tumors in the mice exposed to 70% oxygen (7). The possible explanation of HBO antitumor effect in animals could be the difference in the activity of an oxygen radical scavenger, superoxide dismutase (SOD), between normal and tumor cells. That difference is manifested as a lower mitochondrial SOD (Mn SOD) activity and commonly as a lower cytosol (Cu-Zn SOD) activity in tumor cells (8). Since the exposure to HBO is accompanied by increased production of oxygen radicals, the diminished SOD activity could participate in susceptibility of tumor cells to HBO.

In view of the above-mentioned data, it should be emphasized that when judging the effect of HBO, not only the possible tumor-promoting or -enhancing effect, but also the antitumor effect, should be taken into consideration. Further investigations of oxygen radicals influence on the living cell will certainly help in clearing up the possible mechanisms of HBO action on tumor.

Julije Mestrovic
Department of Pediatrics
Clinical Hospital Split
Spiniceeva 1, 21000 Split
Croatia

References

To the editor:

Comments on Maine urchin divers

Butler's article on Maine urchin divers was very interesting, but while saying he is "mindful of its limitations" he does not tell us what they are. The article states that a Maine urchin diver is "usually" a physically fit young man, "2%" are untrained, "a small cadre" have disqualifying medical problems, and so forth, only in the next-to-last sentence are limitations mentioned. This survey was by mailed questionnaire. With this method, a potential limitation is that those who do not reply—almost 80% in this study—can be the most typical. Responders can be a self-selected group and put a bias in the data.

Revealing my own bias, I will agree that few urchin divers are women and that most are probably young and therefore healthy (who else would go diving in Maine, in winter, in bad weather?). However, the numbers could be skewed—young, fit, healthy divers are more likely to respond than older, untrained divers with medical problems. The article tells of deaths leading to publicity and regulatory activity and earnings of $500–$1,000 per day. It is not hard to imagine that 80% of the divers were suspicious of the survey and just threw it away (or had a different address, were out of diving, deceased, etc.).

It would take sampling the non-responders to know how representative Butler's data are. I feel that, with only 22% responding, he may have stretched a bit characterizing the group and should have, at least briefly, pointed out the study's limitations.

C. Gordon Daugherty, M.D.
8807 Wildridge Drive
Austin, Texas 78759

The author responds:

I am pleased with the response this article has generated. I enjoyed reading Dr. Daugherty's letter. His comments raised a number of points I would like to address.

- He notes ...it is not hard to imagine that many were suspicious of the survey and threw it away. This limitation is certainly real; however, it was addressed in a cover letter that informed the potential respondent that the survey was self-funded and in no way affiliated with state government. In fact, state legislators were convening formal hearings at the time, including witnesses from all involved factions. This made for strong opinions which many of the respondents expressed in the survey.
- Dr. Daugherty states..."I suspect few urchin divers are women and most are probably young, healthy men—who else would go diving in Maine..." Women included 2.8% of the respondents. Those over 40 years and over 50 years made up 16.7% and 2.2%, respectively, of respondents. Thus, almost one fifth of the divers responding were older. Looking at licensure purchasing from 1992 (when licensure was initiated) to 1994 (when the moratorium was enforced), there is almost a fivefold differ-
ence (807, 1992 and 3,500, 1994). These older divers almost certainly represent the core cadre of divers that was the industry until Japan became the major purchaser. Only with the gold rush to garner urchins did the diving population burgeon with the younger, inexperienced divers. It was at this time that fatalities occurred. Of the four in 1993, two were individuals making their first dive, and one had less than 3 wk experience. The fourth was an experienced diver whose death was attributed to poor equipment.

- He also states: "With 22% responding, I feel he [Butler] may have stretched a bit...." I disagree. My discussion consistently referred to tables of results. These results were the raw data from the respondents. There was no attempt by me to "stretch" these data. In fact, my conclusion includes this disclaimer: "...this survey has begun to characterize the Maine urchin diver." More work is certainly needed.

- Dr. Daugherty is rightfully concerned with the survey's limitations. These include the postal service, the honesty of the respondents (since the survey was anonymous there was no way to verify responses), question design (most were open-ended, inviting commentary), inability to examine non-responders, and a very limited support structure (i.e., funding, staff, computer). Again, my survey is only a beginning. Further investigation is certainly necessary.

William P. Butler, M.D.
Hyperbaric Medicine Fellow
Davis Hyperbaric Division
Armstrong Laboratory
Brooks AFB, Texas
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supply system. These data also stress the need to prevent contamination of divers’ skin, ears, and mucous membranes, and to develop the deep diver’s resistance to infections.

A. N. VICTOROV
V. K. ILYIN
N. A. POLICARPOV
M. P. BRAGINA
V. G. SOBOLEVSKI
A. D. SYSSEOEV
T. J. NORKINA
I. N. KORNUSHENKOVA

Institute of Biomedical Problems
Moscow, USSR

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To the Editor:

Simulation of a microbial epidemic on a diving ship

Divers who work in harbors and near sewer outlets often are at risk of contamination
by infectious agents, followed by development of infectious diseases (1, 2). Studies confirm the danger to divers during their contact with contaminated water, in spite of protective features of the divers’ equipment (3–5).

