. Sabiston DC, EO Thei]en, and DE Gregg. The relationship of coronary blood flow and cardiac output and other parameters in hypothermia. *Surg.* 1955; 38: 498-505.

26. Schroder K. 1975. Unpublished communication. Everett, Washington 98203: Everett Mountain Rescue Unit, Inc.

27. Shanks, CA, and HM Marsh. Simple core rewarming in accidental hypothermia. A case treated with heated infusion, endotracheal intubation and humidification. *Brit. J. Anesth.* 1973; 45: 522-525.

28. Shanks CA, and CA Sava. Temperature monitoring of the humidifier during treatment of hypothermia. *Med. J. Australia.* 1972; 2: 1351-1352.

29. Trott, Otto, MD. Personal communication. 1881 Havard Ave., Seattle, Washington; 1975.

30. Truscott, DG, WB Firor, and LJ Clein. Accidental profound hypothermia: successful resuscitation by core rewarming and assisted circulation. *Arch. Surg.* 1973; 106: 216-218.

31. Undersea Medical Society Workshop. *Thermal problems in diving.* Report Number WS:12-1-74. Bethesda, Maryland 20014: Undersea Medical Society, Inc., 1974.

32. United States Coast Guard. *Hypothermia: recognition of and precautions for.* Commandant Instruction 3130.15B, 1975.

33. Webb, P. Rewarming after diving in cold water. *Aerospace Med.* 1973; 44: 1152-1157.

34. Wessel HO, GW James, and MH Paul. Effects of respiration and circulation on central blood temperature of the dog. *Am. J. Physiol.* 1966; 211: 1403-1412.

* * * * * * * *

FISH BITES MAN

The fish were really biting when Chuck Gosgreve took his boat out off the Louisiana coast. A 33lb king mackerel bit his arm and he needed nine stitches. But the fish landed in the boat for the day’s biggest catch.

(Sunday Telegraph, 11 April 1971)

NOTICE OF MEETING

SPUMS - AGM - MANA ISLAND, FIJI

JUNE 5-13, 1976

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ALTERNATE REWARMING TECHNIQUE!

.IDLE TALK: POT-POURRI

There must be many who, like myself, find amusement and education in the little filler items of press, radio and television. Such can on occasion prove to be at least as important to us unimportant persons as the reports of major catastrophies and cruelties that are so generously served with headlines for our entertainment every day. You doubt it? Perhaps you may be a little persuaded by considering a few of the items that teased my interest through their relating to the sea and diving in some degree. And what better way to start than the report from the CSIRO Oceanographers that the sea isn't level. They are not referring, naturally, to the irregularities that occasion mal de mer but to a difference all of 70 cms between the highest and lowest sea level, if such an expression is now permissible. There is apparently a north to south flow down the east coast of Australia from the Coral Sea to the Tasman and this contains ambidexterous currents, the clockwise rotating eddies having cool dense water in central "valleys" and the anti-clockwise eddies having "humps" of lower density warm water at their centres. There is also a 50 cm fall between the Coral and Tasman seas. So if you think the water is too cold (and you wish to avoid hypothermia?) seek the higher sea!

Naturally what interests the headline writers most is the chance to write "SHARK" in heavy type. After the pre swimming season traditional stories of schools of sharks cruising off Sudmeu hungry for the first, and presumably subsequent, swimmers it was somewhat of an anticlimax to find a small para reporting a 1.2m shark for sharing a beach pool with two swimmers. The report suggested that the shark was as eager to leave as were the swimmers, but they beat their own best times, and the shark, to make their exits. It is not known whether it escaped or was captured by council workmen. Perhaps it was put on contract by Forbes Carlile as a pacemaker for his swimmers. But few captive sharks are left alone for long, as the Manly Marineland ones know so well. Their contract must surely have some small print binding them to be kind to anyone who drops in for a record attempt. There have been a spate of articles on this waterhole, usually claiming some record. Still, it will make a change for the residents to have a young lady there for 24 hours or so demonstrating a variety of helmets to pass the time. It makes a change from playing cards or chess. It will be interesting, now that women have a legal right to absolute sex equality in all things (at least in the UK), to see whether underwater endurance records continue to be sex related. Last year the UK suffered a rash of record attempts, Brian Foulds coming up last with a time of 88 hours 2 minutes. It was a trifle unkind of Dr Joe MacInnis to choose to spoil it all by remembering that the Toronto held "Canadian Sportsman's Show" in 1961, included a competition in underwater scuba endurance. This ended by agreement, with the three finalists surfacing after notching up 126.5 hours. As they each won $1,500 one should not sneer too loudly at show business!

