SPUMS JOURNAL
South Pacific Underwater Medicine Society
OCTOBER TO DECEMBER 1979

CONTENTS

continued on page 28

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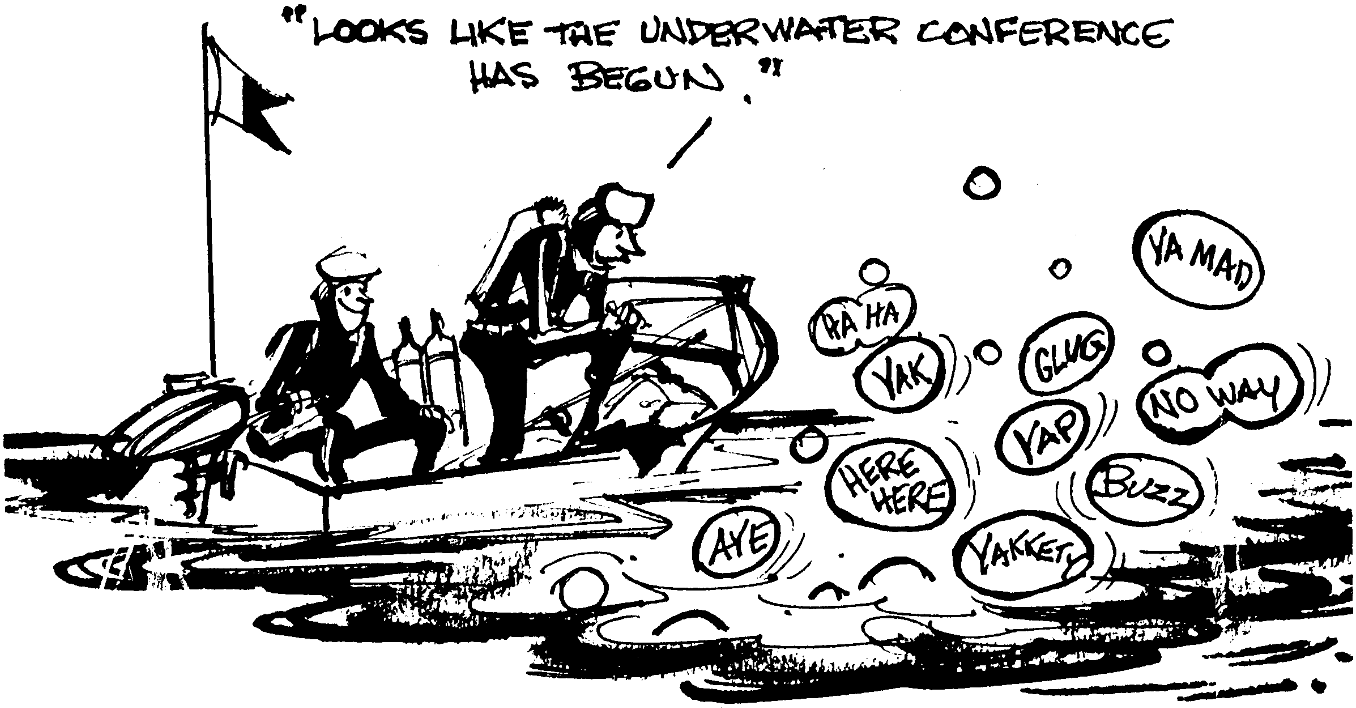
EDITORIAL

Readers can hardly fail to observe a change in the format of this Journal/Newsletter and may wonder why we have departed from the design used for the past successful years. The answer is simple, for in order to reduce the ever increasing penalty of postal charges we have made a successful application to obtain Category B rates for our Australian membership circulation. This involved some concessions towards making packets easily handled in bundles and of a preferred size. Our previous Journal could not be readily adjusted to these "environmental changes" and so, regrettably, had to go. The content is, happily, not subject to the same fiscal forces and will continue to interest or bore readers much as previously. Readers are invited to offer their views on the changes and can regard the layout as open to change if a suitable case is presented.

This issue has reports from the recent Scientific Conference-AGM of the Society, and we are indebted to John Knight and Janene Mannerheim for ensuring that this information is available. This devotion to duty by a retiring Secretary shows what we have lost and gained, for he is now welcomed as the new President of SPUMS. Our new Secretary has already shown members that he will be an excellent successor, for you will already have received Chris Lourey's newsletter advising dates for RAN Courses and the 1980 AGM plans. He, as are all the Committee members, is welcomed. Our past President and past Committee are thanked for their work for the Society. It is pleasant to note the friendly take-over by Melbourne from Sydney, a possible pointer to some future time when another State (or Country?) could take a turn with the running of our Society.

In addition to the Vila reports our papers come from many sources. We are pleased that permission is so freely granted for the use of articles that would otherwise be limited in availability, at least as far as most of our members are concerned. No apologies are offered for this policy, and none should be thought necessary when account is taken of the quality of these "one previous careful owner" papers. NAUI, PADI, and the US Navy have been particularly rich sources. These papers are written with a non-medical readership in mind but contain much of real interest and importance to all our readership. In general they direct attention to the problems and uncertainties associated with diving, in contrast to the specialised investigation of small but important aspects of matters that are the rightful province of Physiologists and our big brother, UMS. Both approaches are necessary if Diving Medicine is to justify the hopes placed in it by those involved in diving, both for sport and commercially. It is from simple observations of the generality of divers that the grand design will be recognised, and from the physiologists will come the fine detail. The use of highly motivated and experienced divers by research units may yet be seen to have held back progress of our understanding by making problems seem too simple. The recent influx of scientific curiosity by female divers had stressed the often forgotten fact that though divers may be much of a muchness they are far from being uniform, and this influences their reaction to diving stresses.

The time is long past, and can never return, when the conscientious lecturer in Diving Medicine needed only a copy of the Diving Tables and a bottle of soda water to have the basics for a thorough exposition. Though there may be a common human tendency to fear information that questions previously held beliefs, in our area of interest we must accept that a period of uncertainties is inevitable during our progress from the initial simplistic view of Man, and the effect of a hyperbaric environment upon him, and one where bubbles are omnipresent (but usually asymptomatic) and yesterday's physical activity can effect the safety of today's dive. But try and look on the bright side: if it wasn't for the problems there would be no interesting articles for you to read, safe in the belief that these things only effect other people anyway. Perhaps we would identify better if we followed our Cartoonist's idea for our next conference.



DISCLAIMER

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.

MINUTES OF AGM OF SPUMS HELD AT LE LAGON HOTEL, PORT VILA, NEW HEBRIDES ON WEDNESDAY JUNE 27TH, 1979

1. Apologies were received from D Walker, C Lourey, W Rehfisch, R Leitch, G Davis, T Trewartha, A Robson.

2. The minutes of the previous AGM held in Suva in June, 1978 were read and confirmed on the motion of T Cairns, T Swain.

3. There were no matters arising from the minutes.

4. The President addressed the meeting.

5. The Secretary gave a report on the year's activities. SPUMS has reached maturity as it is now recognised at State, Federal and Industrial levels as an expert body. Only one meeting has been held, on Saturday March 3rd, at the School of Underwater Medicine, HMAS Penguin. Members had attended RAN courses and Hyperbaric Oxygen courses at Prince Henry's Hospital. This year's speaker was Jefferson C Davis, President of UMS. Consideration of next year's meeting based on Singapore with diving either at Pulau Tioman or the Maldives was advanced. Dr David Elliott, President EUBS, who had indicated that he would be available as speaker, has had to withdraw for next year. He sent the official greetings of EUBS. Dr John Miller, Duke University and Secretary of UMS has been asked to be next year's speaker.

6. Financial report. Attached audited report.

7. Annual subscription to stay at present level of $20 for full members, $15 for Associates, $25 for corporate members.

8. Election of Committee. There only being the following nominations:

President:	Dr John Knight
Secretary:	Dr Christopher J Lourey
Treasurer:	Dr William Hurst
Editor:	Dr Douglas Walker
Committee:	Dr Victor Brand
	Dr William Rehfisch
	Dr Darryl Wallnor

They were declared elected.

9. Mr RG Goddard was again appointed Honorary Auditor.

10. There being no business of which notice had been given, the meeting was closed.

STATEMENT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 30TH APRIL, 1979

Opening Balance 1/5/78		
Investment Accounts - CBC Savings Bank Ltd.	1645.12	
Investment Accounts - Mutual Acceptance Ltd. (10.5%)	1000.00	
Cash at Bank - ANZ Banking Group Ltd.	1691.43	
Cash at Hand	2.00	4338.55
Add Income		
Subscriptions	4787.68	
Bank Advice	25.00	
Interest - Mutual Acceptance Ltd.	99.48	
Interest - CBC Savings Bank Ltd.	260.82	
Returns from Penguin Meeting	182.00	5354.98
		9693.53
Less Expenditure		
Post	852.90	
Duplicating	104.93	
Stationery	83.96	
Newsletter	2117.50	
Travel	718.39	
Reimbursement	30.00	
Petty Cash	5.00	
Fiji Conference	183.98	
Bank Charges	69.46	
Meetings	247.35	4413.47
TOTAL FUNDS 30/4/79		$5280.06
Represented By:		
Investment Account - CBC Savings Bank Ltd.	1905.94	
Investment Account - Mutual Acceptance Ltd. (9.75%)	1000.00	
Cash at Bank - ANZ Banking Group Ltd.	2372.12	
Cash at Hand	2.00	
		$5280.06

AUDITORS REPORT

I have examined the above statement of receipts and payments for the South Pacific Underwater Medical Society and state that the statement gives o true and fair view of the financial transactions of the Society.

ROBERT G GODDARD, ARMIT (Com) AASA

SUBSCRIPTIONS

Members pay $20.00 yearly and Associate Members $15.00. Associate membership is available to those neither medically qualified nor engaged in hyperbaric or underwater related research. Membership entitles attendance at meetings and the Annual Scientific Conference and receipt of the Journal/Newsletter. Anyone interested in joining SPUMS should write to the Secretary of SPUMS, Dr Christopher J Lourey, 43 Canadian Bay Road, Mount Eliza, Victoria, 3930.

NOTES TO CORRESPONDENTS AND AUTHORS

Please type all correspondence, in double spacing and on only one side of the paper, 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 these in a presentation suitable for photo-reduction direct. Books, journals, notices of symposia etc., will be given consideration for notice in this journal.

Report on the Vila Meeting of SPUMS

June 1979

Dr John Knight

Held at the Le Lagan Hotel, Port Vila, New Hebrides the Annual Scientific Meeting was extremely successful. However disaster nearly struck before we left Sydney. Our overseas speaker, Dr Jefferson C Davis, the President of the Undersea Medical Society, was to have flown into Sydney on Thursday evening. Owing to the grounding of the DC10s he had to transfer to a flight due in at 0830 Friday. Our UTA flight (on board a chartered Qantas 747) was to leave at 1100. Dr Davis' flight was delayed and yet further delayed. Luckily for SPUMS UTA's take-off had to be delayed. A worried Secretary of SPUMS, a worried travel agent and a worried UTA official haunted the PanAm arrival gate and collected Jeff Davis with just enough time for the three passengers to be last onto the 747, Dr Davis without a seat allocation. Luckily for SPUMS Jeff is a widely travelled man and always carries his slides and clothes with him as hand luggage. His diving gear was in the PanAm cargo hold and reached him a week later.

At Noumea we transferred to an Air Nauru 737, again on charter to UTA, arriving at Vila airport in the dark shortly after 6pm. The hotel provided excellent accommodation, reasonable food and a very suitable meeting room. However gremlins were about. The slide projector would work when tested before the lecture but coyly refused to function during the lecture. Here Jeff Davis displayed the flexibility that come to the rescue on a number of occasions. He carried on while another projector was produced. Next day the electricity supply disappeared in the same way. Thereafter projection was no problem. However by then the Secretary of SPUMS had tripped over the microphone lead, pulling the amplifier from its stand to the floor. It then sulked and refused to work for SPUMS, it was however mended in time for the band to blast our eardrums at the Saturday Barbecue.

Jeff Davis was the main speaker. Resumes of his talks are being prepared and will he published in the Newsletter. The first week was mainly devoted to Decompression Sickness and hyperbaric oxygen therapy, including many case reports. It was a fascinating and informative series of sessions. Dr Davis has extensive experience of decompressions sickness. He is an US Air Force doctor and for reasons connected with its easily remembered telephone numbers the USAF gets many Scuba diving accidents, both decompression sickness and air embolism. The USAF has chambers around the world for the treatment of its own personnel who develop "aviators bends". His experience include some remarkably complicated patients most of whom improved dramatically with recompression and adjuvant therapy. The Edmonds Underwater oxygen apparatus for the treatment of decompression sickness was demonstrated in the pool during the sessions on decompression sickness therapy. Vila is some hours by air from the nearest chambers and there are no aircraft immediately available that can pressurise to ground level. The water is warm and there is always somewhere sheltered to immerse the patient. Almost the ideal place to use the Edmonds equipment if it was necessary.

Ian Unsworth, President SPUMS 1975-1979 and Jeff Davis presented two days of hyperbaric oxygen. Both have considerable experience, although Brooks AFB has attracted more patients.

The two speakers advanced similar treatment regimes and produced similar results. Dr Unsworth preferred uninterrupted oxygen breathing while Dr Davis uses cycles of 25 minutes on oxygen and 5 minutes on air. Dr Unsworth also differed in his approach to burns treatment. He covers the burn in a plastic bag and runs oxygen through the bag so as to bathe the wound in oxygen and raise the PO_2 to bacteriotoxic levels throughout the wound. The presentations of the treatment of radionecrosis of surgical wounds of the head and neck were most impressive and the results most satisfactory. Dr Davis distributed reprints, when his diving gear arrived, of his paper (Davis JC, Dunn JM, Gates GA and Helmbach RD, Hyperbaric Oxygen, A New Adjunct in the Management of Radiation Necrosis Archives of Otolaryngology, Feb 1979, 105: 58-61) to all participants. There are a few copies of the reprint left, and they can be obtained from the Secretary of SPUMS, Dr Chris Lourey, 43 Canadian Bay Road, Mount Eliza, 3930.

Jeff Davis' most controversial presentation was that on physical standards for sports divers. Once again the subject of asthmatics not diving raised protests. In the ensuing melee neither side could convince the other.

During the second week inner and middle ear barotrauma was discussed. One day was devoted to the problems of medical care in the New Hebrides. The spectrum of disease and the primitive nature of the local society mean that public health should have a high priority, but this is the weakest side of health care. At popular request from the local diving club a second demonstration of the Edmonds underwater oxygen therapy equipment was put on. This time the audience was almost all French divers. Luckily for them they had an efficient interpreter so they did not have to listen to John Knight's bad French. Jan Pegg gave an interesting talk on the habitat dive to 500 feet run by the University of Hawaii some years ago. The whole exercise was conducted in the open ocean and the next speaker contrasted habitats with the current system of saturation diving where the divers live in a chamber on the deck and travel to work in o personnel transfer capsule (commonly called a bell by commercial diver). In this segment the principles of saturation diving were covered with a discussion of the physiological and engineering problems involved. The session ended with a slide tour of various chamber installations. The highlight was Jan Pegg's tape of helium speech at the surface, at 50 feet and at 500 feet. Very few had heard helium distorted speech before and none could decipher any more than the opening A,B,C. No one put his hand up when the speaker said "Anyone who can understand this put his hand up".

The last session was devoted to a discussion of the sperm whale's sonar system by Jan Pegg and a conducted tour of the USN's new Experimental Diving Unit at Panama City by John Knight. The Ocean Simulation Facility with a wet pot 48 Feet by 15 feet and a depth capability of 2000 feet, has been used for testing new equipment, such as the Mk 12, which will one day supersede the old hard hat Mk V, and the Mk 14 push-pull very deep diving concept.

The social and diving side of the programme was a success. There was one unfortunate dive trip when an inexperienced skipper anchored in the wrong place but every other dive was acceptable or better. Votes of thanks are due to Anthony Newly and Renato Miola of Allways Travel who once again oversaw the travel and diving arrangements, to Bob and Gill Netherwood of "Escapade" and Denny and Merrell Smith of "Nautilus Dive Shop" who ran the diving operations with great skill and immense enthusiasm.

Reports from the SPUMS SCIENTIFIC CONFERENCE, 1979

Sunday June 24th
Report by Dr Janene Mannerheim

Doctor Jefferson Davis commenced the SPUMS Conference for 1979 with an account of how a US Air Force Colonel became involved in Underwater medicine. Prior to 1959 the USAF had reported aver 1700 cases of altitude decompression sickness and of these 750 were serious (neurological). Jeff has researched these and reported them (Davis JC, Sheffield PJ, Schuknecht L, Heimbach RD, Dunn JM, Douglas G, and Anderson GK. Altitude Decompression Sickness: Hyperbaric Therapy Results in 145 Gases. Aviation, Space and Environmental Medicine August 1977: 722-730). He was treating aviators with decompression sickness and in Amsterdam became involved in hyperbaric oxygen therapy. Since then there has been an explosive increase in sports diving cases and he has treated over 100 sports divers with decompression sickness.

