

a major problem, so much so that a lot of diving companies will actually do a bacterial swab of everybody's ears before they go under pressure. Using non-toxic germicides such as Panocyde, cleaning of the pressure chamber is a daily routine. One of the reasons why one has to be very careful is in case an operation is necessary under pressure, which occasionally has to be done, the real problem will be trying to get a sterile field. You cannot use inhalational anaesthetics, you have to use regional blocks.

Question:

In aviation medicine near misses are reported.

Dr David Elliott

The real problem is getting people to report accidents. I do not know about commerce, but certainly in the Royal Air Force there is anonymous reporting.

WHAT SHOULD BE THE MEDICAL STANDARDS FOR SPORTS DIVERS?

John Knight

This session is necessary because the various sports diving teaching organisations have raised their standards over the past few years. Seven or eight years ago all one had to do to get a "C" card was pay the money and they would teach you. Instructors found that they were having difficulty getting people through the practical side because some of them were very poor swimmers. So the first standard was that everyone had to swim 200m in five minutes. About this time there were four fatalities under training in Victoria, all on their first sea dive, in one year. One was due to a dropped weight belt catching on a knife.

Some instructors started looking around for some sort of medical standards. The only medical standard available in Australia was the CZ 18 Air Diving Standard produced by the Standards Association of Australia for commercial divers. One reason for medical standards for commercial divers is the need for Workers' Compensation insurance. The insurer wants the divers to be fit and unlikely to cost money. So naturally they need long bone surveys. Also in the Standard, borrowed from the Royal Australian Navy diving manual, is the statement that the upper age limit for learning to dive is 35. That is quite reasonable when you see what they are put through on the Naval ships divers' course. There are no reasons why sports divers should not learn to dive after 35. An ECG to show whether the man

had relatively normal electrical activity before he was employed was a good idea. Borrowed from the Navy were questions about whether you had VD, whether you had piles, or skin rashes which had very little bearing on a sports diver being likely to survive his training and his sports diving. This standard has now been superseded by AS 2299, which makes it compulsory to have exercise ECG's for commercial divers, because ordinary ECG's have not predicted who is going to die from a coronary before his next six monthly medical.

We have a standard, but it is not for sports divers, and FAUI, the Federation of Australian Underwater Instructors, is asking that trainees meet these standards. PADI, the Professional Association of Diving Instructors, gives the novice a note which says that the diver must have normal cardiovascular and respiratory function and be able to clear his ears. That is a fairly general sort of standard, which most of us meet, but it does not help the GP who knows nothing about diving. The problem has become acute because FAUI has taken to reprinting the appropriate medical exam form from AS CZ 18. Everyone who goes to a FAUI school is given one. Usually he is told the names of a number of doctors who understand diving medicine. They are also told that the alternative is to take the form to their own GP. One budding diver was knocked back as unfit because he had varicose veins. I am sure that hydrostatic pressure is not really going to risk his life by compressing his varicose veins. But his GP did not know anything about diving medicine.

When diving instructors told me that they were getting all sorts of medical knockbacks, on grounds that did not seem sensible to them, I wrote to the National Co-ordinator of FAUI in May 1979. By May 1980 I had still not had a reply to my letter. When in October 1980 I still had not had a reply I sent copies of my letter to all diving instructors known to me in Victoria.

My letter was along these lines: The object of a diving medical before teaching people to dive is to weed out those who are likely to come to harm by diving, especially those who are likely to die as a result of entering the water environment and its changes of pressure. I enclosed a draft letter for FAUI to send out with every copy of the diving medical examination form. The letter was headed "To the Examining Doctor" and it went into the reasons why I considered that people should not dive with certain conditions. My list of conditions why people should not dive are pretty basic when it comes to sports divers. (These letters were published in the SPUMS Journal of July-September 1981).