The longest piece of show business of the Year was the saga of Ben Cropp's off and on affair with a White Pointer. In the end the Burton-Elizabeth Taylor affair lasted the headline course better, but the competition was fierce. The many suggestions reaching print on the subject of this duel included one from Theo Brown that the diver would only stand a chance of survival if they took the shark's teeth out first: he didn't suggest any form of handicapping for Ben. But he was a bit sore at the time because nobody wanted to supply money for his experiments at scaring sharks by making noises in the water. The RSPCA seems to have remained silent. But sad to say our

Ben made himself ineligible by rupturing an eardrum in an emergency ascent. It must have been badly damaged if the lure of $US 1 million fee didn't stimulate the repair process. Sharks certainly have a strong "image" because box jellyfish are said to have killed more Australians than have sharks yet it is hard to visualise any circumstances in which even a miserable $US 0.5 million kitty would be presented for a man v Chironex fleckeri contest, even by an enterprising pantyhose manufacturer. In clear contrast, the newspaper stories of sharks caused the good Archbishop Stylianos to amend the blessing of Sydney Harbour by attaching a cord to the cross he threw into the water so that its recovery didn't require any members of the congregation to dive for it. Perhaps someone will now write a Thesis on what makes Man decide his attitude to other creatures.

There have been a number of slightly surrealistic reports that leave one with the regretful feeling that the truth would be less bizarre. How about the item that said that a scuba diver suffered oxygen poisoning from a dive to 30 meters, because of overbreathing. The victim's head was put in a plastic bag at the hospital as treatment. The mind positively boggles at the hotch potch of underwater medicine problems so very confidently served up by the reporter. Still, it could make a rather nice question for the Diploma: discuss the differential diagnosis! And elsewhere there was a doctor telling the press that some of the present Kiss of Life methods were fatal but not saying which. He did say that his Council would soon be considering discovering a safe method but he didn't approve of <u>amateurs</u> being allowed to attempt resuscitation. It really is a comfort to be so reassured.

This is America's Bicentennial Year and as part of the celebrations a poll was taken of 75,000 children concerning their choice of a "bicentennial animal". The traditional Bald Eagle lost by a small margin to the Horse, but among the write-in candidates on the ballot paper were fleas and sharks. I feel there must be a snappy retort to that if only one could think of it. One can explain the latter by reference to the recent film, but why the fleas? And what does one (charitably) conclude concerning the swimmers who buy, and presumably wear, plastic shark's fins on their backs and buy ice cream flavours renamed Finnala, Jawberry and Sharkalate! UGH!

Another American initiative relative to Sport Diving was the effort by the CIA to make friends with Castro and give him a Scuba outfit. They ran into trouble over suitably preparing the wet suit with fungus spores and the breathing apparatus with TB. They also had a theory that without his beard Castro would loose his charisma; their Bible reading being better than their laboratory technique, the theory was never put to a practical test. It is not on record whether Castro's interest in scuba diving persists. Perhaps they should have read up on the Borgias?

But for pure unadulterated B-Film scripting the latest story to come out of Miami Beach seems unbeatable. The chosen victim was the wealthy widow of a whisky millionaire. She was sent a parcel containing a dead fish and the suggestion that she and it would have a lot in common if she failed to follow instructions. These involved a parcel of money being taken on an involved route in response to phone calls, the final destination being a bridge. Here the courier was to attach the packet to a string and let it down into the water. It took so long to find the string that the police had time to arrive and discover a lawyer in a black wet suit, with snorkel and flippers and no good cover story, waiting in the water beneath the bridge. This

example of bad dive planning (he should have used a rebreathing set) will shock all serious divers.

By no means all the interesting sidelights of life are here reported, just sufficient so that you can no longer say “There is never anything in the paper nowadays”. See what idle talk you can collect and send it in.