Decompression sickness can be seen as three separate diseases.

1. Gas separation (bubbling) requiring immediate treatment.
2. Blood/bubble interaction requiring complicated treatment.
3. Permanent tissue damage.

The terminology of decompression sickness needs clarifying. There are objections to classifying decompression sickness as Type I and Type II, eg. Limb bends is a tag which really means that at the same time as joint pain is occurring central bubbling can be picked up pre-cordially with a Doppler detector. Better terms could be found for aero-embolism and dysbarism as they are too confusing, meaning different things to different people.

Limb bends symptomatically can vary from mild to severe. Where are the bubbles? The gas probably separates in tendons and ligaments, causing a tedonitis. It has been shown that gas in the joint cavity is painless. Swelling of the hands can occur from lymphatic bubbles. Exercise aggravates the pain. Pressure eases it. A sphygmomanometer cuff inflated over the site of pain eases it, by squashing bubbles which have separated out.

Jeff presented slides of the School of Aerospace Medicine, Brooks Air Force Base, Texas. The hyperbaric chamber facility consisted of a large hypo/hyperbaric chamber used for treatment and research, and a small chamber. Both with depth capabilities of 225 feet. An unconscious patient can be slid in on a trolley.

Hyperbaric oxygen can be used to treat:

1. Decompression Sickness
2. Gas gangrene
3. Carbon Monoxide
4. Gas embolism
5. Refractory Osteomyelitis
6. Osteoradionecrosis
7. Soft tissue radionecrosis
8. Non-healing ischaemic soft tissue wounds
9. Slow bone healing after osteotomies
10. Burns

Decompression sickness which has been treated in his chamber includes:

1. Decompression sickness presenting with skin rash pruritis and mottling.

2. Presenting with fatigue, often a precursor (as are skin manifestations) of more serious symptom.

3. Chokes, presenting with dyspnoea, substernal pain, cyanosis and an irritable non-productive cough. McIver, Fife and Ikels have shown that its pathophysiology requires numerous central venous bubbles filtered in the lungs to form pulmonary gas emboli followed by a blood/ bubble interation with a decrease in platelets and an increase in serotonin and in epinephrine (adrenaline for Australians).

4. Neurological decompression sickness. 15-25% of all cases (other than Pacific Island native divers) present as neurological decompression sickness. The clinical manifestations are confusing and there appears to be no pattern, which is understandable given the number of sites in the CNS where bubbles can lodge. Onset is gradual from within several minutes building up over approximately 6 hours. Never diagnose hysteria!

i. Spinal decompression sickness most commonly starts with low back pain - upper lumbar, lower thoracic level, radiating to the abdomen, then parasthesiae and weakness of the legs. It is followed by loss of the anal sphincter tone and bulbocavernosus reflex and finally urinary retention. What's that you say? The bulbocavernosus reflex. Put your finger in the patient's anus and with the other hand pull his penis. If the reflex is present the anal sphincter contracts and your finger is gripped. There was no information on how to elicit the reflex in females. Hallenback, Bove and Elliot's research on dogs supports the hypothesis that the following sequence of events occurs.

   a. Pulmonary Gas embolism
   b. Raised pulmonary arterial pressure
   c. Raised azygos vein pressure
   d. Obstruction of the epivertebral venous system causing stasis
   e. The stasis and bubbles lead to platelet aggregation and damage, thrombosis, congestion and haemorrhagic infacts on the white matter.

   Goats have been found to have congestive spinal infacts although they have only had symptoms of limb bends.

Case 39 years old, Male Oral Surgeon. One 72 cubic foot tank. Depth 110-160 feet. Ascended on reserve. He repeated the dive after a 30 minute surface interval. He developed abdominal pain, numbness and weakness of his legs. He recompressed himself on air at 20 feet. When he ascended he had only tingling of his right foot. Next day he dived to 140 feet, on ascent spent ten minutes at 70 feet and 15 minutes at 10 feet. He still had tingling of his right foot. Management: First do a neurological examination. Tremor of the hands found. He was compressed and decompressed on an extended USN Table 6, which gave complete recovery.

ii. Brain decompression sickness presents often with visual disturbances, blindness blurring of vision, etc. Also spotty motor and sensory loss, mental confusion, headache and convulsions. The mechanism possibly involves bubbles in the lipids.

Case A pilot pretended to have limb bends and was treated on a short oxygen table. He actually had visual defects but lied, as he was afraid that he would be barred from flying again. His visual defects persisted and he required treatment with an extended Table 6.

5. Labyrintine decompression sickness. This is a problem with saturation diving, though Jefferson Davis knows of two cases in sports divers. Clinically there is vertigo, tinnitus, nystagmus, nausea, vomiting, and hearing loss. The aetiology is little understood and there are several possible mechanisms hypothesising gas changes in the perilymph and the endolymph. Treatment requires prompt recompression on Table 6. A delay of 45-60 minutes gives poor results.

The differential diagnosis of the giddy diver

On Descent
1. Caloric
2. Barotrauma, ie. tympanic membrane or round window rupture

At Depth
1. Counter diffusion
2. HPNS

On Surfacing
1. Labyrintine decompression sickness which tends to occur up to one hour after the dive
2. Round window rupture which usually occurs during the dive.

The differential diagnosis of decompression sickness

Limb Bends	Injury
Chokes	Myocardial infarction
	Contaminated gas and oil mist.
	Pulmonary barotrauma
CNS	Head injury
	CVA
	Insulin dependent diabetic with hypoglycaemia
	Arterial gas embolism
Labyrintine	Round window rupture

Monday June 25th
Report by Dr Janene Mannerheim

Carl Edmonds' Underwater Oxygen Apparatus for treating decompression sickness in remote places was demonstrated in the pool.

Following this Jefferson Davis startled us with a case presentation of a diver who reached 240 feet on air, switched to oxygen for his decompression stop on ascent and then flew next day in a Boeing 747 pressurised to 5,000 ft. He later developed neurological decompression sickness. SPUMS members, known to dive and then fly, or dive and then climb active volcanoes, at least have not yet been caught at 240 feet on Scuba.

Despite treatment, 25% of those presenting with neurological decompression sickness are left with residual symptoms or signs. From a recent workshop in the US (to be published in September 1979) it was considered that immediate care, and care during transport are probably most important. It is important to choose the correct mode of transport, the type of chamber and then the appropriate treatment table. The sooner treatment with recompression is started the better. The longest delay involves getting a plane that can be pressurised to sea level (these include the Lear Jet, the Hercules C 130, Boeing 737 and Boeing 727) or a helicopter (if there are no mountains to be crossed).

Initially,

A. Give 100% oxygen by mask to wash out nitrogen at atmospheric pressure. Oxygen can be given for 20 hours before pulmonary toxicity occurs.
B. IV fluids. Low molecular weight Dextran has been advised, but Charles Wells, of Houston, Texas has shown that any fluid can be used. The aim is to avoid haemoconcentration and platelet aggregation.
C. Urinary catheter, to measure fluid output or to treat retention in paralytic cases.
D. Push oral fluids if intravenous is not available.
E. Steroids are controversial. Use Decadron 20 mg IV. Its maximum effect is reached in 12 hours.

Heparin before a dive can help to prevent decompression sickness, but heparin afterwards is not advisable because of the possibility of:

1. CNS bends with haemorrhage into the white matter.
2. Burst lung and its complications.

A one man chamber compressed with oxygen (eg. Vickers) is not advisable as you cannot do further neurological examinations, cannot extend the tables deeper and cannot cope with an emergency in the chamber. If using such a chamber for 30 minutes at 60 feet and a two hour ascent to the surface 1% of patients will develop pulmonary oxygen toxicity. It is mainly suitable for the therapy of burns or osteomyelitis.

The goal of hyperbaric oxygen therapy in the treatment of decompression sickness is to reduce the bubble size by compression to allow resolution of the bubble, to avoid its growth during ascent and to increase the oxygenation of the anoxic or damaged tissues.

USN Table 5 should be used only for limb bends, pain only type. It is important to do a neurological examination first as pain may mask CNS symptoms and signs. After about 30 minutes of 100% oxygen at pressure the capillaries shut down and tissue PO_2 drops. This can be prevented by switching to air for five minutes after 20 minutes on oxygen. While breathing air the patient can talk, drink fluids if there is no IV running, and a further neurological examination can be done.

USN Table 6 should be used when there is any one of the following:

1. Delay in reaching the chamber.
2. Any neurological manifestations.
3. Symptoms still present after 10 minutes on 100% oxygen at 60 feet.
4. Chokes.
5. Vasomotor instability.

With the prolonged use of 100% oxygen at 1 - 2 ATS it is difficult to differentiate between pulmonary oxygen toxicity and the chokes. If a regime of 20 minutes oxygen and five minutes air is used any pulmonary embarrassment can be assumed NOT to be due to pulmonary oxygen toxicity.

USN Table 6a should be used for air embolism. We were shown slides illustrating:

A. 92 cases of sports divers with decompression sickness successfully treated with USN Tables 5 and 6.

B. 32 cases of decompression sickness. 8 of which were treated on air at 165 feet. Of these six were cured and 2 left with impairments. The remaining 24 were treated at 60 fsw on oxygen. 22 cleared with one or two treatments and two were permanently impaired.

C. The importance of treating even after extreme delay in reaching the chamber. Bubbles have been found up to 14 days later.

In a study of 25 air embolism cases, 8 occurred during swimming ascent training from 30 feet. A discussion on the advantages of the left lateral, head down, position took place. A slide showed the return of the cerebral circulation in a cat which was placed in the left lateral, head down, position following massive, visible, induced air embolism.

Tuesday 26th June

Report by Dr Janene Mannerheim

Excellent presentations were given by Jefferson Davis and Ian Unsworth on Hyperbaric Oxygen Therapy. Jeff commenced with the statement that chambers were not put to full use treating only decompression sickness (not enough cases) and should be used more often for hyperbaric oxygen therapy. His lecture dealt in detail with gas gangrene. It was noticed that most of the lay audience quietly departed as slides of clostridial myonecrosis and cellulitis were shown.

Inside the large double lock chamber used by Jeff, fire proofing facilities were illustrated, eg. spun-gloss blankets, lighting outside, no electrical connections, no spark sources, compressed air rather than electrically powered motors. Patients can sit or lie comfortably with on oxygen mask on. More than 9 patients can be treated at the some time. Modified aviation masks are used as they are lighter and more comfortable than others. Patients who cannot wear a mask are treated with a transparent hood which encloses the head. Intensive care of the very sick patient who may need general anaesthesia can be accomplished. The medical attendants breathe air and are decompressed breathing oxygen.

Outside the chamber the console includes gauges monitoring in ATA, PSI, mm Hg, and FSW.

Gas gangrene is caused by Clostridium perfringiens (ex Welchii). It requires ischaemic tissue to multiply. Under pressure the solubility of oxygen in plasma increases as the oxygen partial pressure increases, but there is very little increase in the carrying capacity of haemoglobin.

Patients can present with combinations of pain, tachycardia, skin bronzing, blebs, crepitus, myonecrosis, haemolysis, oliguria, obtunded sensorium, shock and seizures.

CASE A 19 year old male developed gas gangrene in one leg injured in a motor bike accident. Treatment required debridement of the wound, massive doses of penicillin, broad spectrum antibiotics, hyperbaric oxygen, tetanus prophylaxis, and whole blood replacement. He survived with good repair and skin graft.

According to Brummelkamp (1960) 100% oxygen can be used for 90 minutes at 3 ATA for three times in 24 hours or a maximum seven times in three days. The oxygen partial pressure reaches 2193 mm Hg. C perf stops producing toxin at a PO_2 of 250 mm Hg, and is killed at 1400 mm Hg. Anti-toxin should not be used.

Hitchcock reported the following survival rates in 1973:

Antibiotics alone	50% survival
Hyperbaric oxygen alone	No survivors
Surgery alone	No survivors
Hyperbaric oxygen &surgery	55% survivors
Hyperbaric oxygen and antibiotics	70% survivors
Hyperbaric oxygen and surgery and antibiotics	95% survivors

In Dr Davis' series the aetiology of gas gangrene was:

Trauma	68%
Elective Surgery	15%
Sports injuries	11%
Drug addicts	6%

Other case histories showed examples of a central necrotic zone with surrounding advancing zone, debrided wounds, X-rays of gas in the tissues, fasciotomies, liquified muscle, the importance of saving tissue in the injured hand.

Of all cases treated at Brooks AFB, Texas only one patient has developed pulmonary oxygen toxicity. Two cases of limb bends have occurred in the medical attendants.

Dr Ian Unsworth complemented Jefferson Davis' presentation on the use of hyperbaric oxygen therapy, showing the chambers at Prince Henry Hospital, Sydney. These are a large multiman chamber with three compartments, one of which is fitted with operating theatre facilities (with a depth limit of 80 Feet) and a smaller chamber attached to the large one. The small chamber has a depth limit of 350 feet of seawater. The control panels for the two chambers are side by side. Each compartment of the large chamber complex can be used as a separate chamber. The chamber complex has been involved in experimental work on pigs, treatment of a Red Setter and 300 fsw dives on heliox as well as treating humans.

Ian agreed with Jeff's list of indications for using hyperbaric oxygen therapy (detailed on page 5) and went on to discuss carbon monoxide poisoning and air embolism. He stressed the importance of recognising air embolism in general medicine, as out of 39 cases only one had been caused by diving.

Carbon Monoxide Poisoning

CO is found in coal gas and in natural gas (15%). Furnaces, kilns, wood fires, paper fires, and engine exhausts provide exogenous sources of CO. The most significant clinical criteria are loss of consciousness and finding the victim in a car, garage or gas oven. The so-called cherry red lips are not seen. The carboxy-haemoglobin bond is 250 times stronger than the oxy-haemoglobin bond. Toxicity is enhanced by hypoxia.

The half-life of CO in air is 250 minutes.
The half-life of CO in 100% oxygen at 1 ATA is 49 minutes.
The half-life of CO in 100% oxygen at 2.5 ATA is 9 minutes.

Statistics of CO poisoning in Australia are available with breakdown into male, female, age groups, accident and suicide.

Gas Gangrene

Between 1971 and 1977 58 cases have been treated at Prince Henry Hospital Hyperbaric Unit with a

24% mortality rate. 9 of the 58 cases were from elective surgery on patients with peripheral vascular disease who received no antibiotic cover. 16 were caused by trauma, ie. agricultural and industrial accidents. Clostridium perfringiens is a Gram positive rod (however dead Cl. perf. stain Gram negative).

The patient's own immunity is important. If they cannot help themselves hyperbaric oxygen therapy cannot help them. Eg. a patient with Hodgkin's disease on immunosuppressants who had a WCC of 20,000 developed gas gangrene following grazing an elbow. Other cases of gas gangrene were shown including slides of a buttock pierced by a bull's horn, scrotal infections, necrotizing fascitis in diabetics, and a child who had had a hind quarter amputation before being referred to Prince Henry Hospital. This last patient probably would have kept his leg if he had been referred early in the disease.

Wednesday 27th June

Report by Dr Janene Mannerheim

In the morning some members visited the British Base Hospital in Vila and were invited to join a wardround. New Hebridean patients suffering from TB, tibial osteosarcoma, maxillary lymphomas (not Burkitt's) and bilateral corneal opacities were presented.

Following the AGM the new president, Dr John Knight, took us on a panoramic study of the hyperbaric chambers in the western Pacific. Slides of chambers at HMAS PENGUIN, and the Hyperbaric Unit at Prince Henry Hospital in Sydney were shown along with those of chambers at Prince Henry's Hospital, Melbourne, the Melbourne Metropolitan Water Board works at Braeside, and at the Fishermen's Co-operative at Mallacoota in Victoria. Outside Australia the slides showed chambers in Nauru and Truk. Finally two portable chambers were shown, one a Portable Inflatable Recompression Chamber or PIRC which was demonstrated at the UMS meeting at Miami in June 1979 and the other is produced by Dräger. In this the attendant sits up with his legs under the stretcher that the patient lies on. From the outside it looks like a large red boot. It can be attached to a Dräger chamber and the front of the foot removed and the patient lifted into the larger chamber. This transfer under pressure capability is useful but limited as it will only mate with a Dräger chamber.

Dr Jefferson Davis continued with the topic of hyperbaric oxygen therapy. It is possible for a hyperbaric chamber to pay for itself if it is used for the other conditions mentioned previously. The largest hyperbaric oxygen complex has six chambers and is in Moscow, USSR. Treatments are usually one per day per patient, every day, for thirty days, excluding Saturdays and Sundays. For instance patients with refractory non-healing treated with 100% oxygen at 2.4 ATA for 90 minutes. There are 5 minutes air breaks every 20 minutes during this time. Treatment is given five days a week. This exposure gives am arterial PO_2 of 1100 to 1300 mm Hg with additional oxygen carried in solution in the plasma. Optimum tissue PO_2 is 30 mm Hg. In these sorts of wounds the PO_2 is much lower. The rise in PO_2 results in fibroblastic proliferation, collagen formation and capillary buddings and the fistulae heal and epithelium grows over.