ABSOLUTE CONTRAINDICATIONS

I consider an absolute contraindication any illness which makes the person unconscious without warning. I do not consider the aura of a fit coming on as adequate warning to

get out of the water. The only other one is a diabetic on insulin, because if he works hard he may become hypoglycaemic. I do not believe that, even if you are good at telling your hypoglycaemias you are going to be able to find the pocket in your wet suit, take out the barley sugar, unwrap it, lift your regulator out of your mouth, pop in the barley sugar, put back your regulator and purge it, and then suck the barley sugar in time to guarantee that you will not go unconscious. The reason why I do not think it is a good idea for people to go unconscious under water is that a lot of people going unconscious under water drop their mouthpiece, but they go on breathing. Human lungs are not designed to run on either sea water or fresh water. You may survive if you drop your mouthpiece and stop breathing but if you go on breathing you are going to drown.

TABLE 1

ABSOLUTE CONTRAINDICATIONS TO DIVING

CONDITIONS LIKELY TO CAUSE:

UNCONSCIOUSNESS

PULMONARY BAROTRAUMA

- Previous spontaneous pneumothorax
- Lung cysts
- Scarred lungs
- Obstructive lung disease
- Lungs that empty unevenly
- Previous thoracotomy
- Asthma

BREATHLESSNESS

DAMAGE TO EARS

- Inability to clear ears
- Perforated ear drum
- Previous middle ear surgery with insertion of prosthesis
- Previous repair of inner ear fistula

The other absolute contraindication is anything that will make your lungs more likely to burst with changes in pressure. At the head of my list I put a history of spontaneous pneumothorax, because that lung can burst without being subjected to changes in pressure. Then I put bullae and other air traps that show up only with a chest X-ray. I include thoracic surgery, because you really can not tell what has got stuck to which when somebody has been fossicking around inside the thorax. Old tuberculosis and other scarring diseases, such as sarcoidosis or hydatids, which is not uncommon in Country Victoria are also reasons for not diving. I very nearly passed a man as fit to dive, because I missed the old scars in his lungs and he had forgotten to tell me that when he was aged 11 he had been in hospital to have an operation to remove hydatids from

his lung. The night before he had a coughing fit and he brought up a lot of funny sputum. Next morning his surgeon sent him home as he no longer needed the operation. The radiologist picked it up and rang me to warn me. When I spoke to the patient he was really quite relieved that he did not have to go diving. He was only taking up diving to be a buddy to his 17 year old son, who had bullied him into learning. I also include foreign bodies such as bullets. They cannot get into your lungs without scarring.

I have left out of that list the things that cause problems with breathing out, such as chronic obstructive airway disease and asthma, although they are very important, because you have got to get all the others out of the way first. In my opinion somebody who has had asthma in his or her adult life should not dive. We had proof of this in Victoria this past year when four people have got into serious trouble by getting asthmatic attacks in the water. The last one I heard of was the Monday before we left for the Philippines. This was a girl doing a night dive as part of her training. It was in Portsea Hole, which is 80 feet deep, a stupid place to take people on their first night dive. However there were lots of instructors. One (who told me about this) was watching this pair of novices sinking steadily downwards because they had not inflated their buoyancy compensators enough. So he swam down and inflated the girl's compensator by mouth. As he put his own regulator back in, his light went across her face, and to his horror he saw the regulator was not there. He picked it up and stuffed it back in her mouth, but it just fell out again. He pulled the string on her CO2 vest and on his, both of them worked (Mr Murphy must have been asleep), and they shot to the surface. He had one thought in his mind on the way up. "Are we going to come up underneath the boat?" because it was a very solid boat, but luckily they came up alongside. She was unconscious and rigid. It was difficult to get her back into the boat. They gave her oxygen and after about 10 minutes she started to scream and kept this up for about 5 minutes. It came out later that she was an asthmatic needing constant treatment who had seen a diving doctor who believes that it is quite safe to let asthmatics go diving.

On the other hand a 22 year old who used to get asthma as a child, but has not had any asthma since the age of 12 and no treatment since the age of 10 is a different problem. If his vitalograph shows that he can empty his lungs at a normal rate I think that he can safely dive with the provisos that he has got to watch his contents gauge and never run out of air, and that he comes up slower than the 60 feet per minute recommended by the US Navy tables. If you really watch your rate of ascent 60 feet per minute is quite slow. Many divers take less than 30 seconds to reach the surface from 30 feet.