* * * * * * * *

A FIRST DIVE ... BUT THE EDITOR REGRETS

Some readers will have been fortunate enough to read the Daily Telegraph in Sydney on 3rd February 1976, attracted no doubt by the banner headlines: Down under with a grey nurse”! Unfortunately the Editor has refused his permission to our reprinting this first hand account of a dive, even though it would have been without a single alteration. The article was by a UK journalist, Clive Bolton, a man apparently without diving experience for he stated that this was the first time he had ever used breathing apparatus underwater. The dive was in the 20 foot deep Manly Marineland tank in company with an instructor, a turtle and assorted sharks. He was warned that the turtle was the more likely to bite him or at least it would be the more troublesome of the inmates if any did bite. He ended his dive when the otitic barotrauma became too troublesome. The article commences with the words: “This story could have been my obituary. How I let myself be talked into it I’ll never know”. His instructor is writing a book called “Sharks don’t eat people”. If permission becomes available the full article will be printed. Till then you can’t be told about it. It’s real humorous.

* * * * * * * *

SOME OBSERVATIONS ON HYPOTHERMIA
Dr John Knight

Hypothermia is an ever-present hazard to divers, especially in winter. As most divers know little or nothing of its effects it is fortunate that most people dive with a single 72 cu ft cylinder and lack of air makes them leave the water before they are too chilled.

Mr A, a shipwright in his 30's, had learnt to dive so that he could clean yachts bottoms without slipping the boats. His other duties meant working underwater most of Saturday and Sunday. He had a partner who helped him in this task, but the partner developed trouble with his ears and stopped diving. So Mr A spent even more time underwater. As the summer ended and winter closed in he noticed increased frequency of micturition and urgency. This inability to hold his water was new and was the reason for him consulting a doctor. As the story unfolded he mentioned that once he could not remember whether he had scrubbed one side of a yacht's bottom when he got out of the water. When he checked he found he had indeed scrubbed the boat's bottom on both sides, but the last thing that he remembered was going round the rudder. On another occasion he had watched his arm scrubbing backwards and forwards while he noted that he could not feel his arm moving, and he was not consciously moving it. His main interest at that moment was a sensation of terrible cold and a desire to get out of the water, which he soon did. One day his partner pulled him from the water when he saw him "just sitting there" instead of working. Mr A thought these episodes odd, but not odd enough to seek advice. However he had bought a longer pair of wet suit trousers to try to keep out the cold.

His work involved 3 hours or more in the water at a stretch. He emerged briefly when one bottom was scrubbed, long enough to get to the next yacht. Each took some 1.5 hours to scrub clean. He was seldom more than 7 feet from the surface. He sat rather than swam and performed a constant to and fro movement which meant that there was a constant flow of water into the jacket of his wet suit. After spending the morning in the water he would have an hour's break for lunch and then re-enter the water.

This man had obviously suffered from hypothermia without realising what was happening as he was working in water of about 9.5 to 12.5°C (which is the range of Port Phillip Bay water at St Kilda in winter according to the Bureau of Meteorology).

When a diver enters cold water there is an immediate decrease in blood flow to the skin. This cold induced reaction is partly mediated by sympathetic hollow nerves and partly by the direct effect of cold on the blood vessels. The next result is a fairly rapid reduction in heat loss from the limbs.

As a result of this peripheral vasoconstriction there is a short lived, about 5 minutes, paradoxical rise of deep body temperature as centrally produced heat from the liver, heart, kidneys and intestines is not being distributed normally to the limbs and has nowhere to go. But this happy state of affairs does not last as heat loss through the chest and abdominal wall is mainly by conduction and is little influenced by skin vaso-constriction.

Figure 1 (redrawn after Beckman and Reeves) shows how the rectal temperature of an asthenic (thin?) subject dropped over 2 hours sitting in water at (74°F), which is temperature was accompanied by a marked increase in metabolic heat, which however was not sufficient to stop the drop in temperature although the rate of drop declined. However by the end two hours this man's heat output was dropping and he had to be removed from the water. Mr A was in water 10-14°C colder.

The subject of Beckman and Reeves experiment was unclothed while Mr A wore a 3/16th wet suit. Wet suits are quite efficient insulators when subject is close to the surface and motionless. They depend for their efficiency on the closed aircells in the neoprene (which are compressed at depth and so become less efficient) acting as insulation, and the presence of a thin layer of still water, warmed to skin temperature, between the skin and the wet suit. Movement exchanges this warmed water for cold and accelerates cooling.