We were shown a series of slides of 23 cases of radionecrosis with non-healing. These patients were treated with hyperbaric oxygen, surgery and antibiotics. Most had pain relief within 10 days of starting hyperbaric oxygen and healing followed unless there was residual tumour.

In a series with osteomyelitis which was refractory to conventional treatment 53 were treated with hyperbaric oxygen. 12 months later only 6 of the 40 who were followed up had had a recurrence. This is an 85% success rate. The necessity of surgery, antibiotics and co-operation with the orthopaedic surgeon was stressed. Further slides of individuals whose chronic ulcerations and fistulae were healed by hyperbaric oxygen included radionecrosis of the vagina and buttocks, radiochondritis of the larynx, oro-cutaneous fistulae diabetic ulcers and gangrene, one requiring daily treatment for two years, a venous stasis ulcer present for 15 years, and amputation stumps.

If hyperbaric oxygen therapy is continued for too long the fibroblasts are killed. As a rule of thumb a wound that won't heal has tumour in it.

Following radiotherapy and prior to any surgery patients should receive hyperbaric oxygen therapy as it encourages good wound vascularization for further reconstruction.

The absolute contraindications for hyperbaric oxygen therapy are:

1. Pneumothorax
2. Pulmonary blebs
3. Pulmonary cysts
4. Systemic viral disease
5. Optic neuritis

The relative contraindications are:

1. Inability to equalise middle ear pressure. Those who cannot equalise may need polyethylene tubes inserted through the tympanic membrane.
2. Fever
3. Chronic pulmonary disease. These people require a very slow ascent to avoid pulmonary barotrauma.

Dr Ian Unsworth, who has the most experience of treating patients with hyperbaric oxygen in Australia continued the subject. He discussed its use in non-healing ulcers. He believes that it is necessary to apply oxygen topically to the ulcer as well as systemically to the patient. He covers the area with a plastic bag and seals it to the skin and runs oxygen through the bag. Ian mentioned the loss to the community, let alone to the individuals who suffer, from burns. More needs to be done in this field as some centres are reporting dramatic improvements with hyperbaric oxygen twice a day to burns. Not only does the burn tend to be less infected but they also heal much more quickly than with normal conventional burns therapy.

He also discussed the work that he and Dr Yeo have been doing with spinal trauma cases. The results are encouraging but not conclusive.

Thursday 28th June

Report by Dr Janene Mannerheim

Pulmonary Overpressure Accidents

Dr Jefferson Davis

The bursting pressure of the human lung is some 50 to 100 mm Hg which is equal to 3 to 5 feet of seawater.

Lung rupture results in:
- Mediastinal Emphysema
- Arterial Air Embolism
- Pneumothorax

Precipitating factors are panic, breath holding, laryngospasm at depth, pulmonary disease, eg. blebs, obstructive lung disease, and abnormalities in lung compliance.

The greatest danger is in shallow depths, due to the greater expansion of air with the pressure change. For instance travelling from 99 feet to 66 feet produces the same gas expansion as travelling from 11 feet to the surface.

From the pulmonary capillaries air travels into the pulmonary veins, then to the left side of the heart and on through the internal carotids to the brain.

Slides of experiments involving air emboli in cat cerebral arteries showed the cat with its arteries exposed, then with bubbles visible and later in a 30° head low position with the arteries clear.

The Clinical Manifestations

Cerebral gas embolism manifests itself as loss of consciousness, confusion, aphasia, visual disturbance, parasthesiae, vertigo, convulsions, paralysis, chest pain, skin changes, retinal artery bubbles and arrhythmias.

Gas embolism, mediastinal emphysema and pneumothorax can all exist at the same time.

Treatment

Always do a neurological examination before beginning treatment.

Only treat a pneumothorax in a recompression chamber if it co-exists with air embolism. Put in a chest tube (intercostal cannulation and suction or underwater drainage) at depth before ascent. Air embolism patients should be immediately compressed to 6 ATA in the Trendelenberg position.

Special Considerations

Attendants will be required at depth as the patient may become violent. Remember the chamber is HOT AND NOISY and that the patient is disorientated and may have burst ear drums from rapid compression.

Drowning

Dr Jon Pegg

Jan Pegg is a regular, informative and welcome speaker at SPUMS annual conferences. His first slide depicted the evolution of man from water to land to water again in cartoon form. He then demonstrated osmosis with passage of fluid through a semi-permeable membrane from a hypotonic to a hypertonic solution.

We were entertained with a movie of an anaesthetised, tracheotomised rat submerged in isotonic fluid subjected to 200 psi partial pressure of oxygen. Although the rat was making heavy weather of breathing water he was getting enough oxygen and survived the experiment. He woke up under water as his ether anaesthesia wore off. For an adult human to breathe water in the sea seems physiologically impossible. There is the inability of the airways to move enough water, the non-isotonicity of seawater, and the difficulty of raising the PO_2 high enough.

In drowned victims estimates of serum sodium in mEq/L are as follows in blood taken from the left ventricle:

Fresh water	128 ± 12
Other Fluids	135 ± 10
Sea water	150 ± 13

However 10% have normal electrolytes and 10% have a normal PO_2 and dry lungs, presumably due to laryngospasm.

The surface tension is greater in larger alveoli due to the presence of surfactant. Freshwater denatures surfactant. In seawater pulmonary oedema occurs. There is bronchospasm with the inhalation of both sorts of water and also osmotic damage to the pulmonary epithelium. Any significant aspiration will cause an abnormal PO_2. It is important to observe near-drowning victims closely as atelectasis can suddenly develop. PO_2 should be measured. A patient with pulmonary alveolar collapse and shunting needs steroids.

Dr Pegg suggested the following points in treatment:

1. Ventilation is essential.
2. Use the Heimlich manoeuvre, ie. empty the upper airway before EAR.
3. Do not try to do EAR in deep water without flotation.
4. Do not give up too soon.
5. Make sure that the victim is drowned and not unconscious eg. a diver with air embolus.
6. Give bicarbonate intravenously according to blood gases.
7. Do not let the lung collapse completely during CPR.
8. Intubate with a cuffed tube or put the victim on his side to prevent aspiration.
9. Look for other causes often associated with drowning, eg. alcohol, myocardial infarction, head injury, epilepsy, diabetic coma and hypoglycaemia.
10. Do not extend the neck when clearing the airway in case there is a fractured cervical vertebrae. Protrude the jaw instead. Put on a cervical collar to avoid causing a quadriplegia. This applies especially to those who have dived in head first.
11. Bronchospasm, bradycardia and hypotension are signs of aspiration, not necessarily of a myocardial infarction.
12. Chest X-ray can show sand and other foreign bodies in the bronchi. This is proof of aspiration.
13. Warm the cold victim by insulation rather than by using active warming unless a defibrillator is available. Remember that warming the periphery leads to peripheral vasodilation, this improves the blood flow through the cold areas warming them but cooling the blood that goes back to the centre and so causing a drop in core temperature.

The reported cases of long survival following drowning are due to:

1. Cold water.
2. Cardiac arrest associated with the diving reflex trapping oxygenated blood in the cerebral circulation.

With a non-breathing victim in the water give on initial breath and then bring to shore as fast as possible. One should only pause occasionally to give EAR. Getting to shore or boat is more important. With a scuba diver who has air in his tank one can use his regulator purge button to inflate his lungs.

Flotation Devices, Cold Water and Swimming

Dr Peter McCartney

Peter has been doing trials in Tasmania's cold water, testing several different buoyancy vests or jackets. Subjects were timed while swimming two lengths of an Olympic sized pool and then again with the various vests. The aim of the trials was basically to show how buoyancy devices could help or hinder survival. For those who spend a lot of time in boats Peter recommended the U Vic Thermofloat, a jacket which turns into a wetsuit by pulling down a flap and making a pair of trousers. This is the brain child of Dr Hayward of the University of Victoria in British Columbia. The jacket contains a layer of foam neoprene which gives both buoyancy and insulation. The jacket is practical and of good appearance. It is available in Australia from Protector Safety Services Pty. Ltd.

Friday 29th June

Report by Dr Janene Mannerheim

Dr Jefferson Davis discussed:

A. Decompression Sickness case histories:

1. 5 cases presenting as decompression sickness who were actually air embolism. Treatment was with USN tables 4, 5, 6 and 6a. Mannitol and Decadron were used intravenously.

2. A diver descended to 100 feet for 50 minutes. He later flew over a 4,000 foot mountain. Treatment included Dextran and Decadron as well as recompression.

3. A 42 year old male spent an unspecified time at 100 to 200 feet. He repeated the dive 2 and a half hours later. On surfacing he developed a cervical cord lesion. There was not enough oxygen available to use USN Table 6 (4 hours 45 minutes) so Table 5 (2 hours 15 minutes) was used and then Table 3 (air for about 18 hours). The results were not good. When oxygen arrived he was treated on Table 6 with good results.

4. A diver who spent 9 minutes at 110 feet at 6,000 foot altitude made a sudden ascent. He developed a spinal cord lesion.

5. Some Okinawan divers were diving on a shuttle system 150 feet, in an attempt to treat one of their number. The results were that two died and three survived after treatment with USN Table 6.

B. Gas Gangrene Case Histories.

A large commercial airliner crashed in a swamp in Florida. Surgeons closed wounds that should have been left open and several people developed severe gas gangrene.

C. Physical Standards.

In the USA the standards of diving physical examinations are equivalent to the 1930 standards for aviation physicals, ie. a form from the diving instructor for the doctor to complete, no chest X-ray requirements and usually performed by a doctor with no knowledge of underwater or hyperbaric medicine.

Absolute contraindications

1. Seizures except febrile convulsions as a child.
2. Syncope; neurological, cardiovascular, other.
3. Insulin dependant diabetics. Hypoglycaemias aggravated by cold water and exercise. He poses a threat to others who try to rescue him.
4. Coronary artery disease.
5. Sickle cell disease or trait.
6. Non-patent Eustachian tubes.
7. Meniere's disease.
8. Pulmonary disease, blebs, cysts and foreign bodies.
9. Middle ear surgery with a prosthesis.
10. Alcoholism and drug addiction.

Relative Contraindications

1. Previous history of pneumothorax. This may require a lung scan to exclude pathology.
2. Asthma. This becomes a 'maybe' dive situation if he has been totally clear for two years.
3. Migraine.
4. Psychiatric problems, eg. depression.
5. Previous history of neurological decompression sickness. These must be assessed on the previous recovery. Nerve root lesions.
6. Head injury with pre-disposition to post-traumatic epilepsy. Wait for two years. X-ray, EEG and neurological examination must be normal before allowing diving.
7. Poor vision.
8. Hypertension on drugs.
9. Perforated tympanic membrane.
10. Pregnancy.
11. Recent fracture or sprained joint.
12. Inguinal hernia.

Not all those present agreed with Dr Davis an energetic discussion ensued.

FATAL CRAB NIP

A newspaper reports that a man has died in America after being nipped by a crab while out fishing. He developed a severe illness and was admitted to a hospital, there having his leg amputated two days after receipt of the injury. Despite antibiotics he died 12 days later, apparently from a heart attack. It is believed that the infecting organism was a marine vibrio which thrives only in salt water, an infection that is hard to isolate. Dr Amodio, in reporting the facts, said "We are really not sure how dangerous the organism is. The problem is that perhaps it causes minor infection in people and usually isn't identified." People are believed to become infected by eating raw oysters in some instances. The US Centre for Disease Control has recorded 39 cases in which people have been infected by vibrio.

Australian, 10 September 1979

Reports from the SPUMS SCIENTIFIC CONFERENCE, 1979

A CASE OF INNER EAR BAROTRAUMA

Dr Janene Mannerheim presented the case of a diver who had difficulty equalising his right middle ear pressure below 30 feet on a 120 feet dive. He developed vertigo and pain during ascent, stopped for decompression at 10 feet and on surfacing continued to have pain, and developed tinnitus and sensitivity to noise. He did not have an upper respiratory tract infection but had been diving at least twice a day for the previous three days. He normally had excellent Eustachian tube patency. He drove back to Melbourne from Mount Gambler with a very painful ear.

Next morning he found pus and blood on his pillow. Examination of his ear revealed a Grade V barotrauma with a ruptured drum, blood and a pulsation discharge.

Audiometry He had had an audiogram done some two years before which was, for the affected ear:

500 Hz	1000 Hz	2000 Hz	4000 Hz	6000 Hz	8000 Hz
20 db	15 db	10 db	15 db	20 db	20 db

His post-dive audiogram was quite different:

500 Hz	1000 Hz	2000 Hz	3000 Hz	4000 Hz	6000 Hz	8000 Hz
30 db	30 db	20 db	45 db	70 db	80 db	70 db

He was placed on oral antibiotics, aural antibiotic drops and a nasal antibiotic spray. X-rays of the petrous temporal and mastoid revealed less numerous and less clearly defined air cells on the right (the affected side) than on the left.

Three days later his audiogram was:

500 Hz	1000 Hz	2000 Hz	3000 Hz	4000 Hz	6000 Hz	8000 Hz
40 db	60 db	60 d	90 db	100 db	105 db	—

ie. a deterioration in hearing. He still had significant tinnitus but no further vertigo.

Ten days later the right middle ear was explored. It was filled with adhesions, glairy fluid and chronically thickened mucosa suggesting chronic infection. Good exposure of the round window was obtained but no leakage or fistula was visualized. The round window was packed with gelfoam.

Post-operative audiometry showed gradual improvement in hearing. The tinnitus ceased.

First week post operation	500 Hz	1000 Hz	2000 Hz	3000 Hz	4000 Hz	6000 Hz	8000 Hz
First week post-operation	20 db	25 db	25 db	35 db	50 db	75 db	65 db
Three weeks post-operation	15 db	15 db	10 db	15 db	35 db	50 db	45 db
Two months post-operation	5 db	5 db	5 db	0	15 db	15 db	10 db

STOP PRESS

This diver presented at the end of November 1979 with incapacitating giddiness following a dive when he could not clear his ears. By next morning his giddiness had gone but he was deaf and had a painful, discharging ear. At operation a linear tear was seen in his round window and fluid was seen welling out of the tear.

CAUTIONARY TALE

An incident report contributed by RSA.

"Our club, thank god, has so far been spared the horror of a serious mishap. But such an event was close a short time ago. The club ski-boat was full of students when it hit a reef in the dark, ripping its bottom open and then overturning and tossing one fellow, who had been sitting on the bow, head first onto the rocks. This resulted in him suffering a skull-base fracture, ruptured spleen and other injuries. Others suffered from fractured collar bones. The boat driver suffered a severe knock on his larynx, a piece out of his nose, and a terribly guilty conscience. He had actually landed up under the boat in the water and had dived to get out. By and large I ascribe our good safety record thus far largely to the good state of the equipment, the generally excellent health of the divers (and their training) and their thorough acquaintance with our diving sites. Besides, we do not have to force an outing if conditions are really poor since there is no financial incentive. The diving supervisor, a former chief instructor in the navy, is a level headed man and a powerhouse of strength, as is the boat driver and many others. Still, we are all only feeble humans and the little thread of life is torn so quickly. Since the accident there has been a drastic shake-up in procedure, which now is strictly according to the {UK) New Code of Practice".

Comment: This illustrates how a moment's error can allow the development of an urgent life threatening situation. It is obvious that only a healthy, well trained and disciplined group of divers could survive an incident such as this without suffering at least one fatality in the immediate confusion.

All who are involved in the organising and management of "dives" are advised to give serious thought to being able to "contain" the most serious incident possible, and even greater thought to taking all possible measures to prevent any accident occurring. Weight is given to this advice, which might otherwise be dismissed as a Council of Perfection which it is not practicable for real-life diving situations by considering a recent legal case in New South Wales where a successful damages claim was made on a Local Council for injuries received when diving into a pool. The victim became paraplegic because the water depth was less than that necessary for safe diving. It took seven years from the time of accident till the conclusion of the ten day-legal battle. With compensation at $981,000, plus legal costs, not to mention possible costly appeals to higher courts, it is the path of wisdom to insure thoroughly and practice your diving with scrupulous attention to correct procedures.

Health Services in the New Hebrides

Speaker: Dr Paul Fenton

Report by Dr John Knight

In some ways the local climate is healthy, equable and sunny, in other ways it is unhealthy, (mainly culturally) and gives rise to serious disease and gross pathology. There are four non-connecting health services. These are:

1. British
2. French
3. Private, which is restricted economically to the expatriate population.
4. Custom (leaf medicine). This is secret to its practitioners, who charge for their services but are not full time healers. The remedies used differs between medicine men. The value of their medicines has not been assessed. They are often consulted for terminal cases.