RELATIVE CONTRAINDICATIONS

The main relative contraindication is inability to clear their ears to your satisfaction, ie. you cannot see the drum move.

You have got to teach most novices how to clear their ears. It is no good saying "Hold your nose and blow" that makes one go red in the face but it does not necessarily open the Eustachian tubes. They have got to wobble their jaw muscles about, or swallow and then quite often you find that they can clear their ears beautifully.

TABLE 2

RELATIVE CONTRAINDICATIONS

FEV1/VC Ratio less than 75%
 Poor physical condition
 Previous myocardial infarction
 Pregnancy

For those who can not clear their ears there is a lot to be said for looking up their noses and seeing if the septum is straight. If it is he has got more of a problem than if it is not. The Royal Navy some years ago assessed all the people who had failed to equalise their ears in submarine escape tank training, which requires a dry compression to 100 feet. If they had deviated septums the septum was straightened. 98% of those operated upon could clear their ears afterwards. Perhaps they were just frightened of having their nose done again! Nevertheless that sort of success rate with an operation is rare. When people can not clear their ears, you show them how, you give them decongestants and you tell them to go away and practice. But the most important thing is getting in the water and trying. For although they may not be able to wave their ear drums at you, they may be able to clear their ears in the water.

In Singapore last year, Chris Lourey told a very interesting physiological story of what happens to heart rhythms when people get into water. He pointed out that in cold water quite a large proportion of the deaths in the group over 35 are due to cardiac causes. That is an American statistic. Our death rate in Australia is mercifully so low that you can not do similar statistics. We can just point out that the great majority are inexperienced, many have borrowed a friend's gear and have had no training. I do not see why it is up to us, as doctors, to say that someone with an ST segment depression in his ECG should not dive for recreation. One should tell him that he might die from his diving, but I do not believe that we have any right to say that he should NOT dive. We have got every right to tell the commercial diver, an employee, that he should not dive, because he no longer meets the required medical standard. I have all the commercial divers' ECG's read by an expert as well as looking at them myself. If somebody comes to me with angina and says that he wants to go diving, I tell him that I think that he should not dive. If somebody comes to me having had vein grafts to his heart, I tell him that if he wants to go diving it is up to him, but if he is a commercial diver I tell him to give up diving because he no longer meets the standard. I can not see why somebody who enjoys diving should not be allowed to risk dying while he is diving as long as he does not inconvenience too many other people.

After all he is allowed to risk dying while driving his car.

The reason for knocking back a prospective scuba diver (I am only dealing here with learning to dive) is that instructors want a standard. If you encourage people to dive who are going to die while learning to dive the instructor is in a very dicey position. He will be sued and so will you for saying that the dead diver was fit to dive.

I am looking for a standard that protects the instructors, so that they do not get people who are going to die on them and also protects people from their lack of knowledge. People get carried away by the beauties of the Barrier Reef and are not satisfied with snorkelling. They want to learn to dive. One university student I saw was an uncontrolled epileptic, a diabetic and had asthma. I managed to talk him out of diving. If you explain what the risks are, most of the people who should not dive accept your advice and stick to snorkelling.

SPUMS has been asked to produce a simple standard that can be understood by any doctor who has no diving knowledge (they do a lot of the medicals) so that the instructors can be certain that they have excluded those who should not dive for medical reasons.

DISCUSSION

Chairman: Dr Bob Hare

I want points of view. These will be noted and published.

Dr Mace Ramsay

I think that you have got a double standard. I mean if you are not going to allow someone with asthma to dive, why allow a heart case to dive. It seems crazy to me. The older group who have got arrhythmias should not be going underwater.

Dr Tony Slark

I think we have got to be very concerned about being too paternalistic in our attitudes to people. We have to allow people who are enthusiastic to do things.