Figure 2 (redrawn after Craig 1966) shows that there are three rates of heat loss with an unclad subject entering the water. The first steep slope, a high rate of loss, is the heat loss from the limbs and skin as vascular regulatory mechanisms come into play and the limbs and skin cool to near water temperature. The second slope, a loss rate about 1/5th of the initial, is that experienced when skin temperatures have dropped to approximately that of the surrounding water and limb vasoconstriction is leading to very low blood flows and so less loss of heat. Forearm flows as low as 0.5ml 100^{-1} min^{-1} at 13°C have been recorded while the blood flow was 17.6ml 100^{-1} min^{-1} in water at 45°C (Barcroft and Edholm, quoted by Keatinge). This low flow is cooled effectively as the main limb veins lie close to the main arterial supply and heat exchange occurs between the two. So little heat is lost from the limbs while just sitting still. Movement increases muscle requirements for oxygen and so increases blood flow, leading to an increased loss of heat. The third slope is about 1/10th of the rate of loss of the second and is the result of increased heat production. But the body is still losing heat. Little work has been done on the rate of heat loss in men wearing wetsuits, but Dr Craig tells me that the effect of a wet suit is to abolish or reduce the large initial heat loss while not altering the other two rates of loss. This refers to men sitting in a stirred water bath.

Figure 3 (redrawn after Pugh) shows the effect of exercise, in this case swimming, on the rectal temperature of a thin subject in water at 16°C. The upper line is sitting while the lower one is swimming. In both cases the man was too cold to continue after 30 minutes, although his core temperature has dropped much less while sitting than when swimming. The hollow lines show how the core temperature continued to drop after he had been taken out of the water. This continuation of cooling after active cooling has stopped is known as the "after drop". In this case the swimming exposure had to be terminated as he could no longer keep himself afloat.

Figure 4 (redrawn after Pugh) shows that even in water as warm as 25°C (77°F) a thin subject loses heat. While at 16°C (61°F) he was unable to continue swimming after 30 minutes and in water at 20.5°C (69°F) he was rendered immobile by hypothermia in 45 minutes. This man was thin, he had an average of 5mm of fat on his body. However a fat man (fat 30 mm thick on his abdomen and 20 mm on his back) had different responses. This well insulated man maintained his core temperature better when swimming than

when sitting. Heat loss is all a question of insulation and heat generation. If the heat can be retained inside the insulation not much can get away.

The dangers of hypothermia for the diver are mainly those of failing mental faculties, slowing of thought and reactions and inappropriate responses. These occur before loss of muscle power, which of itself can lead to drowning.

Divers suffer from acute hypothermia and the treatment is acute rewarming. When the patient has been hypothermic for many hours the effects of cold diuresis, which reduces blood volume, and of a thoroughly cold heart which is beating slowly and inefficiently, combined with rapid rewarming with its consequent vasodilatation are often fatal. These patients should be insulated so that they lose no more heat and then left to rewarm themselves with their own heat production.

Most of the knowledge we have about hypothermia is from hypothermic anaesthesia where the aim is to cool the body, and brain, so that the cerebral circulation can safely be interrupted. These low temperatures with their risks of cardiac arrythmias are not likely to be attained by diver unless he is left unconscious in the water.

Although there are individual variations most people are incapacitated by cold at a rectal temperature of 34.5°C and many are too cold to tolerate continued immersion even above rectal temperatures of 37°C. At these temperatures the heart rate has not been slowed significantly by cold.

The dangers of hypothermia are greater if the diver dives again before he has regained all his lost heat. Figure 3 shows that even 1.25 hours after leaving the water the swimmer in 20.5°C water had not regained his starting rectal temperature. Had he then re-entered the water his endurance would have been much reduced as he had less total body heat to supply losses to the water. It is of interest that the exposure with the higher (20.5 C) temperature in Figure 4 when the man was incapacitated at a rectal temperature of 34.5 C, the same temperature as he was incapacitated in water at 16°C, he took longer to restore his total body heat than when exposed to colder water. Cold vasodilatation probably played its part in the rapid cooling in the colder water. In this condition the blood vessels suddenly dilate and the limb is flushed with blood for a minute or two before vasoconstriction recurs. This effectively cools the blood and the heart and the core of the body. In slightly warmer water, not cold enough for this to happen, cold seeps into the body from the surface and it took longer for the core temperature to drop, but there is more very cold tissue to warm after the cold exposure is completed.

