

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 FEV<sup>1</sup>/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 FEV<sup>1</sup>/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,  
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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 O<sub>2</sub>/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 O<sub>2</sub> 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 O<sub>2</sub> consumption. An example of this

is a person who can run a distance of 1.73 miles in 12 minutes has an O<sub>2</sub> uptake of 51 ml/Kg/ min.

Cooper has come up with many tables correlating fitness with O<sub>2</sub> 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 <sub>2</sub> uptake ml/min	<35	<30	<20
Miles run in 12 mins.	<1.3	<1.14	<0.87
3. O <sub>2</sub> 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 <sub>2</sub> 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

foetus or as a secondary effect through hypoxia because of its effect on placental function.

Bolton (1) surveyed the pregnancy histories of 208 female scuba divers - 109 dived during pregnancy and 69 did not. Two out of the 20 who dived to depths greater than 30 m in the first trimester gave birth to babies with congenital anomalies, one had multiple hemivertebrae, one an absent hand. Four others diving to lesser depths had babies with other congenital malformations (2 with congenital heart disease and 2 with minor abnormalities). There were no recorded malformations in the babies of the mothers who did not dive during pregnancy. More than 6% of the babies in the diving group were small for dates compared with only 1.4% in the controlled group.

We would like to report a baby born with arthrogryposis and some dysgenic features whose mother went scuba diving in early pregnancy. She was a 22 year old prima gravida. Both parents went on holiday from the 40th to 55th day post LMP. The mother dived at least once daily to a total of 20 dives in the 15 days. Most dives were to a depth of 18 m or less but three were to 30 m and one to 33 m. The ascent rate used by the mother and her husband was 18 m per minute, though this was usually estimated rather than actually timed. When decompression was required, a modified version of the USN tables was used. All the dives except one were without complications, the exception involved an "equipment failure" of the husband whom she was buddying, at the end of a strenuous 15 minute bottom time dive at 18 m. The rate of ascent of both was described as "very rapid". She felt well but tired after this dive.

No medications were used apart from oral Sudafed 60 mg. on two or three occasions to aid ear clearing, early in the holiday.

The rest of the pregnancy was uneventful. The abnormalities noted in the baby were unilateral ptosis, small tongue, micrognathia and short neck. The penis was adherent to the scrotum. The upper limb joint movements were all normal except for the hands. The fingers were in fixed flexion with some webbing between 3rd, 4th and 5th fingers, the thumb was digitalised but had two phalanges. The hip joints were dysplastic with reduced range of movement and one hip was dislocated. There was fixed flexion deformity of the knees and bilateral equino-varus deformity of the feet. The head circumference was normal and motor development was appropriate for the baby's age at 3 months. Karyotype, EMG and muscle biopsy were all normal.

The embryopathic timetable of thalidomide affected the upper limbs around the 40th day and the lower limbs between the 41st and 45th day. Thalidomide specifically affects the migration of cells destined to form the posterior root ganglia. Arthrogryposis is presumed to result from either muscle disease or abnormalities of the cells forming the anterior root ganglion so the same time table may be applicable.

It would be wise for women to refrain from diving below 9 m if conception is a possibility or if they are pregnant. A

course of perfection would be to abandon diving for the duration of the pregnancy.

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## REFERENCE

1. Bolton ME. Scuba diving and foetal well being: A survey of 208 women. Undersea Biomed. Res. 1980(7); 183-189.

## DISCUSSION PAPER ASTHMA AND DIVING FITNESS

Douglas Walker

Few will disagree with the present situation where an applicant who mentions that he has asthma is likely to be refused clearance to dive using compressed air should he attend for a "Diving Medical". However, with the increasing requirement by reputable diving instructors of a medical check before starting a course, increasing numbers of people are encountering problems should they mention that they have ever been saddled with that diagnostic label. As about 10% of the population is estimated to have an asthma tendency at some time, the problem is significant. As fewer and fewer instructors remain outside organisations with codes of conduct (and Insurance conditions) which limit their freedom to ignore medical assessment, as increasingly applicants attend doctors with diving medical knowledge, the problem will grow for those with a strong desire to dive and a "bar sinister" in their history. They may be forced to make a choice between honestly revealing their history and being cut off from qualified diving instruction or "forgetting to mention" certain parts of their medical history in the expectation that their deception will pass unnoticed. The justification of having a Diving Medical is to increase safety for all involved. Does the present absolute bar on diving fitness acceptance actually debar those it should, and does it increase diving safety? Nobody knows, for there are still many scuba divers who began before medical checks, or indeed qualified instruction, was considered necessary.

The term "asthma" is a diagnostic label which covers a wide spectrum of problems, ranging from the person with persistently disadvantaged respiratory function to the person who had a few "wheezy sounds" during a childhood URTI episode. Similarly, the trigger factors, degree of disability and response to appropriate medication vary widely. While the person who has episodic or persistent inadequate effort tolerance would be crazy to dive (though may, de facto, dive) the majority are able to maintain all normal activities with rare need for medication.