If FAUI says that they want people to achieve a certain medical standard, we have to point out that the tests necessary cost \$100 or \$200 more than the cost of the course. So we have got to do a medical evaluation at a cost that bears some relationship to the cost of the diving course. There is no point in doing a whole lot of things that are paternalistically safe in order to make absolutely sure that there is no legal comeback. When somebody who has a disability comes to you, you can say "Yes, you may dive, but you must be careful". It may be careful of going too deep, or careful about going down without certain degrees

of surface support. Most amateur divers of course go diving with no surface support at all.

You must not say to the person you can not dive because you can not get into the boat because that bloke, if he is intelligent, can fix up some way of getting into a boat with a few buddies. You have to say to the instructors that this fellow can dive, as long as you take notice of his disability, which is recorded here on the report. I do not think that you should ever give a certificate to a person stating that they may not dive under any circumstances, because they chuck it away as soon as you give it to them. Your certificate should say that this person is fit to dive as far as we know, which is as far as the extent of our examination is concerned. Or it should say that this person is fit to dive with certain degrees of supervision, or in limited circumstances. Those certain limited circumstances might be in a swimming pool that is no more than 6 feet deep and with half a dozen instructors around him. As long as you say what those circumstances are you will not be at fault.

For goodness sake let us not try to play God by telling people who are interested in diving what they may or may not do.

Dr Peter James

Asthma is perhaps the best example to show how confused we are about our standards. Beryl Turner says that asthma is totally contraindicated and I read an article by Tony Slark, in *Modern Medicine*, which says you can dive if you have not had an attack for two years. I have also discussed it with several respiratory physicians who state that smoking is a greater contraindication to diving than asthma as you are more likely to block the small airways.

On the legal aspect, Beryl Turner said, at a Sports Medicine Conference, that asthma is an absolute contraindication to diving. Should a doctor let someone with asthma dive, and they die, she is willing to give evidence against that doctor. That is one opinion. Who are the experts? Who do I ask about asthma? What proof is there that asthma is a contraindication to diving? What proof is there that asthma has directly caused problems?

Dr John Knight

One answer is that asthma has been responsible for four cases of very near death, underwater, in Victoria last year. Of course one can not say that these were only due to asthma. What I think happens is that the circumstances of the dive and the asthma combine to give you the problem. Certainly David Cossar had a very sick customer, whose problems became evident at 15 feet, on his hands when he was doing his final checkout. That patient stayed blue for some considerable time on 100% oxygen. So they had a real gas exchange problem. But if you want controlled trial, cast-iron, evidence there is none.

I do not believe that you have to exclude every asthmatic from diving, but because of the cases that occur I think that

they are stupid to dive, because they increase the risks. I can not stop my friends who have asthma and have been diving for years from diving. They are willing to take the extra risk. However, the instructor organisations are frightened of being sued and they want to exclude the common causes of death and problems, which I think is a fair enough request.

Dr Bob Hare

I think that it is also incumbent upon the instructors to insist on the medical being done before the client pays a lot of money for a diving course. On the course I was on they did not insist on a medical until the checkout sea dive. That is the wrong way to go about it.

Dr Wayne Lehmann

Quite clearly under these circumstances, all patients with known coronary heart disease should be excluded because they are liable to sudden death. We have excluded asthmatics, because very rarely their attacks may be sudden and they may die underwater. Obviously this applies to coronary heart disease also. I think that we should include also patients with known cardiac arrhythmias.

Dr John McKee

There are many retrospective examinations of students who have done diving courses. A fortnight ago I had a ring from a young fellow whom I had treated seven years before. He had had a motor cycle accident. The handlebar went right through his chest. He had completed his diving course in Sydney and was dismayed to find that his operation was a hazard to his diving.

Dr Greg Leslie

It has been shown that exercise is beneficial for people with coronary heart disease. Whether someone who has had a coronary or has coronary disease should be barred from active sport for life is a very disputed question.

What physical standards of fitness do you use in assessing whether someone is fit to dive?