Mr A was advised to wear a wet suit hood, gloves and boots, and a second wet suit top (so increasing the available insulation and cutting down portals of entry for fresh, cold water). He was advised to have a hot bath or shower and a hot drink during his lunch break and most importantly have a longer lunch break and never to get into the water unless he felt warm.

DATE TO REMEMBER: 5 -13th June 1976 SPUMS AGM - MANA ISLAND - FIJI

Further reading:

Beckman EL and Reeves E. Physiological implications as to survival during water immersion at 75°F. *Aerospace Medicine*. 1966; November: 1136-1142.

Craig AB and Dvorak M. Thermal regulation during water immersion. *Journal of Applied Physiology*. 1966; 21: 1577-1585.

Craig, AB and Dvorak M. Thermal regulation of man exercising during water immersion. *Journal of Applied Physiology*. 1968; 25: 28-35.

Craig AB. Heat exchange between man and the water environment. In *Underwater Physiology.* Ed. Lambertsen CJ. New York and London. Academic Press. 1971: 425-433.

Golden FSt C and Rivers FJ. The immersion incident. *Anaesthesia*. 1975; 30: 364-373.

Hayward JS, Echerson JD and Collis ML. Effect of behavioural variables on cooling rate of man in cold water. *Journal of Applied Physiology*. 1975; 38: 1073-1077.

Keatinge WR. *Survival in cold water*. Oxford: Blackwell Scientific Publications, 1969.

Pugh LGCE. Temperature regulation in swimmers. In *Physiology of Breathhold diving*. Ed. H Rahn. National Academy of Science - National Research Council Publication 1341. 1965: 325-348.

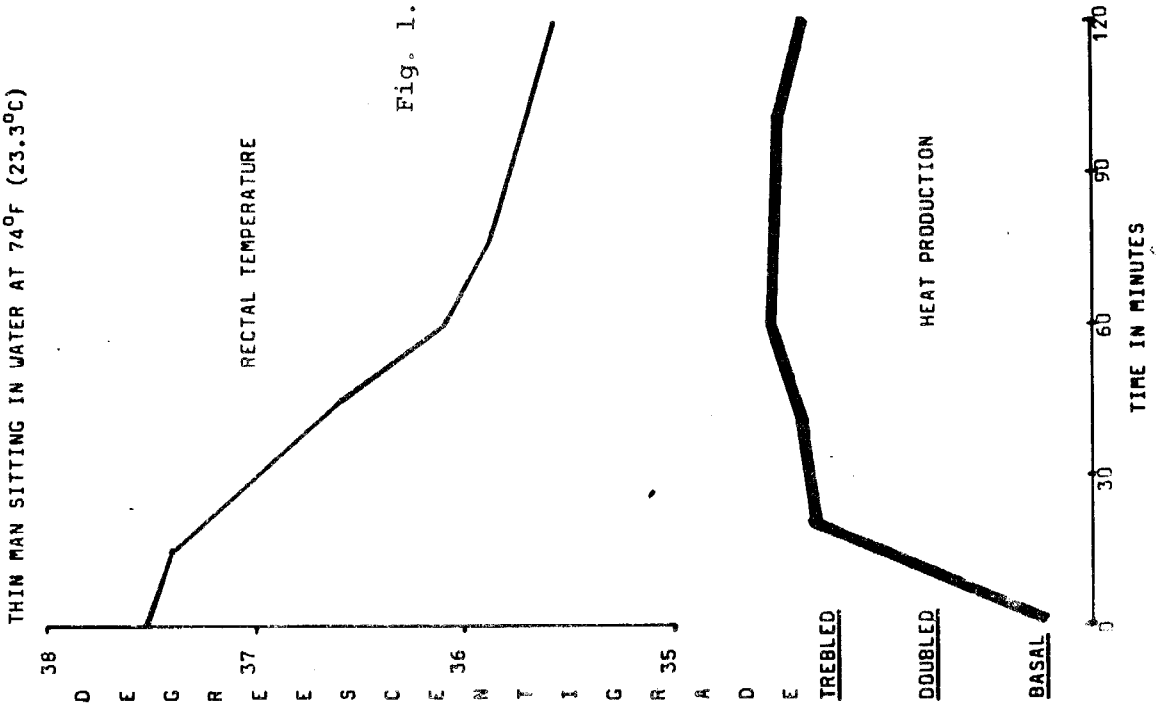
Vaughan WS. Diver temperature and performance changes during long-duration, cold water exposure. *Undersea Biomedical Research*. 1975; 2: 75-88.