Over the years there has been animosity between the French and the British. However, recent changes at the top have produced more co-operation than in the past. But economics dictate that either the French or the English Hospital in Port Vila will have to be closed one day. But neither administration wants to close its hospital. There are plans for amalgamation under discussion. Rural health personnel are trained in the two hospitals.

A large native demonstration recently prevented the closing of the British hospital. However, there is hostility between the Francophone and Anglophone New Hebrideans, and there are inter island rivalries. The group has at least 100 separate languages and union was foisted upon the natives by Europeans. Just about everyone speaks "bichelamar" (pidgin) and their island language.

There is a well established health service. There are 12 hospitals, some of the islands have two hospitals. There are over 100 dispensaries, French, British, and mission. There is a rural health service and WHO are running four programmes. There is no shortage of money for health, the amount of aid per capita is higher than anywhere else. By third world standards they are over-doctored.

The deficiencies of the system are that there are no significant statistics, medical records only go back a few years, there are no long term health records, most deaths occur at home and the cause of death is unknown. If a New Hebridean looks middle aged he or she is probably 25-30. The organised health service is quite new. In 1973 Dr Don Bowden was the first doctor to visit the Banks Islands and others.

Significant illnesses include:

Malaria, Vivax and Falciparum are common. The transmission is focal and not intense. It is not a cause of death. Cerebral malaria is not seen. A contrast to the Solomon Islands where malaria is a problem.

TB: According to WHO it is as common in the New Hebrides as anywhere in the world. It presents as pulmonary, glandular and meningitis. Babies are given BCG at birth. A three drug regime is used: Streptomycin is stopped after three months and the others continued for another 3 to 6 months. The rural health service provides follow up.

Leprosy: There are 45 new cases a year. The hospital sees ten a year so the incidence is increasing and it will become a public health problem. Most of the lepers come from isolated islands. There used to be a leprosarium but it was closed some years ago. In lepromatous leprosy relapse is likely due to the patient's failure to take his drugs. (Dopsone and Lamprene for 6 months and then Dopsone for life). Follow up is in the care of the rural health service.

Infantile Gastroenteritis, and malnutrition are common on islands. There is a diarrhoeal control programme which emphasises breast feeding, oral rehydration, improved sanitation, health education and surveillance.

Other common illnesses are respiratory illnesses, chronic otitis media, filariasis. The latter is spread by night-biting anopheles and is difficult to treat and eradicate. Those who are symptom free often have microfilariae. Polio is hyperendemic - 100% of the population has antibodies by the age of 4 or 5. Dengue and typhoid occur. There is a strange meningitis which is due to the rat lung worm larvae eaten on lettuce. The larvae, which live in a snail, normally survive in the human digestive tract and migrate into the body. Gonorrhoea is seen but so for no syphilis (though this may be due to there being no dark ground illumination microscope available).

There are few chronic disease. No cases of cancer of the lung or of the colon have been seen. There is a high incidence of lymphoma. Cancers of the breast, stomach, skin and cervix are seen, as is osteogenic sarcoma. Diabetes is rare, only 20-30 patients in the whole group of islands. Mass screenings have not found glycosuria. This suggests genetic modification by the environment as the introduction of western affluence to Nauru and other Pacific islands has brought on upsurge of diabetes there. Death registration is poor and there is no legal requirement for a post mortem in unexplained deaths.

The problems in the New Hebrides are ignorance, mistrust and lack of extension to the villages. Perhaps the best value for money would be to scrap the hospitals and transfer the money and staff to the districts for health education and sanitation control. However most medicos would find this extremely boring.

Fish Poisoning in the New Hebrides

Speaker: Dr Don Bowden

Report by Dr Janene Mannerheim

Patients presenting are sometimes so ill that a different aetiology is often considered.

Cases seen have included Cone Shells, Jelly fish and Ciguatera.

The Chinese have documented records with typical descriptions of Ciguatera poisoning going back 4,000 years. Ciguatera comes from "Cigua" Snail poisoning. Early Western records are from 1606 when Pedro Ferdnandez de Quiros, a Portuguese navigator sailed for the King of Spain, to discover Espiritu Santo, of the New Hebrides.

James Cook, years later, records Ciguatera poisoning too.

British battles have been lost because of it.

Usual presentation in New Hebrideans:

Nausea, diarrhoea, abdominal pain, weakness, muscular paralysis, bradycardia (40-50 bpm), hypotension, generalised aches and pains, sweating, hypothermia, (bradycardia and vomiting improve after 24-48 hours).

UNUSUAL PRESENTATIONS INCLUDE:

1. Acute anaphylaxis with laryngeal oedema. Treated with steroids and O_2. (Was this really scombroid poisoning?)

2. Skin Itch. Treatment: Do not eat the fish!

3. Tingling around the mouth, fingers and toes.

Symptoms can start while still eating the fish, but usually occur 2 - 48 hours afterwards.

Some researchers have said there are several toxins. Others, a single toxin probably synthesized by algae on reefs. Recently researchers in the Pacific have determined that a dinoflagellate related to that which causes red tides may be the source of the toxin. It lives on the surface of algae. Herbivorous fish consume the algae. These fish are eaten by larger fish eg. Barracouta.

Most fish caught in the New Hebrides contain some toxin. It is thought that poisoning is dose related, though not necessarily. Brightly coloured fish are not eaten. Geographically one reef area with Ciguatera prone fish may be 3-4 km from another area. Any species of fish can be affected, eg. Shark, Tuna, Cod. A decade later, the same species fish in the same area may NOT have it. Interference by man can alter the pattern, eg. explosives.

The toxin cannot be eliminated by preparation of the fish. It is thought to have anticholinesterae activity. There is argument about this.

In the New Hebrides patients have presented with symptoms ranging from minor to moribund. One died two days after.

TREATMENT

1. Reassure and send home.

2. Admit. Give atropine and neostigmine for the bradycardia, fluids and electrolytes for the V and D.

3. Leaf medicine.

Twelve genera of plants are used for Ciguatera poisoning in the South Pacific. Several are used by New Hebrideans in the Vila Base Hospital.

The leaves are boiled like tea and the fluid is drunk.

CASE HISTORIES

A man speared a 10lb fish, shared it with his friends and 4 dogs for lunch. They became ill that afternoon. 3-4 days later the patient was weak (like myasthenia gravis) and had paralysis of the lower limbs. He was discharged home in a wheel chair from hospital after 3 weeks.

A 12 year old female patient's first attack was mild, but her second attack 1-2 years later necessitated 3 weeks in bed. She complained of tingling in the hands for a year whenever she drank cold water or ate fish. This was possibly psychogenic.

DISCUSSION

Question? "Is a cat worth using to test fish on?"

Answer: "Yes, probably because of the cat's size you get results quickly (24 hours). Sometimes a cat will become sick, but humans won't.

Question? "What other methods can be used to test fish?"

Answer: "There are some folk-law tests such as soaking the fish with a silver coin. Tarnishing of the coin indicates Ciguatera contamination of the fish. Or hang the fish up. If ants and flies swarm over it, it is presumably safe."

SPUMS member Dr John Parer quoted a New Hebridean girl from Mete Village who said that all cases were cured by chewing the leaf of the White Pandanus and a cane with similarly striped leaves. He produced specimens.

Dr Don Bowden commented that it is not used at the hospital as most patients do not know what Leaf Medicine to use and neither do the MO's. It is left to the patient's experience and choice.

Dr Victor Brand commented on his wife Fifi's personal experience with possible Ciguatera poisoning in Tahiti. Mrs Brand's symptoms had included fever, tachycardia, aching joints, diarrhoea, one episode of temperature inversion and tingling of the hands and feet. Later Beaus lines appeared on the nails and there were hair changes and desquamation of the soles.

General Practice in the New Hebrides

Speaker: Dr Tom Biggs

Report by Dr Janene Mannerheim

The population of the New Hebrides is about 100,000 comprising 95,000 Melanesian including those from other islands, eg. Fiji, Tonga and 5,000 English and French. It is a young population 46% under the age of 16. This is reflected in the pattern of medicine ie. many young patients.

The New Hebridean concept of illness is that it is caused by a spell cast by a relative. Most use the native Leaf Medicine man to counteract the spell.

The climate with its temperature and humidity produces ideal conditions of temperature and humidity for bacterial and fungal culture. Much sepsis and infection is seen.

The archipelago is also a great psychosocial incubator.

Typical endemic diseases are malaria, tuberculosis, leprosy, fibiariasis, gastroenteritis and intestinal parasites, causing deficiency anaemia. Routine postal natal care includes malaria screen and treatment.

TB is rife, often presenting as tumours eg. neck, breast. Congenital haemolytic anaemias are seen often. Degenerative and metabolic disorders are uncommon. Though the population has been smoking since World War I, not one single case of carcinoma of the lung has been seen! Other typical infections commonly seen are:

Bacterial:	Skin Infections Pyogenic Myositis
Parasitic:	Head lice and occasionally body and pubic lice, scabies.
Fungal:	Groin rashes and otitis externa (with secondary bacterial infection).
Viral:	Hepatitis Dengue Polio

Saturation Diving

Dr John Knight

Saturation Diving is mainly used in deep diving work where the bounce dive would involve many hours of decompression which is economically and physiologically wasteful. This deep diving is mainly done on the off-shore oilfields, but deep dives in chambers ashore are used for research and equipment testing. Habitats are mostly used for research in physiology and in marine science.

The main advantages of saturation diving are that there is only one decompression for many hours work and that teams of divers can work round the clock.

Saturation is applied in research where chamber dives go to ever greater depths to test human physiology under pressure and to test equipment. Habitats are mostly restricted to marine science now as they are not as cost effective as chambers for physiological studies. In salvage and construction work the divers live in deck decompression chambers and "taxi" to work in a personnel transfer capsule (known as a "bell" to divers), never coming out of pressure until the job is done.

There are drawbacks to saturation diving of course. It is an expensive pastime running a saturation system, the basic engineering costs are high, the helium costs are high, and the labour costs are high. Besides a pressure proof system there is need to control and monitor the pressure and the atmosphere. The gas mix must be right with the level of oxygen critical to prevent pulmonary damage. It is now accepted that some nitrogen should be in the mixture, partly for haematological reasons and partly to help control HPNS, of which more later. Carbon dioxide must be kept at a tolerable level, about 0.5% surface equivalent is attainable. Other gaseous contaminants have to be removed, as does moisture. The circulation of gas is important to keep the atmosphere constant and the temperature within tolerable limits. Toilet facilities have to be provided, and interlocks on the plumbing so that the distressing case of the diver who lost some feet of his intestine down the pan when the wrong valve was opened cannot be repeated.

Human physiology is rudely jostled by deep diving and saturation diving is not problem free. Many divers suffer from compression arthralgia during the descent. On dives deeper than 200 metres the high pressure nervous syndrome (HPNS) is normal. It can be modified by slow compression and pauses on the way down for the symptoms to settle and by the addition of nitrogen to the breathing mixture. Luckily most of the saturation diving takes place in waters where the depth is shallower than 200 metres. All divers suffer weight loss during a long saturation dive in helium. Divers feel cold in a helium environment. The temperature range that is comfortable is much reduced and the temperature required for comfort during sleep is higher than that during activity. Even when working the diver is not prevented from heat loss without precautions. Helium is a good conductor of heat so the diver in a dry suit is inefficiently insulated and loses heat to the water and also through the respiratory tract as he warms the cold helium which needs more heat to warm it than nitrogen. The diver and his breathing gas must be heated at depths below 600 feet and it is highly desirable at much shallower depths. Ear infections are common (otitis externa) in the damp warm atmosphere of a chamber. Prophylactic ear drops are a good investment. Finally getting back to the surface. Decompression sickness is common on experimental dives and often takes the form of a vestibular "hit" at depth.

The talk was illustrated with slides of various chamber installations. These included shots of the Commercial Diving Centre at Wilmington California; the deep rescue chamber owned by International Diving Contractors which is now the hub of the British North Sea hyperbaric rescue system; and J Ray McDermott's Drilling Barge 21 in Bass Strait.

Diver protection From Cold

Dr John Knight

The commonest form of protection is the wet-suit, which being made of foam squashes with increasing pressure and so becomes less effective as an insulator.

The dry-suit used for 150 years depends on trapping gas in the diver's underwear for its insulating properties. Modern dry-suits, with the waterproof garment made of foam neoprene are effective insulators at the surface. However just getting into the water compresses the underwear, most commercial materials tested are compressed to 30% or so of their original thickness when under a pressure of two feet of sea water. So if the underwear is reasonably expanded round your chest it will be pretty skinny round your legs. Water getting into the suit ruins its insulation which depends on the layer of trapped gas. Your immersion diuresis will also deprive you of insulation if your bladder isn't big enough. Various gases transmit heat at different rates and while carbon dioxide is a good insulator it is not safe to have in the suit unless the helmet is completely separate from the suit. There is a concept for suitable underwear which will be comfortable, moisture absorbing, insulated, water impermeable but gas permeable. Unfortunately this paragon of clothing is still in gestation. At great depths even the dry suit will not keep the diver warm and he must be heated.

The common form of heating used in commercial diving is the hotwater suit. The open type is a wet suit with a number of outlets for hot water which flows over the diver and to waste. The closed form has the hotwater flowing in pipes in the suit but not coming into contact with his skin. This system can be used with a dry suit. In either case there is need for a hotwater supply, usually from the surface through the diver's umbilical.

In the cold water the diver needs heat added to his inspired gas to conserve his body heat. The simplest is a hotwater jacket round the supply hose to the diver's regulator. This has been reported on in Skindiver Magazine. The USN has settled for putting hot water round the inlet and exhaust hoses of its new Mark 12 recirculating diving gear, while in other equipment there is a heat exchanger through which the breathing gas passes and is warmed. The heat is provided either from the surface or from the PTC or a local heater carried on the diver. The USN is experimenting with a propane fired, air supplied diver carried unit. This functions effectively to 60 metres but thereafter the propane liquid vapour pressure is inadequate. Another heater under development is one powered by magnesium wool burning in oxygen. This gives off no bubbles so is suitable for warming those engaged in clandestine operations.

One more bright idea is under study. This is to provide the large amounts of heat for PTCs. It has been suggested that seawater pumped at a high pressure down to the PTC can be run through an inefficient turbine, which would produce heat for the PTC. It is even envisaged that a similar device might be made for the diver working out of the PTC. Maybe I misunderstood the mechanism but it doesn't appeal to me!

A Visit to the US Navy Experimental Diving Unit, Panama City, Florida, June 1979

Speaker: Dr John Knight

Panama City is on the Gulf Coast of Florida in the northern part of the state. The day of our visit it was sunny and hot. We were shown over the facility, by the senior doctor, Captain WH Spaur, MC, USN. The party consisted of members of the Undersea Medical Society who had just attended the meeting in Miami.

The experimental Diving Unit exists to test and develop new equipment. To assist in this they have the new Ocean Simulation Facility which contains a large chamber complex capable of going to 2250 fsw (68 ATS) and also to a vacuum of 1 Torr (151,000 feet of altitude). The temperature in the chambers can be held anywhere between 29°F and 90°F in the wet chamber and between 50°F and 110°F in the dry chambers. Humidity can be controlled between 50 and 95% relative humidity. The wet chamber is 47'3" by 15'10". One end is a huge door through which submersibles can be placed in the chamber for testing. To reduce corrosion freshwater is used in the wet chamber. The turbidity and light levels are variable from dark to light. Any mixture of gases can be supplied and there are computers to maintain and check on the atmosphere and pressures. Besides this magnificent complex with its five interconnected dry chambers there is a double lock chamber 26'6" by 8'6" for treatment of diving emergencies and also an unmanned chamber for equipment testing.

The standard dress for divers has been unchanged for over 100 years. The USN divers' outfit of 1878 was almost indistinguishable from that of 1978. Modern commercial divers wear quite different gear, much lighter and less bulky, with better vision, but it doesn't anchor the man to the bottom so well for bottom jobs and men get accustomed to the gear that they have been trained to use. Learning to work in a hard hat is a special skill, and some divers are unwilling to adapt to the newer equipment.

The USN some years ago started the process of designing a new rig to replace the old hard hat. This is now operational and is known as the Mark 12 surface supported diving system. The new helmet has much improved vision and is neutrally buoyant with zero moment, making an ideal freeswimming helmet when used with a neck dam. With air the system is open circuit. When using helium there is recirculation and carbon dioxide scrubbing. The helmet had to be modified with recirculation ducting. Recirculated gas is directed across the faceplate and face to flush away carbon dioxide and gas is exhausted from the sides of the helmet producing an efficient carbon dioxide flushing system. A carbon dioxide absorber and recirculator pack had to be designed. Gas enters from the umbilical and passes through a venturi into the helmet. The venturi causes a secondary recirculating flow through the canister and back into the helmet. At peak efficiency the ratio of recirculated gas to fresh is 14:1. There is an emergency gas supply in the back pack which can be used either in the semi-closed or open mode.