Dr John Knight

The standard that I use is about as fit as I am (laughter). I think fitness is largely a subjective assessment unless you have got a laboratory where the subject can run on treadmills.

Dr Greg Leslie

You do not need a laboratory. You need a measured distance to be run or swum in a given time. I think that SPUMS should look into this because there is a tremendous

amount of published material on fitness. It comes down to ml of oxygen per kilogram per minute. However you do not need an oxygen consumption meter to register it. You merely need a few simple physical tests of endurance. I think this should be incorporated into the examination of divers.

Dr John Knight

I think that the most important thing about diving safely is that you are happy in the water. Remember that a third of the students who complete their course will never get into the water as a diver ever again and another third dive four or five times and then give up diving. Only one third of diving trainees continue to dive. Those are Melbourne figures, where the diving schools teach somewhere between 4,000 and 5,000 people a year. Your requirement that they swim a certain distance in a given time is part of the diving course.

Dr Greg Leslie

But that is a very small distance in a very slow time. If SPUMS is going to make recommendations, there should be a certain level of physical fitness.

Dr John Knight

Would you like to put pen to paper and send the executive your recommendations?

Dr Victor Brand

The Club Mediterranee in Morea had a very simple physical test. Your pulse rate was counted and your blood pressure taken. Then you did 30 knee bends and after a minute the pulse rate was counted again and your blood pressure was taken. There are more than one of these dubious medical tests, which I suppose could be used.

Dr Tony Slark

Physical tests should be just for commercial divers. Not for the amateur enthusiast who wishes to start a sporting activity which may encourage him to take physical exercise.

Question:

What is the Sharpened Romberg test?

Dr John Knight

You get the person to stand with one foot in front of the other with arms folded across the chest. When they stop wobbling you ask them to shut their eyes and you time, in seconds, how long they can stand there without falling

over. Carl Edmonds has a mathematical formula for scoring the result. I just count the seconds. If he can stand there for thirty seconds I reckon he has fairly normal balance.

From what has been said it may be simplest to word the medical certificate as follows: "He wishes to dive. I have examined him and he suffers from asthma, coronary heart disease and cannot clear his ears, but it is up to him to dive if he wants to."

Dr Janene Mannerheim

You should say that in your opinion you do not consider him fit, but if he wishes to dive, that is his decision.

Unidentified Speaker

I fly for fun as well as dive. I do aerobatics for fun too. I have had a coronary. When I started I had to go before an av-med examiner. I failed my first examination because I had a history of a coronary. So I had extensive ECG's done and these were sent down to a triad of experts who decided I was stable. I had been stable for three years at the time and had the same ECG tracing then as on healing. I was allowed to have a student pilot's licence. It has been renewed every year. I have got an aerobatics ticket as well. However I am not allowed to go for a commercial licence, that is the only restriction. I took it that when I wanted to learn to dive the same thing would probably hold. Actually he was not in the slightest bit interested in the ECG or anything like that. He said "You know what you are about" and left it at that.

I think we need to think about having a sub-aqua medical examiner who knows something about the hazards the sports diver is likely to meet and we need some sort of referral system, that can advise against diving, not that you can not, but we advise against it. In aviation, it is that you may not get a licence.

Dr David Elliott

I have heard all this before. I am advisor to NAUI in the UK and to the British SubAqua Club. I have done several years of lecturing to the American Medical Association courses, where this comes up every year. I think that it is very difficult, if not impossible, to answer the questions which you are putting to yourselves.

The diver who is unfit puts himself at risk. He may, if the circumstances are pretty dodgy, put three or four other people at risk. A man in an aeroplane puts all the population on the ground below at risk, should he crash into the wrong sort of building. I think that the examination for aviators is not a precedent for divers.