Webb P. Thermal problems in diving. *Undersea Medical Society report* No. WS. 12-1-74. 1974.

Webb P. Cold exposure. In *Physiology and Medicine of diving and compressed air work*. Ed Bennett FB and Elliott DH. London; Bailliers Tindall 1975: p 285-306.

REDRAWN FROM BECKMAN AND REEVES 1966

Fig. 1.



BODY HEAT LOSS

Fig. 2.

VASCULAR RESPONSES INCREASED HEAT PRODUCTION

FIGURES IN C/HR PER °C TEMPERATURE DIFFERENTIAL BETWEEN BODY CORE AND WATER

(AFTER CRAIG 1966)

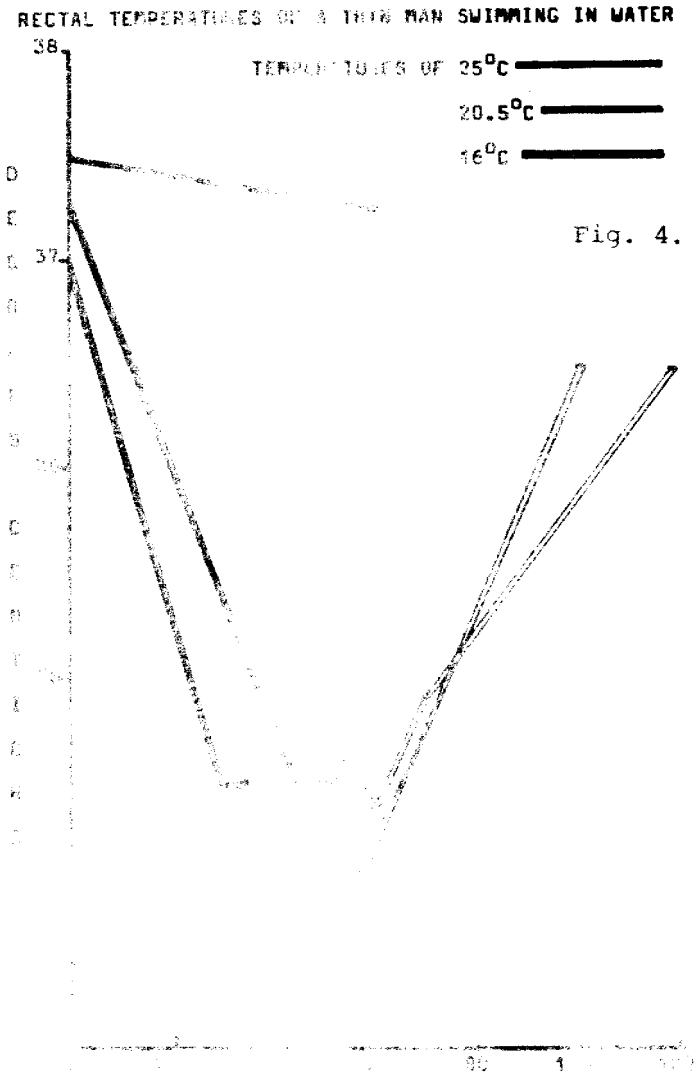

RECTAL TEMPERATURES OF A THIN MAN SWIMMING IN WATER
38
37
TEMPERATURES OF 25°C
20.5°C
16°C

Fig. 4.