Endurance was a problem at first. Everything except carbon dioxide absorption was OK. As with all absorbers failure follows a predictable pattern, good absorption slowly fails and then at the break through point carbon dioxide build up occurs.

The first manned trails to 450 fsw using 12 lb. Baralyme had an endurance of about 1 hour although unmanned trials had obtained 9 hours in 40°F water.

Testing showed that the problem was centred on the temperature humidity conditions in the system. The moisture content of the absorbent was considered important. Changes included using "High Performance Sodasorb", two varied condensers to retain moisture and insulation added to the canister. This again gave an unmanned endurance of over 9 hours. Used by men in a test pool the breakthrough was not for 10 hours. But manned at 600' it still failed to make the required 9 hours. It only lasted about 5 and a half hours before carbon dioxide build up occurred. Trial and error showed that running hot water over the top cap of the canister and using shrouds around the helmet hoses to allow the hot water to circulate round them gave acceptable performance.

Slides were shown of the EDU, OSF and the various items of equipment.

Thermal protection for the Mark 12 diver is with a dry suit provided with hotwater tubes on the inside of the outer nylon garment. The water is never in contact with the diver but he is kept warm.

Another interesting development which has been evaluated at the EDU is the push-pull system, the Mark 14 closed circuit saturation diving system. This is designed to be used from a PTC and circulates the PTC atmosphere to the diver using the PTC atmosphere control system to scrub the diver's carbon dioxide, The great advantage is the saving in helium compared with the more usual open circuit equipment. There are four parts to the system. The pump package, the PTC control console, the umbilical and the diver-worn equipment. Gas is taken from the PTC, compressed and pumped through a filter and through a hotwater heater to the diver's helmet. From the helmet it is sucked (the pull) through a water trap and a pump and released into the PTC.

The warmed gas enters the helmet through a diffuser (which reduces the noise level) and leaves through a safety exhaust valve and an exhaust regulator which maintains a relatively fixed positive pressure in the helmet while the suction on the downstream side is between 15 and psig. The safety exhaust valve is there to protect the diver in the event of the exhaust regulator failing. When there is a 50 cm of water underpressure in the helmet the SEV closes and blocks the exhaust path.

The USN requirements were not produced by three commercially available systems so the USN had to design its own system. There were problems with the pump design, limited life, high power demands and large size. The present pumps have proved reliable and the whole unit is the size of one of the gas cylinders on the PTC. Another problem during testing was the collapse of the return hose with its internal pressure up to 6 Ats less than ambient. Internal wire braid reinforcement was needed. For monitoring the equipment performance both manned and unmanned, a computerised system monitoring temperature and pressure a 6 locations as well as pump motor characteristics and helmet flow was designed. This allowed recording and retrieval of such things as helmet gas flow, minimum and maximum pressures over 3 second intervals and respiratory patterns.

Like all diving equipment respiratory resistances rise with heavy work. At 100 watts the helmet maximum pressure rose to 30 cm water during the 5 minute work spell and dropped again when the diver rested. At higher work levels the helmet pressure dropped (the diver was beating the pump) to levels which allowed some water to leak in round the neck seal.

Should Divers Use Drugs?

JM Walsh, PhD
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The title of this article may sound somewhat ominous, so I'd like to define and clarify what I mean when I talk about "drugs". Drugs come in many forms: they can be ingested, injected, inhaled, and even absorbed through the skin - and we are concerned about all of them.

This discussion will not be restricted to street drugs or to prescribed medications, because we want divers to realize that many substances affecting body chemistry (eg. aspirin, nasal sprays, alcohol, nicotine, caffeine) are not generally thought of as drugs - but probably should be.

If you follow the scuba literature you probably have decided, as I have, that there are two schools of thought concerning the use of drugs while diving. The Navy provides no specific instructions concerning medication and fitness for duty: the diving supervisor makes his decision based on the recommendation of the Diving Medical Officer (DMO), and that recommendation may vary considerably from one DMO to another. Some say there are a variety of drugs available that will counteract most minor problems and if you are unaffected by these drugs on the surface, you will be okay in the water. In direct contrast, many DMO's believe that under no circumstance should a diver ever take any kind of drug within the 24 hours before diving.

Now, it seems to me that there's room for discussion between these opposite opinions. So, I'd like to spend the next few paragraphs examining the facts and trying to evolve some logical recommendations and conclusions.

To begin with, there are many variables that alter the effects of drugs. In reality, there is no such thing as "a drug effect", because a drug never acts exactly the same in all individuals, or even in the same person on different occasions. The action of a drug depends, to a large extent, on the physiological and psychological makeup of the individual at the time the drug is administered and on the prevailing environmental conditions. A partial list of the kind of variables that can modify drug action is shown in the table.

Any drug can be toxic if you take enough of it and people vary widely in sensitivity - so much so that an appropriate dose for one person can be an overdose for another. Let's consider what happens physiologically and biochemically when we dive. In the underwater environment we are subjected to:

1) increased hydrostatic pressure,
2) varying partial pressures of N_2 and O_2 in compressed air, and
3) the interaction of changing gas and pressure with all of the variables mentioned above.

Pressure itself can exert numerous changes in our body chemistry. Many effects are obvious only at very high pressures, but even at the depths that divers are accustomed to, the increased work load of breathing under pressure can cause CO_2 buildup from reduced gas exchange and changes in blood constituents can occur. Cell membranes undergo pressure-induced changes, which may account for numerous hyperbaric phenomena, for example, nitrogen narcosis. Even oxygen, which is needed to sustain life, becomes toxic and can cause pulmonary damage and convulsions when the partial pressure is raised sufficiently. Research dives have shown that metabolic, hormonal, neurological and cardiovascular changes occur at depths as shallow as 90 fsw.

When you plan to dive, you must remember: changes in your body are going to occur during the dive, and this makes it tough to predict how a drug will act because so much depends on your physiological state and the environment, both of which are continuously changing. Even under carefully controlled conditions in our laboratory at the Naval Medical Research Institute, we have found that the behavioural effects of drugs change under pressure and that the way in which they change is not predictable from their surface characteristics.

Research in our laboratory has been concerned primarily with the behavioural aspects of drugs and how they affect neuromuscular co-ordination, judgement, emotional status, and the auditory and visual systems.

Our work has focused on three areas:

1) use of drugs to provide hyperbaric medical treatment for divers (eg. in recompression therapy and for emergency treatment requiring drugs that would work effectively and safely under relatively high pressures - ie. up to 1,500 fsw);

2) use of drugs to maximise the number of men available for duty and to prevent the onset of hyperbaric disorders (eg. a safe, effective drug for sinus problems, or something to prevent nitrogen narcosis);

3) unauthorized use of drugs (eg. self-medication, drug abuse, or excessive consumption of substances that may be harmful, such as alcohol or caffeine).

PARTIAL LIST OF VARIABLES THAT CAN AFFECT DRUG DISPOSITION IN A DIVER

EXTERNAL	INTERNAL	PHARMACOLOGICAL
Breathing Gas	Age	Acute vs. chronic
Current	Allergy	Administration route
Diet	Anxiety / panic	Bioavailability
Pressure (depth)	Cardiovascular function	Dose
Pressure x gas interaction	Circadian rhythm	Excretion
Nitrogen narcosis	Disease state	Metabolism
Oxygen toxicity	GI function	Presence of other drugs
CO_2 intoxication	Infection / fever	Tolerance
Visibility	Pregnancy	Vehicle
Water Temperature	Weight	

The programme is designed to comparatively evaluate drug compounds, beginning with studies involving small animals (usually rodents) and then thoroughly evaluating the substance in larger animals (monkeys or dogs) before testing it in human divers. The animals and humans are trained to perform similar complex tasks; then they are treated with the drug and exposed to normal and increased pressure conditions in a dry hyperbaric chamber. Because there are thousands of drugs available on the market, we have selected representative compounds from major drug classes for test and evaluation.

Results of these evaluations have demonstrated how widely the effects of drugs vary when introduced to the hyperbaric environment. Some specific observations follow (* indicates statements based on information where human evaluations have been conducted).

* Analgesics Aspirin and Acetaminophen (Tylenol) have been tested at depths to 180 fsw, and even moderately high doses (3-4 tablets) have not produced behavioural or physiological problems.

* Antihistamine (Benadryl) At prescribed doses we have consistently observed decreased performance, mental clouding and reduced fine motor co-ordination.

Decongestants (Sudafed) Behavioural effects of decongestants under pressure are not as toxic as those observed with the antihistamines, although we have seen some slowing of judgement and co-ordination. In addition, researchers and clinicians suggest that decongestants may predispose divers to cardiac arrhythmias.

Depressants Pentobarbital and alcohol have been evaluated, and the effects did not appear to get worse under pressure. However, alcohol intoxication, which can cause nausea or vomiting, would certainly be a problem for the diver.

Diuretics No behavioural effects have been observed at normal doses.

Hallucinogens Delta-9-tetrohydrocanna-binol (THC), the active ingredient in marijuana was evaluated in animals. The effects of marijuana, which interferes with cognitive processing and neuromuscular control, get worse under pressure, and these effects are magnified as the partial pressure of oxygen increases.

* Motion Sickness Remedies Dramamine, an antihistamine-type motion-sickness preparation which is actually a combination of antihistamine and stimulant, does not appear to produce any significant behavioural problems at depths to 180 fsw.

Stimulants Dexedrine, Wethedrine, and the antidepressant Monoamine-oxidase-inhibitors interact with pressure conditions to interfere with judgement and muscle co-ordination at depths as shallow as 50 fsw. These drugs also may have undesirable cardiovascular effects.

Tranquillizers Chlorpromazine, Librium and Valium caused changes in the dose-response curves from animal subjects when these compounds were evaluated under pressure. The magnitude of the effect was dose-and pressure dependent. In addition, although we have no data for humans, lack of alertness or overconfidence resulting from tranquillizers would certainly be troublesome at 100 fsw.

Now, these findings need qualification:

1. Although the studies were carried out under carefully controlled laboratory conditions, they were not done in the water, and the addition of that factor and its associated variables (eg. cold, anxiety, fatigue} certainly could alter the effect of drugs.
2. As you've seen, we have not completed all of the evaluations with humans. Some of the conclusions are based on animal research and, therefore, direct inferences about humans must be made with caution.

In summary, there are three important facts that you should remember when you plan a dive: 1) Changes in your body chemistry occur while diving; 2) many variables affecting drug action can come into play during a dive; and 3) the interaction of these facts (1 and 2) cause drugs to change unpredictably.

Recommendations

- It would be wise to avoid all drugs while diving.
- Remember that over-the-counter preparations can be as toxic as prescription or abused drugs.
- If you must dive under medication be informed. Get full information from your diving medical officer, realize that even the most benign compound may become behaviourally toxic under pressure, and dive with extreme caution.

Reprinted from FACEPLATE

THE FLYING DIVER

Dr Christopher W Dueker

A glance through a dive magazine reveals the many opportunities available to recreational scuba divers for exotic vacations. Unfortunately the dictates of schedules, land transportation, etc. often mean that a seven day trip includes just four days of diving. Consequently, the diver may be tempted to spend his entire vacation diving right up till flight time. This may result in on unexpected case of decompression sickness.

On land, a diver's tissues are completely saturated with nitrogen at a pressure equivalent to the partial pressure of nitrogen in the atmosphere. During a scuba dive, the body absorbs more nitrogen since the nitrogen pressure increases with depth. This excess nitrogen is eliminated during ascent to the surface. Usually some excess nitrogen (compared to the pre-dive state) remains in the tissues upon surfacing. Decompression tables are designed to keep the surfacing nitrogen below the level likely to trigger decompression sickness. Combinations of dive depth and duration are matched with tables permitting either direct or delayed ascent. It takes over twenty-four hours to completely eliminate the excess nitrogen. This slow surface elimination of nitrogen forms the basis of the "repetitive dive tables".

Going above sea level in any fashion driving, hiking, ballooning, or flying causes the pressure on the body to fall. Oxygen and nitrogen pressures are lower in Denver than in San Francisco. Sea level nitrogen pressures are just as excessive at 18,000 feet (one half atmosphere) as nitrogen pressure is at 33 feet compared to sea level. Aviators are subject to decompression sickness at high altitudes. Of course, they also suffer from hypoxia unless oxygen is supplied by mask or by aircraft pressurization. Pressurization of cabins almost eliminates the risk of decompression sickness in aviation. Military aviators have the opportunity to make low pressure chamber excursions to altitudes equivalent to 25,000 to 40,000 feet. These exposures are done to familiarize crews with low pressure problems. To prevent hypoxia, oxygen is breathed throughout the "flight". Before leaving sea level, the crew breathes oxygen to reduce their nitrogen stores. Complete nitrogen elimination would take more than twenty-four hours, but a significant amount can be eliminated with thirty to sixty minutes.

Despite all precautions, decompression sickness does occur in high altitude exposures. The incidence varied from 0.012 percent to 0.38 percent with the group studied. Of interest, about 25 percent of the cases of decompression sickness occurred at an altitude lower than 25,000 feet (0.37 atmospheres). This, in the presence of oxygen, pre-breathing refutes the widely held belief that decompression sickness is difficult to induce during low pressure exposures. The data comparing diving and altitude decompression sickness are not available; however, the major reports give a diving decompression sickness incidence of about 0.047 percent for air diving.

Aviators have one major advantage over divers. Returning to sea level alleviates aviation decompression sickness since it is a recompression from altitude. About 28 percent of the cases completely resolve when sea level is reached. The remainder sometimes require chamber treatment.

When a diver becomes a flyer, the problem of nitrogen elimination gets more complicated. The excess nitrogen remaining offer a dive increases the likelihood of decompression sickness upon further decompression to altitudes above sea level. The total nitrogen equals that remaining after the dive plus the body's normal amount. As atmospheric pressure decreases, the stored nitrogen becomes excessive and may cause decompression sickness. Essentially the flying diver is at risk from a combination of diver's decompression sickness and aviator's decompression sickness.

The potential risk of decompression sickness associated with flying after diving is very great.[1] Fortunately, there have been very few such cases reported. Two factors explain the low incidence. First, gas elimination progresses during the time the diver moves from the dive site to the airplane. The inefficiency of travel usually makes this a relatively long time. Second, commercial airplanes are pressurized so that ambient pressure does not decrease to those levels seen in low pressure chamber excursions.

Most divers have been subjected to several "rules" about flying after diving. Confusion abounds since there is no well established standard for flying after diving. Considerations include: the dive depth, dive duration, surface interval before flying, number of dives made, altitude reached, duration of flight, and the diver's physical status. Because of the many possible dive/flight combinations, it is not surprising that no single rule suffices.

The problem of altitude reached is minimized by the virtual standardisation of commercial airplane pressurizations. Planes usually fly with 8.6 pounds-per-square-inch added to ambient pressure (of course the added pressure varies so that the total does not markedly exceed 14.7 psi). Thus pressure remains at sea level until above 20,000 feet. At the usual maximum altitude of 41,000 feet, cabin pressure is still 10.9 psi (0.74 atmospheres) - equivalent to 8,000 feet altitude. Pressurization failures are very rare and are treated by rapid emergency descent.

Probably the first official directive on flying after diving appeared in 1962 in the Naval Medical Newsletter. Based very loosely an experiments in man, it prohibited flying to cabin altitudes in excess of 18,000 feet within 12 hours following a dive to 30 feet.

This rule was very restrictive and did not appear to consider the much lower attitude during most flights. Several other approaches were taken in the late 1960's to determine new standards.

Navy work with dogs actually suggested a more restrictive policy. It prohibited flying above 8,000 feet within 12 hours of a 2.5 foot dive.

Attempts to facilitate flying after diving led to human experiments for short dives (120 feet for 15 minutes) medium dives (40 feet for 200 minutes) and saturation 30 or 33 feet for 24 hours). The conclusion was that a two-hour surface interval was satisfactory except for dives requiring decompression - then 24 hours was advisable. This investigation has been widely quoted often with very incomplete understanding. Repetitive dives were not studied.

Another approach utilized by the Canadian Defence Research Board has used the decompression computer model to construct non-tested tables even more liberal than those using a two-hour surface interval. A commonly overlooked disclaimer of the Canadian tables is that they are designed only for "must fly" situations. Under normal conditions, a 24 hour wait is advised.

Computers were used in a large, formal study which was the first to utilize repetitive dives. Since the maximum dive depth was 47 feet, and since these schedules are untested, they have received little attention.

Another method using extrapolation from diving tables concluded that flying to 8,000 feet was safe, if the diver was in Group D of the repetitive dive system. This approach is untested and based on the assumption that it is safe to extrapolate from diving experience to altitude exposures.

Several problems make all flying-after-diving policies suspect. Basic to all decompression studies is the realization that individual variation drastically affects results. None of the derived tables has been tested adequately. Computer models suggest tables, but they cannot be assumed to be capable of producing reliable tables.