What is the responsibility of the doctor, particularly when it comes to physical fitness as opposed to medical fitness? Physical fitness, provided there is no medical

contraindication for exercising the individual, is really the responsibility of the instructor. The question of what is the responsibility of the doctor with regard to asthma, cardiac problems etc., and to the diving paraplegic has been considered by many other groups. Quite a lot has been written about it. My only suggestion is that it would be worth while communicating with the British SubAqua Club and CMAS, both of whom have enormous discussions on this subject. I hope that you will disagree with some of the things that they have said but nevertheless it will give you a very useful skeletal structure on which to base whatever you decide.

Dr George Gray

I tell all of my stapedectomised people that it is unwise to scuba dive, that they should not scuba dive, they should not do aerobatics, they should not parachute jump and their wife should not clip them over the ear. That is not to say that they have asked me "Can I scuba dive" the moment I have operated on them. If they come back to me after I have operated on them and say "by the way, can I dive?" I then say "No, I would advise against that". Very often they will then try to argue the point. I then ask them to initial their history card to identify that I have in fact advised them against diving. There is a need to practise defensive medicine because patients do not always remember what you tell them.

Dr Terry McGrath

No matter how hard you try you are not going to be right. In January and February this year our group did the medicals at our local diving club. We try to do them properly. We include lung function tests and audiograms. In May our local club had a trip away. One of the best guys physically did not have the money to go on the trip, so while the majority of the club was diving at Lady Elliott Island, he was sitting at home watching television and had a spontaneous pneumothorax.

Question:

What is the reason for the audiogram?

Dr John Knight

It is not a defensive reason. It is in the patient's interest. Every now and then a diver comes in who has damaged his round window or his oval window. He is giddy and deaf, or he may just be deaf. Unless you can prove that he had normal hearing relatively recently it is very difficult to persuade an ENT surgeon that he ought to think of looking inside that ear. If you can show that the chap has had a whopping great hearing loss most ENT surgeons now will think about looking inside the middle ear and plugging the leak. If one does that sometimes the hearing comes back. Not for everyone but many improve. One chap I know has got his hearing back completely twice. Thankfully he has sold his diving gear now.

Dr Peter James

We have a responsibility to our patients, and we have a responsibility to ourselves to do the right thing, but as SPUMS we are also responsible to the community. The government is going to approach us, as the body who should know, to advise them. Where does the responsibility lie? I think that the answer is that it lies everywhere.

Dr John Knight

This discussion has achieved a lot. There is obviously a difference between the younger members of the Society, who are still physically fit and unlikely to suffer from ailments that might carry them off in the middle of the night, and those of my generation who are determined to go on diving.

I agree with Tony Slark that we can not stop people diving. But I can also see the point of the instructor organisations, who do not wish to be presented with people who die during their first sea dives. I think that is a perfectly reasonable request.

I think that all we can do is to say either that this person has passed a certain series of tests and he is probably fit, or this person does not pass the series of tests and can dive if he wants to, leaving it up to the instructor to decide about teaching him. That is the way I look at the medical examination before diving. After the exam the patient is given advice as to what he ought to do. I thoroughly agree that the only people who should do diving medicals are doctors with a knowledge of diving medicine. That is likely to occur with commercial divers in the next year or two. The British have a list of approved doctors for doing diving medicals. The Professional Divers Association of Australasia want the same sort of list. It looks likely that to be on that list you will have to have done the introductory and advanced courses at the School of Underwater Medicine.

The list will not apply to sports divers. It is quite impossible for FAUI and PADI to have all their trainees examined by these people. There are about 10,000 trainees a year. If you do the full works, as laid down in AS 2299, the bill, at the government rate, comes to somewhere over \$130.00. There are X-rays as well, which can add up to another hundred and something if you throw in a long bone survey. I do not think that a reasonable cost as a scuba course costs something in the region of \$180 - \$200. Incidentally, there are no medical benefits for these examinations. I am just repeating the point that Tony made.

I think one should do a simple series of screening tests, that weed out those who are likely to come to harm. If it is necessary, tell them why you do not think they should dive, explain your reasons clearly and then leave it up to them to decide whether to dive or not. However they will have a problem finding somebody to teach them, if they do not meet the standard.

Question:

What do you think these simple tests should involve?