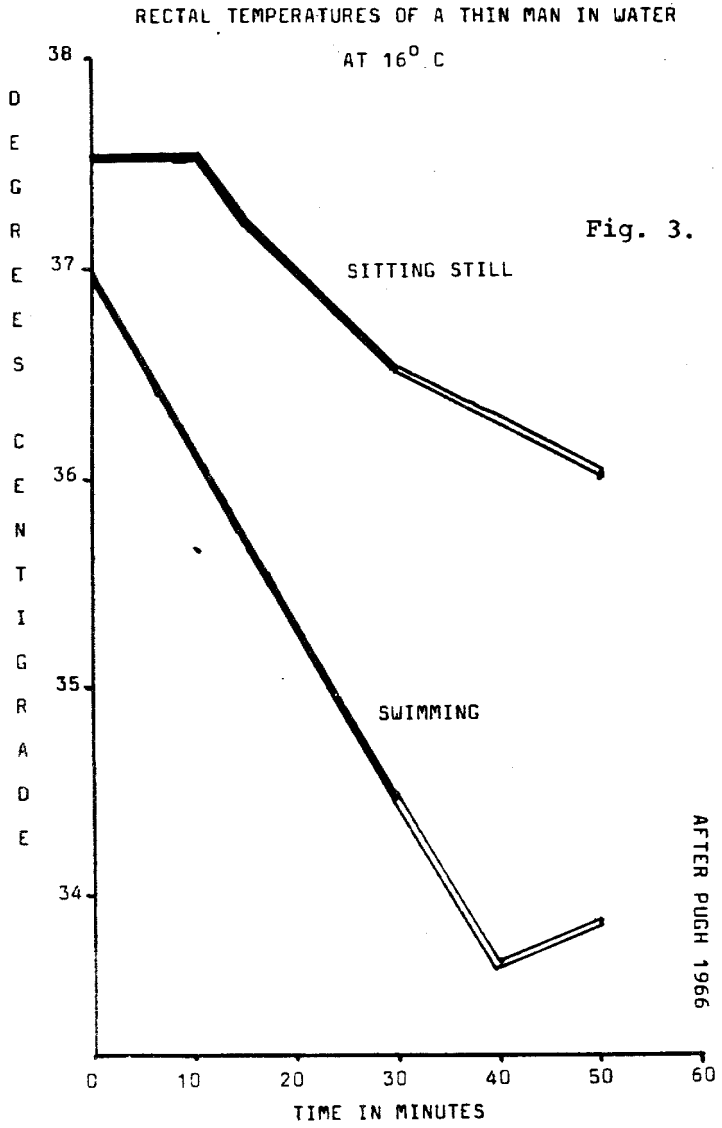

RECTAL TEMPERATURES OF A THIN MAN IN WATER
AT 16° C
DEGREES CENTIGRADE
38
37
36
35
34
SITTING STILL
SWIMMING
0
10
20
30
40
50
60
TIME IN MINUTES
AFTER PUGH 1966

Fig. 3.

SPUMS MEETING IN VILA - JUNE 1975

My apologies for the delay in presenting this report. I can only plead slothfulness and unpreparedness. As Vila was my first diving AGM I cannot compare it with what went before. Certainly we were very lucky with the weather. It had rained steadily for three weeks before we arrived and just before we landed the sun came out and stayed out for the rest of our stay.

Even the best prepared plans go astray and we had our share of unexpected problems. The first was that UTA had no room on board the aircraft that took us from Noumea to Vila for 14 empty tanks, needed to boost the stock at the Nautilus Dive Shop. The plane was quite full and exceedingly stuffy on the ground.

Vila was hot and a lush green. We had to pass through the rather disappointing, dusty, scruffy town of Vila on our way, crammed into 22 seater buses, from the airport to the Le Lagon Hotel. Although the town is a disappointment the setting, a magnificent bay with green hills fringing a deep blue sea is wonderful and will be even more splendid when the space between the road and the sea-wall, which has recently been reclaimed, is grassed. There was the Union Jack fluttering from a flagpole on an island in the bay where the British Commissioner lives. On the mainland by the French Commissioner's house is another flagpole and both flags fly at exactly the same height. One of the niceties of a condominium.