The literature suggests that Escherichia coli M-17 strain can serve as an indicator of epidemic processes and infectious agent transport (6). Known to be harmless to human health, the Soviet drug Kolibacterin is made from this strain.

The purpose of our work was to study the process of epidemic spread of test strain Escherichia coli M-17 among divers and crew members of ships with diving crews. The crew consists of 10 persons, including 3 divers.
<table>
<thead>
<tr>
<th>Days of Experiment</th>
<th>Divers Equipment</th>
<th>Water Closet</th>
<th>Kitchen</th>
<th>Living Rooms</th>
<th>Divers</th>
<th>Cook</th>
<th>Engine Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hand</td>
<td>Intestine</td>
<td>Hand</td>
<td>Intestine</td>
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<td>Intestine</td>
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<td>x</td>
<td>x</td>
<td>0</td>
<td>x</td>
<td>0</td>
</tr>
</tbody>
</table>

x — the sample contains test-strain
0 — no test-strain detected
— — no studies provided
LETTERS TO THE EDITOR

External surfaces of divers’ clothes and equipment, suits, boots, weights, and signal belts were contaminated with test strain fresh broth culture, diluted to a concentration of 10 colony forming units/ml. All the contaminated equipment was put on the divers, who then imitated underwater work in a freshwater lake. The supporting team members took the divers aboard from the water and helped them to undress. They then washed the divers’ equipment and clothes with soap and disinfectant.

Bacteriologic samples were obtained before the study and then daily. Samples were taken by cotton swabs from divers’ clothes, hands, and from deck equipment, kitchen tables, living and dining rooms, and door knobs. In addition, at Day 0 and at Days 6 and 20 of the investigation, intestinal flora studies of the crew were done. The test strain was identified according to its serologic features, biochemical peculiarities (saccharose reducing), and susceptibility to Fredericq colicine.

The data are presented in Table 1. On the day of contamination, the test strain was isolated from the divers’ clothes, from the deck floor, from knobs of deck diving mechanisms, from boots and hands of supporting divers, from the divers’ living-room door knobs, and from bathroom door knobs. However, by Days 2 and 3 of the investigation we had failed to isolate the test strain anywhere.

On Day 6 we isolated the test strain from the intestines of the engine operator and the supporting diver. After Day 12 of the investigation positive samples obtained from living and dining rooms, kitchen, and bathroom were markedly increased. Moreover, at Day 20, three other intestinal carriers were identified: two divers and the cook.

<table>
<thead>
<tr>
<th align="left">TABLE 2</th>
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<tbody>
<tr>
<td align="left"><strong>BACTERIAL SURVIVAL ON DIVING SHIPS (DAYS)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objects</th>
<th>Diver Suit Material</th>
<th>Metal Parts of Diver Equipment</th>
<th>Metal of Ladder</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salmonella typhimurium</em></td>
<td>9</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

We have managed to imitate an epidemic spread of *E. coli* strain among the crew members of the diving ship. This strain not only appeared and settled in the intestines of half of the crew members, but also developed on furnishings and equipment. Apparently a test-strain epidemic spreads from the primary contaminated objects via crew members’ hands to crew members’ intestines and to the kitchen. Having contaminated equipment and some of the crew members’ intestines, the test strain may cycle on board the ship, involving more and more objects and more crew members as its carriers. This corresponds to data in the literature, where the possibility of exogenous spread of *E. coli* among the isolated individuals was shown (7). The situation may be more dangerous the more pathogenic the specimen circulating on board the ship, not only because of the grade of its pathogenicity but also on account of its ability to stay longer on the surface of metallic and nonmetallic objects (Table 2). Thus, we speculate that colonization and spread of *Salmonella* rods on the diving
ship are more intensive than for *E. coli*, because the former may stay on contaminated surfaces for a long time, so *S. typhymurium*-contaminated surfaces may serve as additional sources of infection longer than surfaces contaminated with *E. coli*.

A. B. Syssoev  
V. K. Ilyin  
V. I. Putow  
Institute of Biomedical Problems  
Moscow, USSR

REFERENCES


To the Editor

Decompression sickness risk in women

The incidence of decompression sickness (DCS) in women remains controversial. The early work of Bangasser and Bassett has been challenged by Zwingleberg et al. (1) who claimed that there is no increased incidence of DCS in women. Robinson (2) disputes this finding, on statistical grounds, and asserts that the incidence rate of DCS in women could still be between 0 and 3 times that of men. However, there is another aspect to this question. Although the question of incidence has been investigated, there has presently been no research into whether women are more susceptible to type 2 than men.

I have examined 111 cases of DCS treated at the recompression unit at the Royal Australian Navy base at HMAS *Stirling*. Using linear logistic regression, the association between sex and disease type was considered. From this study, women have a 4.3 times greater risk of having type 2 DCS than men (95% confidence intervals: 1.2–15.8, *P* < 0.05). There was no significant association between the variable of age, diving experience, compliance with recognized dive tables, absence of diving qualifications, or repetitive diving practices and type of disease.

Zwingleberg et al. (1) postulate that the increased incidence of DCS in women may be due to their increased adiposity when compared to men. Cole (3) notes that women