Dr John Knight

My list of tests includes a history that asks questions about such things as spontaneous pneumothorax and asthma. It includes a chest X-ray, because no-one can detect cysts and other lung lesions without a chest X-ray. It includes doing a vitalograph, because it has been shown that most of the people who turned up at the School of Underwater Medicine with burst lungs had FEV¹/VC ratios below 75%. They had all burst their lungs bobbing to the surface having run out of air. However, as a group, those with a low FEV¹/VC ratio are over-represented in these incidents. I include an audiogram to establish that they have got normal hearing. Not all divers complain of giddiness but they all have loss of hearing if they burst their inner ear windows. Divers may be accustomed to feeling giddy. I do a physical examination to make sure that there is a clear wheeze-free chest and that their eardrums move. Those are my basic requirements. As the exercise they are going to undertake is swimming exercise, I think that is the way their fitness should be tested.

LETTERS TO THE EDITOR

FITNESS FOR DIVING

1 Thomas Street,
Lewisham NSW 2049

Dear Sir,

There are a number of fitness parameters which can be fairly easily measured. A lot of experimental work on this has been done by K Cooper et al of Dallas. They have made a study of aerobic exercise and came up with the concept of a person's ability to metabolize oxygen - the greater the amount of oxygen an individual can consume while maximally exercising, the fitter he is. This is measured in ml of O₂/Kg body wt./min.

It is necessary to exercise for a certain period of time to get reliable measurements of this. One is interested in aerobic metabolism as opposed to anaerobic metabolism. (The latter is seen in short bursts of exercise). The suggested minimum period of maximum exercise while measuring aerobic fitness is 12 minutes.

Cooper made actual measurements of O₂ consumption during exercise in a laboratory using a treadmill. He has converted this to a number of everyday activities such as cycling, running, swimming etc., so that the distance travelled by a person in 12 minutes while maximally performing one of these activities can be related to his laboratory studies of O₂ consumption. An example of this

is a person who can run a distance of 1.73 miles in 12 minutes has an O₂ uptake of 51 ml/Kg/ min.

Cooper has come up with many tables correlating fitness with O₂ consumption and relating it to different activities and age groups. He has six categories of fitness from very poor to superior.

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|--------------|--------------|
| 1. Very poor | 4. Good |
| 2. Poor | 5. Excellent |
| 3. Fair | 6. Superior |

Here is an example from these tables for running for 12 minutes.

CATEGORY	AGE 13-19	40-49	60+
1. O ₂ uptake ml/min	<35	<30	<20
Miles run in 12 mins.	<1.3	<1.14	<0.87
3. O ₂ uptake ml/min	38-45	33-40	26-32
Miles run in 12 mins.	1.4-1.56	1.2-1.4	1-1.2
5. O ₂ uptake ml/min	51-56	43-48	36-44
Miles run in 12 mins.	1.7-1.8	1.5-1.7	1.3-1.5

I refer you to his book "The Aerobics Way" for further details of these tables. There are similar tables for swimming, cycling, etc., which give an assessment of a person's aerobic fitness, and relating this to one of the six categories and to the person's age.

To relate this to what level of fitness should be expected in diving is difficult. One has to consider the types of diving and obviously differing standards would be used for professional divers than for sports divers. Exactly what level of fitness should be expected for a person to become a safe sports diver is not easily decided. Obviously the person should be capable of a reasonably prolonged period of moderate exercise - perhaps category 4 at the minimum.

I would think that this could be discussed at one of our future meetings. Without doubt the present standards of physical fitness (in an aerobic sense) necessary to become a certified diver are quite inadequate.

Yours sincerely,
GREG LESLIE

INTRAUTERINE BENDS?

Sir,

Scuba diving is an increasingly popular sport. Any person diving to a depth greater than 9 m is at risk of developing the bends from nitrogen bubbling and venous gas emboli formation which may be clinically asymptomatic but detectable by ultrasonics. Theoretically diving could be a potential teratogen, either through bubble formation affecting the function of the placenta or circulation in the