Most sport divers make several dives in a day, and the best tested tables do not account for this. After several days of diving, the decompression requirements are different than after just one day.

Decompression dives or recompression therapy invalidate all the derived programs.

The experiments which created the two hour surface interval actually ignored certain symptoms: short term pain and skin itching.

Finally, all the existing diving and flying schedules were developed before the current interest in asymptomatic bubbles - "silent bubbles". These bubbles develop in many standard dives and probably would occur in most of the liberal diving and flying programs. The importance of “silent bubbles” has not been firmly established, but they may have long term significance. At any rate the current goal in decompression research is to reduce the incidence of “silent bubbles”.

What is the average diver to do? Consider that most commercial and military agencies are moving toward conservative policies; ie. 8-12 hours after “no decompression” dives before flying. Saturation divers may be kept at sea level for up to a week before being allowed to fly. Remember also that 7% of decompression cases develop after six hours on the surface. A plane trip shortly after a dive would aggravate an already developing case of decompression sickness.

There is one way to safely shorten the time between diving and flying: breathe pure oxygen. But this is not usually practical and would be inadvisable over a long period.

The prudent diver plans his diving vacation carefully by putting the heaviest diving days in the middle of the vacation. This provides a day or two for familiarization of the dive site and gives time for maximum nitrogen elimination.

Save snorkelling and shopping for the last day. Remember that the low incidence of decompression sickness in flying divers is due more to the blessing of inefficient travel connections than to any safety factor. The risk is genuine.

1. Any mode of altitude change can be dangerous as demonstrated by divers who got decompression sickness during a post-dive bus trip.

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Epilepsy and Diving

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It is estimated that since the mid 1950’s, more than two and a half million people have been trained in scuba diving in the United States of America, with probably somewhere under a million of these remaining as active divers from year to year. The popularity of the sport indicates that at some stage a physician may come in contact with a person who wishes to dive. Although there has been a wealth of knowledge produced in the fields of hyperbaric medicine and physiology, in an effort to delineate the stresses and limits of man’s exposure to pressure, there has not been a concomitant dissemination of knowledge of diving medicine amongst the general medical profession.

Some of the stresses which face the diver include the consequence of inadequate medical and physical fitness; the effects of changes in ambient pressure on gas-filled body space and on density of breathing pressure of inert gas, oxygen, or contaminants, such as carbon monoxide; the effects of too rapid a reduction of ambient pressure; immersion in cold water and excessive heat loss; and psychological disturbances due to confinement, isolation, darkness and danger.

In the diving manuals of most Navy and civilian organisations, the importance of medical fitness to dive is always stressed. Perhaps the first step in ascertaining “fitness to dive” is that of ensuring the absence of the various diseases which are incompatible to diving. These conditions may not prevent participation in any other sport, but are especially relevant in diving because of the changes in ambient pressure involved. Also, any disease state which may produce unconsciousness or incapacitation is potentially fatal under water. Although the various Navies of the world have long demanded stringent medical assessments of their prospective and active divers, and most commercial diving organisations are realising their importance, this has not been so in the sport diving field.

Some sport divers may find themselves in the situation where they are more aware of the special medical problems of diving than their medical attendant. It is therefore, of obvious importance that the medical examination should be carried out by a doctor familiar with the medical aspects of diving. There are no doubt, instances of diving fatalities and accidents, which would not have occurred had the victims been assessed medically and advised against diving.

Meckelnburg (1978) states that in the USA all nationally recognised training organisations now require physical examinations of prospective divers before they are allowed to undertake scuba training. Commercial training is even more difficult, and since 1977, regulations promulgated in the Federal Register by the Department of Labour have controlled standards in the diving industry. These regulations produced various reactions amongst different groups - some American diving contractors claimed that to follow the restrictions would put them out of business. The university scientist and scuba shop salesman claimed that it did not relate to them. It thus became obvious that standards may vary with the type of diver.

The population at risk is perhaps difficult to estimate exactly. Apart from commercially employed divers, there are probably large numbers of self-employed semi-professional people or even rank amateurs engaged in underwater work. Such work may vary from harvesting sea life such as abalone to the extremely deep, hazardous, complex off shore diving related to oil exploration.

The problems are enhanced when a person previously self employed as on abalone diver with perhaps little or no training, who may have disqualifying defects, decides that he wants to work for a commercial firm as a qualified diver. Prior to the introduction of more stringent regulations, some of these people could well have been employed by commercial diving companies, and these people could be asked to perform tasks beyond their professional and technical abilities without any consideration of their physical capacity to tolerate the new stresses involved.

Obviously, off shore oil exploration poses the greatest area of risk as many of these diving operations are carried out hundreds of miles from shore where medical and support facilities are lacking and weather conditions may present problems when medical attention is necessary or a casualty occurs. Experience in the North Sea oil fields and from the Gulf of Mexico oil fields indicate that for the year 1974, the fatality rate for off shore diving was 111 fatalities per 10,000 persons per year. This contrasts to an approximate 2.6 fatalities per year per 10,000 persons engaged in general construction industry and mining industry.

In Australia, standards have been laid down by the Standards Association of Australia, Code CZ18 1972. Underwater air breathing - Appendix A - Medical Standards for Divers. This document places special emphasis on the absence of pathology in respiratory, cardio vascular, special senses (visual and auditory) and the nervous system. Table A5 in this document relates to neurological conditions as follows:-

> "No serious signs or symptoms are acceptable. Migraine is acceptable, but this may be precipitated more frequently by diving. A history of epileptic episodes and syncopal attacks are an absolute bar to diving. Almost any neurological disease makes diving inadvisable."

Meckelnburg lists the following neurological conditions which are absolutely disqualifying:

a. Any reason to have sudden loss of consciousness.

b. Seizures after the age of five and unassociated with febrile episode.

c. Any central nervous system disease such as neurosyphilis, multiple sclerosis, etc.

d. Psychosis.

e. Brain tumour.

f. Meniere's disease.

g. Severe migraine.

h. Head injuries present a series of variables that have to be assessed carefully. Head injuries which are absolutely disqualifying are:

    1. Unconsciousness for a period greater than forty eight hours.
    2. Depressed skull fracture.
    3. Known brain laceration.
    4. Sub-dural or epidural haemorrhage.
    5. Intracerebral haemorrhage.
    6. Post traumatic meningitis.
    7. Rhinorrhoea or otorrhoea persisting persisting far more than seven days.
    8. Seizure at the time of a head injury.
    9. Any persistent neurological defect after head injury.
    10. Any persistent EEG change.
    11. A persistent higher intellectual defect.

Individuals would be disqualified for up to two years who have normal EEG and normal physical examination, but who are unconscious for a period of two to twenty four hours with or without a linear skull fracture. Included in this group would be people with post traumatic amnesia for greater than twenty four hours and a post traumatic syndrome with memory loss, personality changes, and disequilibrium for a period up to two months.

A diver with a head injury could be returned to diving offer a period of three months if he had the following qualifications:-

l. A linear skull fracture with fifteen minutes of unconsciousness or less.
2. Loss of consciousness ranging from fifteen minutes to two hours, but no fracture.
3. Cerebro spinal fluid, rhinorrhoea or otorrhoea lasting less than seven days.

Divers suffering neurological bends with a spinal cord lesion or brain lesion could be returned to work if the neurological deficit clears completely, but in the face of persistent neurological deficit, such a diver should be disqualified.

Whatever the cause of a seizure occurring underwater, a fatal outcome can rapidly follow, and it is because of this that standards of fitness to dive have been laid down by various authorities. Current British Naval practice does not accept an individual with an EEG suggestive of epilepsy, even if the patient has never had a fit. United States Navy regulations state that "Organic brain disease, seizure disorders of any sort ... shall be disqualifying". In Britain, the memorandum for medical officers who have been approved by the Secretary of State, Department of Energy to undertake the medical examination of commercial divers in the North Sea states that epilepsy is among the conditions which disqualifies a man from diving. The British Sub-Aqua Club has recently decided to exclude from diving those with a history of epilepsy.

In France, a medical examination of fitness for diving sometimes includes an electroencephalogram examination for professional divers. Corriol et al. (1976) studied ninety professional divers of whom thirty seven displayed EEG patterns susceptible of being interpreted as falling outside the limits of strict normalcy. Previously such patterns have sometimes been considered incompatible with diving, or even pathological by other authors. They proposed a general guideline which placed subjects into three groups fit, unfit, and questionable. In the latter group, a final decision was taken in each individual case in relationship to other medical examinations and was also related to the type of diving being considered. Their article details explicit EEG criteria, of definitive or temporary fitness and unfitness. In line with the recommendations of the British and United States Navies, any subject possessing clear EEG patterns of epilepsy of any kind, was eliminated from further consideration even in the absence of clinical seizures. They did not regard moderate photosensitivity (spike and wave evoked only by photo stimulation) without other evidence of epilepsy as being incompatible with recreational diving provided that regular medical observation took place.

SUMMARY

Because of the large number of people engaged in diving, either commercially or for sport, various regulations have been drawn up by different institutions to govern the health standards of people engaged in this activity. All authorities agree that epilepsy is on absolute bar to diving.

REFERENCES

1. Corriol J, Papy JJ, Jacquin M and Blanquet, F. What EEG criteria for diving fitness. Aviat. Environ. Med. 1976; 47(8): 868-872.

2. Lowry CJ and Thomas RL. Medical Examinations for Diving - a review of 478 candidates. Twentieth World Congress Sports Medicine. Congress proceedings. 1974: 354 - 362.

3. Meckelnburg RL. Medical Requirements for Scuba. Del. Med. Jnl. 1978; 50(1): 25-28

Panic, Training and Personality!

Dr Irvin A Kraft

Panic is a state of unreasoning fear in which the person acts counter to his training and self-interest. In this condition of excitement the higher centres of the central nervous system relinquish control: and the mere primitive brains, together with the emergency nervous system, take over. Man tends to act like a lower order animal desperately struggling to survive. Primitive movement and escape patterns dominate the behaviour.

In such a state, a diver will in effect be asking for death-dealing complications to a complex set of ordinary scuba behaviours. This lack of cortical or thinking control simply cannot deal with elective actions. Automatized activity, such as dropping a weight belt, will come through early on in panic, but in the later phases very little can break the cycle.

Panic is not a primary response pattern of the human organism, but it is secondary or tertiary to a sequence of events or stimuli. These stimuli must occur in a situation of stress, as the individual diver so interprets his particular situation: for what stresses one person might not another. The stimulus situation usually carries with it some degree of strangeness or even may be totally foreign to the diver. This can be realization of being "too deep", sudden disorientation, lack of air, quickly being caught by a strong current, etc. In common, there is an overwhelming sense of not being in charge of one's self and, of course, one's equipment. This flash of awareness acts to alert the pituitary-adrenal medulla sequence for emergency mobilisation, and in a very complex way, the whole organism girds itself to survive - as if it were about to operate without cortical control. Breathing increases rapidly: pupils dilate; eyes open wide and dart apart; the heart beats very much faster; blood vessels in the gut constrict and shunt blood to the limbs.

One can readily see how skilled functioning drops in efficiency. Clutching fingers and awkward limbs do not do well with equipment designed for fine movement, such as releasing a belt buckle. What can't be seen such as equipment attachments and releases hidden from view by a flopping BC, can hardly be manipulated.

This description deals with the extremes and we must also recognise that anxiety or tension states differ from panic. With certain procedures that can be trained into the diver, he can then assert more self-control. Anxiety of this sort, such as examination anxiety, can be useful to tune up the body and perceptions for more efficient procedures. Yet, as most of us know, one can "freeze" in a test and not be able to perform well at all, despite knowing the material. And, in diving, when some of us use amphetamine compounds (such as Sudafed) for vasoconstriction, we are adding to the blood a chemical that acts like the epinephrine the body produces for the alertness of the tension state.

The main point here is for the diver, especially the novice, to be familiar by explanation and thereby experience with these phenomena and not construe them as foreign or bad or shameful. Recognition is the first step to mastery. Each beginning diver needs this as part of his training so that he becomes cognisant of his own individual patterns, says hello to them, and then handles them in such a way that these signs work for him. He doesn't just dismiss them, but searches himself and his situation for clues to what his vigilance system is translating as danger or threatening.

Sixty percent of our respondent divers reported self-awareness of apprehension or tension prior to a dive. Most often this occurred in the hour preceding entry. And, contrary to expectations from the research with sky-divers, in our sample about one-half of those reporting this had 5 or more years of diving experience.

What correlates with tension states or even with panic? Most of our sample (54%) did not have pre-diving life experience that led to episodes of fear or to panic. Of those who had such an experience, they reported predominantly episodes of specific traumas or well delineated phobic patterns. Gender does not matter in either pre-training or training tension incidence.

Once training commences other factors enter to influence the trainee's inner states. The age of the trainee tends to differentiate responsivity to the teaching and the exercises, as youths and adults of the early 20's take to these much faster. This was born out in our study, for 46% of the respondents were over 30 years of age and aged 25 and over at the time of training, and of these 15% reported episodes of panic in training. This compares with 22% of the 38% under age 25. In sum, perhaps instructors should seriously consider the age distribution of their classes and guide instruction accordingly. Also alertness for signs of tension and panic should be enhanced for the older aged trainees. More repetition for this group in a slower manner of various basic exercises would be helpful. Pacing the training is quite important.

Then how much time and effort might go into panic training per se. We mentioned above self awareness of one's own patterns for detecting tension and panic. Our statistics emphasize that in training there are fertile and frequent opportunities for encountering and managing panic since 61% reported such instances. Also 36% of the 61% reported they witnessed others experiencing panic in training. With such a high incidence one wonders if present training deals adequately with panic in pre-pool didactic material and in current pool methods.

A majority of reporting divers considered their instruction in this area inadequate. The equipment cannot be faulted as such, even though it is initially strange and counter to instinctive patterns of the human animal. Less than a third of our divers reported serious problems with their equipment during training. It seems that the verbal content of instruction didn't get through to the trainees. We established this by questioning them about their security feelings with their instructors as persons and leaders. Repeatedly they affirmed instructors set good examples of confidence, skill and assurance, primarily by actions and comments, but not by the substantive content of their formal material.

A major factor that seems constantly underplayed and not adequately emphasized in training is the open-water training and check out dives. Most of the non-pool or "real" diving experiences took place in lakes and was a part of training for 74% of respondents. The real question is how many is enough and under what conditions should the initial openwater training dives take place. Should it be in water deeper than 30 feet? Should it be by one or two trainees with the instructor? Shouldn't students in the older age bracket have repetitive descents and ascents as part of the first dive in open water? Over three-quarters of our respondents emphatically indicated the high importance and value of such experiences. They also emphasized (62%) the inadequacy of open water training. It is almost akin to the first solo flight in pilot training in establishing patterns of confidence and capability.

If we were to suggest one key emphasis for this phase of training, we would urge the instructor to reiterate to the student: “You are in training until you truly know your equipment constantly works for you and not you for it underwater.” If the trainee finds himself still frequently checking and rechecking before entry and then doing similarly once down, then, for example, he is labouring for his equipment: it is not serving its purpose to enable him to be part of the ocean and to enjoy it fully.

We suggest it might take up to 10 openwater dives before the student truly feels comfortable and free from his tensions. In our sample, 58% had one or no dives pre-certification. And, as Schenck and McAniff[1] point out, 7% of fatalities occur on the first open water dives and 23% on an early one.

We suggest another variable that needs re-emphasis. Where the trainee’s diving is being done. Those of us who underwent Caribbean experiences have no real insight experientially to the different and much more stringent conditions of the Pacific Northwest, such as Puget Sound. The different body sensations and encumbrances of the hood, full wet-suit, and thick gloves can lead to a feeling of being constricted and discomforted to the extent of on increase in tension - as if in a big rubber band.[2] These combined with poor visibility, add to the chances for the novitiate to develop a high level of anxiety. Thus, those who teach in warm water areas need to emphasize retraining with appropriate instructors in areas so different from the original one.

To look further into the experiences related to panic, we examined life-threatening situations our respondents (61%) underwent post-certification. These included being short of air below 60 feet without a buddy nearby, using a faulty pressure gauge, being caught in a strong current, and surface struggles far from the boat or shore. Despite the seriousness of the crisis only 14% reported panic as the major response, mentioning not ditching his tank nor dropping his weight belt nor inflating his vest. With closer questioning we picked up on additional 22%, making it one of three verging on or into panic.

Yet, most of these divers couldn’t finger the factors in themselves that might have correlated with their panic response. They could objectively list what they considered the main components or problems connected with panic. Seventy-nine percent thought lack of training or experience after certification played a major role. And exceeding accepted limits, such as dive tables, was next in frequency. Over one half suggested a nervous or hysterical personality played a big role.