The hotel, sited between the lagoon and the golf course looked of native construction, it was only on close inspection that one saw that the palm leaf thatch had been applied to concrete walls and tin roof. Some of the party had self-contained cabins in among the palm trees, but most had rooms in the two storey blocks. There was air-conditioning in these blocks but in order to save electricity, which is fiendishly expensive in Vila, the air-conditioning was turned off as much as possible and it was often left off overnight. The Hotel staff were a fantastic mixture, black New Hebrideans, brown, fuzzy haired Fijians, a most attractive Tahitian, Frenchman, Australians and an American. Quite the best time of the day was "Happy Hour" when drinks were half price, but instead of cutting the price, they doubled the number of drinks served! The hotel food was good but not exciting. There were many more interesting meals in town, but then the problem was getting home late in the evening. One night after a superb meal we asked the proprietor to get us a taxi. He told us that the buses had stopped and that taxis were not available after 9.30 pm and so he would run us back to the hotel, which he did after removing some fish from the back seat. Like our meal it had been caught by him that afternoon.

The first day's diving was fun for me and the morning party but less enjoyable for the afternoon party. The buses were late, and the loading of the boat and the trip to the reef took much longer than expected. The clear, warm water, good visibility and the corals and fishes made my day. Someone found a crown of thorns starfish and someone else a Triton snail. The photographers photographed and the rest of us swam about admiring the beauty of the reef and its creatures.

The afternoon shift had problems. We were home late and some of the tanks had to be refilled. One of the two compressors in Vila was defective and so the Dive boat left much later than planned bearing a number of frustrated divers who had had to wait overlong for their dive. On other days the morning party left at 7 am and the

missing tanks arrived and as a result there was air for the afternoon divers by the time they needed it. The 7 am start was a bit of a strain as conferences seem to need living it up till after midnight. (Who suggested that a diver should not have had any alcohol for twelve hours before a dive?)

Peter Hamley, Deborah Springthorpe and Peter Nicholls kept a close eye on the divers and persuaded most people to use buddy lines. Each day another reef was dived and many made a dive on the wreck in the harbour. Some of us dived in the "blue hole" some miles from the town. This was a shore dive and involved swimming out through a channel in the coral. One day four divers were sharing the hole with three large sharks when the visibility suddenly became nil. Very worrying as sharks do not need to be able to see you to find you. Luckily someone found a line left by Phil Rubinstein to show the way out.

One must not forget the scientific programme which included discussions on aural and sinus barotrauma, a problem of personal interest to a number of those present, decompression sickness, a catenary stone from St Helena, habits, as well as presentations of the diving and other matters of the 1974 AGM in Fiji..

Some took time off from diving to visit Tanna and its live volcano, others went to Hide-away Island by trimaran, others went round the island like proper tourists, others searched for shells at low tide, or sailed or tried their hands with the local outrigger canoes. This usually resulted in an unexpected swim. One evening there was a barbecue and dance at the hotel. On another might we had the chance to attend a "native feast" (specially organised for tourists) where we were fed with pork and local vegetables, and sweet potato, yams and taro. The whole pig which was supported on a bamboo framework and covered with palm leaves and earth. The pork was well roasted, the bamboo framework fell apart while they were lifting it out of the pit and the pig nearly went back for an extra cook. The vegetables all tasted of wood smoke and were all of the consistency of dried potato.

The AGM was chaired by Dr Andrew Gallagher, as the President was on his sick-bed in Sydney. A major decision was to abandon the idea of an AGM in New Zealand as a June meeting would be an invitation to hypothermia and a summer meeting would be poorly attended by Australians. Dr Tony Slark pointed out that while diving at Poor Knights is good it is deep and a long way from the shore. Also that the accommodation would not be Le Lagon standard, much more like camping. The meeting decided that the Isle of Pines would be a much more suitable place for the June 1976 AGM (but as you know the Conference Committee has found it impossible). The office bearers elected were Dr Carl Edmonds, President; Dr Jim Hazel, Secretary; Dr Phillip Rubinstein, Treasurer; Dr Douglas Walker, Editor; Dr Ian Unsworth, Dr Geoff McFarlane and Dr John Knight as members of the Executive Committee. A request for a postal extraordinary meeting was put to the executive in order to alter the constitution so that the AGM and not the Executive Committee chooses the venue for the next AGM. A most enjoyable conference dinner finished off a most successful AGM.

I hope that all other AGMs are as well organised, a tribute to John Parer and Peter Hamley, as comfortable and in such beautiful spots, both in and out of the water, as the 1975 AGM in Vila.

John Knight