Before moving to the next section which deals with subjective aspects of panic and training for it, let me mention that of the divers who had experienced panic:

42% failed to drop weight belt
31% raced for the surface
29% failed to inflate vest
29% did not jettison tank
22% later found air still in tank
22% ripped mask off at the surface
10% took mask off underwater
14% did not turn to buddy for aid

This group of divers were mainly in the 25 and over age group.

When we try to see what are some of the underlying dynamics, the pushes of behaviour, in divers and panic, we need to examine several basic considerations. Among those most important in training is the role of the instructor. Without question he represents an authority figure to the trainee. Under such circumstances, students tend to identify with him, while casting him into various types of authority figures that have been most meaning to them in previous years.

Thus, the instructor of scuba, in contrast to an English teacher or shop instructor or tennis pro, has to get through to the student certain attitudes that can mean life or death in time. Calmness, knowledgeableness, assurance, awareness, alertness, and pleasurableness: these serve as the models with which almost any personality type of student can identify. The trainee incorporates these notions into his own self-image as a diver.

This unconscious identification process serves as under-pinning to the steps necessary to master the equipment. The student just knows it is possible to dive well since the instructor personifies all of it. He also realizes the instructor carries with him at all times a great deal of book and experiential knowledge, which is integrated into his underwater behaviour. This sort of mental picture serves the apprentice as a model.

Standing in his way are images and fantasies of what and of how he is going to be doing and experiencing. Fears and negative, as well as positive, anticipations come through. The task of training is to transmit both scholarly and practical information to the trainee within the frame of his pre-set self-image as it undergoes change with the program. One suggestion here is that a known method or resource for handling the less conscious aspects is to have the training group break into small (6 or less) member groups for discussion of these concerns.

The instructor can construct the groups or let them form by self-selection. They are told to rap or talk about what they feel about the total training up to that point. He (and his assistants, if available} might float from group to group, being accepting of any negative contents that he might encounter. He can share any personal scuba experiences if appropriate. The small group interaction should help lessen tensions and even bring to light panicky episodes not perhaps known to the instructor to that time. Several of these sessions, spaced throughout the programme should be of high value to all concerned. The instructor can suggest they deal with the tension and anxieties, if present, with each step of the training - especially with ditch and recovery buddy breathing, etc. He can emphasize their openly speaking of self-recognition of early signs of tenseness and how others deal with the same phenomenon. The irritation factor, a feeling that the equipment just isn’t correct, can be discussed: how often it really isn’t the belts and tubes, but more they are the objects on which the trainee projects his concerns and fears. The instructor can emphasize, as in our study, probably 60% or more of divers do respond to life-threatening episodes with non-panic behaviour. Again, the point is that tough situations are somewhat built into scuba itself, so handling them can be routine also.

He can ask them to practice relaxation exercises in which they learn more about breath control and large muscle mass relaxation. Just to have a specific routine or procedure that works toward control remains as a measure available - such as minutes before entry. Have the group mentally rehearse procedures to handle certain situations: out of air, exhaling to surface, dropping weight belt. If they do this with eyes closed it is better: for, after all, they can’t see the buckles anyway in reality.

Among the psychodynamics of people and scuba, one is our difficulty in letting go of things in life- money, spouses, and weight belts. Let me mention some ideas that might be of interest to you, perhaps even to be incorporated in teaching. Man is a nose-breathing animal with the major olfactory functions long lost in evolution.

To restrain the use of the nose in respiration is quite a departure from normal breathing patterns. As a side light, mouth breathing is used frequently in our culture as a sign of retardation or dullness. Thus, to put the nose to rest in respiration - except for mask clearance - takes some retraining.

And, this is the essence of scuba training with equipment: how to make the equipment fit the body image of the individual using it?

Any really effective equipment that we use in a familiar or strange environment should really be an extension of our fingers, our eyes, our functions, such as breathing. The epitome of this seen in the equipment used by experimenters in handling radioactive materials, whereby tiny motors translate finger movements into metal claw motions twenty feet away.

We learn how to make the equipment an extension of what we call our body image. You are familiar with this in driving a car. The beginner clutches the wheel when he drives between two cars. Later on, he has his mental cat's whiskers which are really connected to the fenders, so that he spreads out his body as his mind sees it, and he goes in the middle lane between the two cars with impunity. That is an extension of the body image. One of our difficulties is how to extend and make the scuba equipment part of our body image. It takes a long time to do it, longer than under most circumstances of the equipment that we wear. Compare with the hunting rifle: you point it like your pointing a finger. Not the scuba equipment. In fact, one of the interesting things about the tank is that it is on our backs and presumably that is the most logical place for it. Yet, if you think psychologically about people, we know from experiences of very disturbed patients that the one thing that is most ill-tolerated is any approach from the rear. We have this built into us psychologically, and what do we do in scuba? We put the life-essential part on our backs. We have to reach back in a clumsy way to turn some kind of a J-valve, and that's our life back there, and it's back of us that we are most vulnerable psychologically.

So, in many ways the equipment is quite alien to our images. The older the diver, the longer it takes to get that acclimatization, to get that union of the equipment within himself so that he performs and the pack on his back becomes him, not on alien foreign object.

In sum, one of the major aesthetic aspects of scuba diving is that it is a very focused experience in life. You have a start and you have an end with each dive, and it has definite time restrictions in terms of amounts of air. Where in ordinary life do we have this concentrated experience along with an element of danger to our lives? A dive is an intensely visual experience primarily, initially, and later on, when the trainee becomes at one with his equipment he odds the physical body part of "flying" in the water. The diver truly does his own thing while still being responsible for another person. Diving has a unique set of characteristics that make it so different from ordinary life and this produces the hypnotic effect that keeps people diving.

REFERENCES

1. Schenck HV and McAniff JJ. United States Underwater Fatality Statistics 1973. US Dept. Commerce/US Dept. Transportation Report URI-SSR-75-9, 49p. May 1975.

2. Personal communication with Michael Bonsignore, October 22, 1976.

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IDLE TALK: MILDEW ON YOUR HEAD-DRESS AND OTHER BELIEFS

In the field of Sport Medicine there are certain shibboleths that date back to pre-historic times, though this ancestry is probably recognised by few because they are accepted as being so self evidently correct that thought as their origins is neglected. One such belief is the need for abstinence from sexual activity before important events, a belief accepted by most participants and their guides and trainers. From the Shaman before the hunt to the Sport Administrator before the Olympics the belief has been handed down unchanged, and largely unquestioned, with those who seek to buck the system being ceremonially drummed out of the privileged group of those eligible to take part. Afterwards, naturally, "to the victor the spoils". Although the rigidity of Official Pronouncements has been greatly reduced in recent years there is probably a groundswell of residual belief in the truth of such folk knowledge, little attenuated by the onslaught of other opinions.

With the increased involvement of women in diving we should be alert to the possibility of inventing Eternal Truths concerning the dangers they, as compared to male divers, will face. There is naturally the obverse of this, the belief that there can be (because nobody can admit to sexual bias nowadays!) no special factors. The most obvious areas of unthinking beliefs will relate to the menses, the susceptibility to decompression sickness, and resistance to cold stress, of the female with her (usually) greater supply of subcutaneous adipose tissue. The correctness of the medical advice we give will be judged by our successors. They will have the invaluable aid of the retrospectoscope, an instrument we cannot program because it is only now that accurate knowledge is being collected about divers, both men and women though especially the latter group. This is in itself a critical comment on the completeness of past approaches to the acquisition of the basic facts relating to man's problems underwater and under pressure. The fault is now being remedied and all are urged to aid this task. It has taken far too long to recognise the variability factor in divers, both between people and within themselves on different occasions. For too long the Tables have been treated as if they were the Laws of the Medes and Persians of ancient days. Nevertheless there are certain general truths that govern all, else no rational behaviour would be possible and every action would be an assay of the unknowable. Careful divers "cover the field" by adding a step to the depth and times of their dives, the famous J-Factor of the Americans.

These thoughts have been prompted by a couple of recent news items, and made timely by the recent papers by Bolton, Bangasser, Bassett and others. A modern authority on Sport Medicine, Dr Ken Fitch (Senior Medical Officer - Australian Olympic team), has been quoted recently as saying that there is a greater risk of a fatal heart attack from sex, particularly extramarital than from jogging. So the careful athlete is still being urged to be ... careful. And one can commiserate with the Motalyva dancers from the Banks Islands. They are forbidden to have sex for the two or three weeks it takes them to prepare for their performances. Much of this time is spent in the construction of their head-dresses, which are destroyed after the performances. They are allowed sex while the performances are current so being free from some at least of the restrictions formerly binding on the European participants at Olympic events. The increased popularity of the dance group has rather obvious disadvantages for the individual members, but this is seemingly unavoidable. Mr Luke Dini, the Minister for Communications, Transport and Civil Aviation of their country and their organiser, is adamant on the importance of this rule and the absolute impossibility of concealing violations. “Someone did it once and his head-dress turned the wrong colour. The head-dresses should look fresh and shiny and if they break the rules and have sex during the time they are making them, the leaves they use go to mildew and the whole thing just looks old. So nobody will do it, because we’ll all know.”

Before you think that it is just tradition bound Islanders and that strangely dedicated group who spend their most active years trying to run, jump or swim better than anyone else who hold such monastic principles, look around. Janice Kaplan, in Women and Sports, has written “Taboos and Amulets for menstruating women may be relics of antiquity, but where sports and menstruation are concerned the calendar got stuck centuries ago. At one girls’ school, for instance, the students are not only allowed to excuse themselves from gym classes once a month, but are required to do so. The school’s director stated that they would not permit amusement that would interfere with procreation. And in California women who wish to compete in authorised professional boxing matches must sign a statement that, to the best of their knowledge, the contest won’t take place during a menstrual period. Nobody in the Boxing Commissioner’s Office could explain that regulation, except to say “We are aware that women are different from men”, a statement few could fault.

We must be alert to the need for care in evaluating evidence, which in some cases has never been sought for in an organised fashion, before greeting the growing awareness of the differences in physiology between men and women with a rigid and unthinking blank of caution. It seems somewhat callous to say so, but Diving Medicine has been developed, and continues to be modified, by collecting and evaluating incidents that have afflicted the diving population. So what is now required is an ongoing and alert review of women as divers to determine whether in fact special precautions are mandatory. Bear in mind always the comment of a very sagacious man “It’s not what you don’t know that kills you, it’s what you do know that just ain’t so”.

CONSTITUTIONAL AMENDMENT

The constitution adopted in 1975 has proved to be unworkable. The committee has revised the constitution and a copy of the revised constitution is enclosed with this edition of the Journal / Newsletter. In order to cut costs and save on effort the constitution will be assumed to have been acceptable to members if less than 25% of the membership write to the Secretary (Dr CJ Lourey, 43 Canadian Bay Road, Mount Eliza, Victoria 3939) objecting to the new constitution by March 31st 1980.

THE DIVING HABITS AND OBSTETRIC COURSE OF PREGNANT SCUBA DIVERS

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PROJECT REPORT

Margie E Bolton, RN BSN

Hypoxia (decreased oxygen), hyperbaric oxygen (100% oxygen at increased atmospheric pressure}, and hypercapnea (increased carbon dioxide) have been demonstrated to cause malformations and death in developing laboratory animals; however relatively little research has been done to determine the effects of compressed air upon the developing foetus. When breathing air at increased atmospheric pressure, inspired pressures of oxygen, carbon dioxide, and nitrogen increase in a direct ratio to diving depth, causing subsequent elevations of oxygen and nitrogen in the blood. Circulating bubbles may also form during decompression (when pressure is reduced) due to gas expansion at a more rapid rate than the elimination rate. These bubbles are believed to cause decompression sickness directly, by obstructing blood flow or indirectly, by causing blood clotting. Bubbles have also been demonstrated in humans following non-decompression dives (70 feet for 50 minutes) in the absence of decompression sickness (Martin, 1974; Spencer, Johnson and Campbell, 1976). Decompression sickness is a symptom complex which may include joint pain, rash and itching, difficulty breathing, and if severe, death.

It has been widely speculated that bubble formation or hyperoxia (increased oxygen) in the developing foetus could cause birth defects or death. Although bubbles have been demonstrated in foetal goats (Boycott, Haldane and Damant, 1908), dogs (McIver, 1968) and sheep (Fife, Simmang and Kitzman, 1978) following exposure of pregnant animals to compressed air, harmful effects have not been established. Additionally, although hyperbaric oxygen has been demonstrated to cause foetal death and malformation among rats (Miller, Telford and Haas, 1971; Telford, Miller and Haas, 1969) and rabbits (Fujkura, 1964), these same studies failed to produce greater than normal frequencies of harmful effects in control animals which were subjected to compressed air at less than 3 atmospheres absolute pressure (an equivalent of 66 feet sea water).

There are close to three million certified scuba divers in the United States alone, and 200,000 new divers are certified annually. It is estimated that 20 to 20% (sic) of these divers are women in the childbearing years, an increasing number of whom are engaged in scientific and commercial diving. Many of these women will dive during the first trimester before pregnancy is confirmed; others will dive throughout pregnancy without a knowledge of the potential risks involved.

An international survey of pregnant scuba divers was funded by the Florida Sea Grant Program (grant #231*A03) and conducted from 1 April 1978 to 31 December 1978. The purpose of the research was to describe and compare the characteristics, diving habits, and obstetric course of pregnant scuba divers. Frequency of complications among pregnancies during which women dived were compared to frequency of complications among pregnancies during which women dived prior to, but not at any time during pregnancy. Although over 300 questionnaires were completed and returned, many of these women were still pregnant and will be the subject of a follow up study.

The data-producing sample consisted of 208 women from 39 states within the United States as well as many women from Canada, and others throughout

Europe, Australia, Central and South America, and Pacific and Caribbean Islands.

The "typical" pregnant scuba diver was a 28 year-old white, college graduate who was in excellent health and pregnant with her second child. Whether or not she dived while pregnant was directly related to advice received from her physician, approval from her family, and level of scuba certification. If she decided not to dive, the reason given was that she was worried about the effect it might have on her baby. There was no relationship between age or previous medical and obstetric history, however a number of women sampled had important medical problems including asthma, epilepsy, and diabetes.

Of the 208 women sampled, 136 dived at some time during one or more pregnancies. The usual depth of dives made during pregnancy was 45 feet (13.7 metres) however many reported dives in excess of 100 feet (30.5 metres) during the crucial first trimester when the infant is developing. Most women ceased diving before or during the fourth month of pregnancy. Those women who continued diving during pregnancy dived shallower and less frequently as the pregnancy progressed. "Typically" the women who dived during pregnancy never or almost never made strenuous dives, were sometimes chilled, tired easily, and had difficulty getting a wet suit to fit.

In order to determine if the frequency of foetal and obstetric complications was related to diving during pregnancy, each pregnancy was assessed utilizing a scale to divide the pregnancies into low or high-risk groups. Only those women with United States addresses who did not engage in extensive breath-hold diving were included in this comparison. The frequency of six specific complications was analyzed: (a) neonatal death (death within the first 28 days of life); (b) stillbirth; (c) spontaneous abortion (miscarriage); (d) vaginal bleeding during pregnancy; (e) congenital anomaly (birth defect); and (f) low birthweight (5 lbs 8 oz - 2500 gm or less). The frequency of anomalies was found to be significantly higher among combined low and high-risk pregnancies during which women dived. The extent of diving was similar for complicated and uncomplicated groups, however 3 out of 24 women who dived at depths greater than 100 feet (30.5 metres) had malformed infants.

CONCLUSIONS

Many women who were actively engaged in scuba diving, particularly those of advanced or higher certification, dived during the first trimester before pregnancy was confirmed. The women probably dived at the same depths as before pregnancy, unless they intentionally or coincidently limited depth. Whether or not they continued diving once aware of a developing pregnancy depended on their physician's advice, family approval, their attitudes toward pregnancy, previous knowledge of possible risks, and ultimately, how committed they were to diving.

The risk of harmful effects to the foetus from scuba diving during pregnancy appears to be real; however, many more epidemiological and experimental studies must be conducted before any definitive cause and effect relationship can be established or rejected. The greater the depth and/or duration of the dive, the greater are the physiological changes which occur, and the more important are maternal-foetal adaptive mechanisms. Although decompression sickness or treatment within a hyperbaric chamber for a diving injury is unlikely, the associated risks to the foetus from bubble formation and oxygen toxicity would appear to be even greater than those associated with usual scuba diving activities.

RECOMMENDATIONS

Implementation of Findings

It is the researcher's position that each woman must decide for herself what activities she will perform during pregnancy. Hopefully she will make this decision before becoming pregnant. There appears to be no justification for abortion or undue alarm among women who have dived while pregnant, since this and other studies have not conclusively proven that diving is harmful to the developing foetus.

Furthermore, it is the responsibility of obstetricians and diving instructors to inform women divers of the physiological changes associated with diving and the potential risks involved. They also should refer her elsewhere if they are uninformed on this subject. The ever-increasing risk of legal action and escalating insurance rates have prompted some physicians and diving instructors to adopt ultraconservative attitudes. Unfortunately, physicians may "forbid" patients to dive while pregnant, and instructors may refuse to train pregnant women. Even if diving during pregnancy is not condoned, the physician or instructor has a further obligation to the woman who chooses to dive while pregnant. After informing her of the potential risks, he/she should then advise limitations of depth, time, and character to limit depth of dives to 60 feet (18.3 metres); limit duration of dives to one-half the US Navy decompression tables; and avoid strenuous dives, hypo-ventilation (under breathing), and becoming chilled. There are no precautions which can guarantee an uneventful outcome since complications can occur for a variety of unknown reasons exclusive of diving.

REFERENCES

1. Boycott AE, Haldane JS and Damant GCC, The prevention of compressed air illness. Journal of Hygiene. 1908; 8: 419-420.
2. Fife WP, Simmang C and Kitzman JV. Susceptibility of foetal sheep to acute decompression sickness. Undersea Biomedical Research. 1978; 5: 287-292.
3. Fujkura, T. Retrolental fibroplasia and prematurity in newborn rabbits induced by maternal hyperoxia. American Journal of Obstetrics and Gynaecology. 1964; 90: 854-858.
4. Martin, KJ. The normal dive and its sequelae. Journal of the Royal Naval Medical Service. 1974; 60: 55-65
5. McIver RG. Bends resistance in the foetus. Paper presented at the Annual Scientific Meeting Aerospace Medical Association, Bel Harbor, Florida, 1968.
6. Miller PD, Telford IR and Haas GR. Effect of hyperbaric oxygen on cardiogenesis in the rat. Biology of the Neonate. 1971; 17: 44-52.
7. Spencer MP, Johnson DC and Campbell SD. Safe decompression with the Doppler ultrasonic blood bubble detector. In CJ Lambertson (ed.) Underwater Physiology V, Proceedings of the Fifth Symposium on Underwater Physiology. Bethesda: Federation of American Societies for Experimental Biology, 1976.
8. Telford IR Miller PD and Haas G. Hyperbaric oxygen causes foetal wastage in rats. Lancet. 1969; 2: 220-221.

The Undersea Medical Society Meeting, Miami, May 1979
Dr John Knight

The first day was practical and informative with a panel of divers and doctors who had a vast knowledge of the diving industry.

G Fahlman of Taylor Diving and Salvage spoke on "The Achievements and Plans of an Oilfield Diving Contractor". Taylor Diving have a name for underwater welding. They use bell type habitats which fit over the pipe to be welded. The pipe is fitted into an alignment frame, the habitat lowered and made watertight, or rather gas-tight, below the raised pipes, and then the habitat is pressurised with gas so that the welding can be done in the dry. The welders are divers. Even in the dry they wear positive pressure breathing apparatus in case noxious fumes are produced in the restricted space. It is possible to X-ray the welds before flooding the habitat. These outfits cost about $500,000 each to build. It is supported by a normal saturation complex and the divers travel to work in a "bell" (which is better described as a personnel transfer capsule). During a trial weld at 1000 feet off Norway one man wandered out of a television monitor range and when he was found he was dead. No cause of death has been finally decided on. The Norwegian authorities stopped the trial, but it was later completed off Scotland.

Taylor Diving have plans for a one atmosphere welding chamber called SAWS (for Single Atmosphere Welding System). It is much heavier and bulkier than the hyperbaric systems and would require a specialised support vessel. As it is estimated to cost about 510,000,000 to build and as the diving industry is in a mild recession it remains in plan form only.

RH (Dutchy) Holland of Oceaneering spoke on "A Diving Contractor's View of Medical Responsibilities". This was a sensible review of the problems of the medical and diving interface. He stressed the need for knowledge of diving medicine in the doctors, for co-operation with the diving supervisor and for safety above all.

David Youngblood, now ex-Oceaneering, spoke on "The immediate management of Commercial Diving Casualties". He was short and to the point. Immediate management depends on the other divers who are there at the time. They must be trained in first aid and more. The doctor should be consulted immediately but storms blot out radiotelephones and other traffic can cause teleprinter delays. Training of diver-medics is vital to safety.

Ralph Draper of Perry Ocean Engineering spoke on "Rescue Under Pressure". The North Sea oilfields are well away from shore. What should be done in the event of a fire, explosion or rig damage from collision for the men in saturation? There are a number of possible courses. Immediate decompression, which would probably be fatal, is not one of them, and must be avoided at all costs. Escape from the rig must be made under pressure. It is possible to put a bell or the chamber over the side and let it float away. The problems include seasickness of the occupants in any sort of sea, and accidents have a habit of happening in a rough sea, there is no control over the bell and it could get lost or even entangled in the rig. The "hyperbaric lifeboat" which is the Norwegian official solution, is a vessel containing a pressurised chamber which has its own motive power and so can be steered to safety.

This always supposed the man in saturation can get into the hyperbaric lifeboat and it can be launched, which can be difficult if the rig is listing. The British solution is to use helicopters to lift a portable chamber and decant the men into a chamber in Aberdeen at the end of the helicopter ride. There are problems with this approach too. The saturation chambers are not always very accessible, some are down a few decks from the helipad. So a 2 man carryable chamber which mates to the saturation chamber and to the 8 man helicopter chamber may have to be used as a taxi. The helicopter chamber mates with the deep (1000') chamber donated by International Underwater Contractors and the system can be used for men injured or ill under pressure which the hyperbaric lifeboat cannot.

Georges Arnoux, the Safety Officer of Comex UK, spoke on "The Rescue of the Unconscious Diver". This was possible because some other speakers had limited themselves so as to let Georges have some time. On the programme he and Dutchy were sharing a presentation. Out of the problems of Comex equipment has come an intelligent and relatively simple method of rescuing the unconscious diver. Comex bells have relatively small openings. To lift a diver into a bell one has to use a hoist. All deep divers wear a safety harness, to hold the umbilical and provide lifting points. If one hoists a man by the front his head drops back and his airway opens, but he cannot fit through the Comex hatch. If he is lifted from the back his head falls forward and his airway blocks off, but he fits through the bell opening. So he can now be got into the bell. It helps to flood the bell so that his weight is partly taken by the water, and then hoist him vertically. Bells are basically round and the only flat space is the lower door, which as we have seen is too narrow for a man suspended from the front of his chest to get through, a quite inadequate space to lie a man down. Pulling in the umbilicals and shutting the door would take time and it is better spent on artificial ventilation even with the patient vertical. Once the man is in the bell, and his head out of the water, his helmet mask is removed, an air way is inserted and an orthopaedic type plastic collar is put round his neck to hold his chin up. Then mouth to mouth respiration is relatively easy. External cardiac massage is difficult as there is no hard surface behind the diver, emptying the bell and closing the door will take time, so it is recommended that the rescuing diver put his arms around the unconscious man's chest and use his head as the pressure applicator. Does this work? No one knows but it may be better than doing nothing. The flooded chamber will help by pushing blood out of the legs and abdomen and into the chest due to the hyprostatic pressure gradient.

After lunch the meeting broke up into tutorials. I was in that taken by Art Bachrach on "The Potential Role of One Atmosphere Diving Systems". Art has been involved with the USN evaluation of "JIM". Jim grew out of the deep diving armoured suits of the 1930's, which almost all had the same problem. The arms and legs which moved nicely on land froze as the joints jammed under pressure. However Jim has been designed with joints that work under 2000' pressures. He is manshaped and moved with the arms and legs of his operator. His manipulators are controlled only by the operators fingers. He has advantages, he is easy to transport and assembles in a few hours, the operator is at atmospheric pressure so has no decompression problems, he can work to at least 1,500 feet. But there are snags, he is tethered by the lifting line and communication cable. The manipulators are not as sensitive as hands, and he is a bit clumsy as he moves about. The system has 24 hours endurance, rebreathing with fresh oxygen being added as necessary with the CO_2 being absorbed. Currents up to a knot do not inconvenience the operators and do not affect their performance, but with currents over this the performance levels drop, but so they do with divers

Other systems include WASP which has arms and manipulators but no legs, the system being moved by thrusters. Another system is really a small submersible with a man lying inside it.

During the first day NOAA (the National Oceanic and Atmospheric Administration) had a display of their portable recompression chambers. One was a middle sized two compartment chamber which could be lifted onto a truck and made mobile. The interesting exhibit was the experimental chamber, a Portable Inflatable Recompression Chamber or PIRC. The chamber is made of rubber coated Kevlar cloth with a large opening at the top through which the two occupants enter. It is then sealed and held shut with a great long skewer.

At either end of the cylinder is a window so that the occupants can see and observers can peer in. The chamber is 90" x 30" outside diameter. It weighs 95 lbs. The total weight of the system is 250 lbs. The volume of the package you have to transport is 20 cubic feet. The design operating pressure is 73 psi (165 fsw) and its proof test pressure is 110 psi (250 fsw}, while the burst pressure is 363 psi (825 fsw). The length of the access opening is 54". The view ports are 10.75 inches in diameter. It is fitted with CO_2 absorbers of sodalime which will last (in theory at least) three hours. The breathing gas is air which is supplied in 2 x 80 cu ft 5000 psi alloy and fibre glass cylinders. There is a capability for oxygen to be supplied to a rebreather circuit inside the chamber. Among other items of information we were informed that the chamber leaked 0.55 scfm at 60 fsw and 0.45 scfm at 165 fsw and that the chamber was designed for use between temperatures of 30°F and 120°F. I don't think I would like to be inside at that temperature as there is no medical lock to pass in drinks or other needs.

Later in the week NOAA had another chamber display, this time at their offices in Miami, where I was able to see the Dräger two man chamber. This is boot shaped and comes apart in the middle of the foot. First the attendant climbs in and sits with his head up the ankle part of the boot. There is a window over his head to admit light. Then the victim is loaded into the chamber on a stretcher. When positioned his head is on the attendant's lap. Then the foot end of the stretcher is closed in with the end of the chamber which locks with a bayonet fitting. The empty chamber can be lifted by four men (I've been one of them) so I expect the full one would need at least 8. It has been designed to mate with other Dräger chambers by putting the toe end of the portable chamber into the larger chamber locking the little chamber on by the bayonet mount provided and then pressurising the big chamber so allowing the toe cap to be removed, and the stretcher taken into the big chamber. This is fine with Dräger chambers but its shape probably precludes it being carried into any more common chamber.

My final comments are to record my impressions of the Keynote Speech given by Dr John Hayward of Victoria University, British Colombia, who is well known for his contributions on the effects of cold and protective garments. His topic was "Man in Cold Water" and it was an entertaining and informative address largely dealing with protection from cold water. A comparison of the amount of drop in the core temperature after 6 hours in the water, in men lying still, showed that dry suits were only slightly superior to a well fitted wet suit and much more uncomfortable. The trials were for the Canadian Armed Forces to select suitable clothing for aircrew likely to drop into the Arctic so the experimental subjects lay and floated in the water. The dry suit wearers complained of painful feet. Among the outfits tried was the UVic Thermofloat, Dr Hayward's design of a protective garment for yachtsmen and others who are likely to fall into the water. In spite of leaving the subjects legs exposed from mid-thigh the rate of core temperature drop was little more than the wet-suit wearer's.

The UVIC Thermofloat is a jacket designed to save life in the cold waters of British Columbia. It doubles as an insulator and a life jacket. The basic jacket is quarter inch neoprene foam with an outer and inner cover which results in a reasonably smart jacket. When I tried one in fresh water I floated with 6" of my chest out of the water.

Of course a jacket of neoprene will be an excellent insulator, keeping the wind off beautifully, but it won't be much use when the water is slopping in and out of the lower end. Dr Hayward gets over this problem by providing a beaver tail of neoprene which pulls down between the legs and up in front to make a shortie wet suit.

Hooks on the tail fit into rings in the pockets and the final fitting is with poppers round the legs. A flap of neoprene is provided inside the jacket to fold across the chest for extra insulation and the collar unzips to reveal a bright red-orange hood with reflective stripes.

Dr Hayward demonstrated all this, then produced from one pocket a small inflatable raft, which gets you put of the water except for the lower leg and heat loss from there is low due to the excellent counter current heat exchange between arteries and veins and vasoconstriction. Then he produced a fishing line, a light and a few more useful aids to survival including small paddles.

As an aside, a modified version of the UVIC Thermofloat is now in use with the RAAF for flights over cold water. The modifications include thinner insulation and a shorter jacket, with correspondingly longer tail, so that the pilot does not become too bulky.

DIVING SAFETY MEMORANDUM NO. 11 - CORROSION IN DIVING LIFE SUPPORT SYSTEMS

The following letter was recently issued by the Secretary of the Association of Offshore Diving Contractors to all the members:-

"I have just been advised that cases of extensive corrosion have been discovered in the hot water circuits to diving bells.

"In particular installations the corrosion occurred in 1" diameter "Penetrators or Bushings" which were used for piping hot water into the bells. Each of the penetrators was equipped with a male brass reducer fitting into a three quarter inch female. The severe corrosion occurred at the inner part of the penetrators.

"The reason for the corrosion is not clear but could have been caused by an electrical reaction between the brass reducer and steel penetrator; turbulences created by the flow of water hitting the edge of the reducer; corrosion properties of the hot sea water; or/ and the pressure of the hot water (as high as 1000 psi).

"All members are advised to check any similar installations as a matter of urgency."

There are also indications that corrosion can become extensive very quickly in pressurised "sanitary systems" in particular in the sanitary water top up tank and associated piping.

Contents (continued from Page 1)

SPUMS CONFERENCE 1980

The SPUMS Annual Scientific Conference and AGM 1980 will be held from June 20th to June 29th at Pulau Tioman (Malaysia) and June 30th to July 5th in Singapore.

The Keynote Speaker-Guest Lecturer will be Dr Joh N Miller, Medical Director of the Hyperbaric Unit, Duke University, and Secretary of the Undersea Medical Society.

A circular will be distributed by Allways Travel in the near future, or, allowing for printing delays, in the recent past.

UMS ATHENS JULY 1980

The Undersea Medical Society and the European Undersea Biomedical Society will be holding the 7th Symposium on Underwater Physiology at the Athens Hilton from July 5th to 10th 1980.

It will be possible to attend the SPUMS Scientific Conference and then go to the Athens Meeting.

Those wishing to join the UMS should write to:

The Secretary,
Undersea Medical Society,
9650 Rockville Pike,
Bethesda.
Maryland 20014,
USA

The UMS requires sponsors. John Knight and Chris Lourey will be happy to sponsor you.

* * * * *

DAKUVAQA IS WATCHING!

In a humorous but cautionary manner a Sydney reporter has published a brief account of the misfortunes of a Suva businessman. He was (is?) an amateur spear-fisherman and one day he impaled a harmless sea turtle: he now has a permanent limp because a barracouta bit off his right knee cap. Although the reporter liked to describe this "piscatorial vengeance being wreaked on callous humans", the native fishermen have a special and significant interpretation of the facts. They believe in the power of the Shark God Dakuvaqa (pronounced "Ndakuwanga") and had warned the spearfisherman in advance of his "accident" that he'd fall victim to fishy foulness for spearing the inoffensive turtle.

(Daily Telegraph, 31 August, 1979).

FIFTH ANNUAL CONFERENCE ON THE CLINICAL APPLICATION OF HYPERBARIC OXYGEN

The Fifth Annual Conference on the Clinical Application of Hyperbaric Oxygen is scheduled for Wednesday through to Friday, 11-13 June.

Call for Papers

The first call for Abstracts (200 words or less) on original papers in hyperbaric medicine is made. The deadline for receipt of Abstracts is February 15, 1980. Abstracts should be sent to:

Michael B Strauss, MD,
Chairman Program Committee,
Fifth Annual Conference on the Clinical Application of Hyperbaric Oxygen,
C/- Baromedical Department,
Memorial Hospital Medical Center,
2801 Atlantic Avenue,
Long Beach, California USA 90801

COURSES IN UNDERWATER MEDICINE

Courses at the RAN School of Underwater Medicine HMAS Penguin. Preliminary course February 19th to February 29th, 1980. Advanced course March 3rd to March 14th, 1980. Applications, giving full names, address, date and place of birth, medical qualifications and dates, diving experience and reasons for wanting the course, to the Secretary SPUMS.

These courses are held every year at this time.

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COURSES IN UNDERWATER MEDICINE

The Diving Medical Centre will be running courses in Underwater Medicine in 1980 and 1981.

1. November 22nd to 29th, 1980 Bay of Islands (New Zealand) with an optional week 29th November to 6th December 1980 in Tonga.

2. Honolulu, June 2nd to 16th, 1981. First week in Honolulu, second week in the outer islands.

For further details contact:
Diving Medical Centre,
6 Hale Road,
Mosman NSW 2088

REPRINTING OF ARTICLES

Permission to reprint articles from this journal will be granted on application to the Editor in the case of original contributions. Papers that are here reprinted from another (stated) source require direct application to the original publisher, this being the condition of publication in the SPUMS Journal.

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