

THE BIO-MEDICAL RESEARCH DIVER

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Navy divers completing 85°F warm water dives one week, then flying over 1,000 miles to take part in 41°F cold water dives the next week?

It does happen - particularly if the divers are participating in one of the biomedical diving research studies at the Naval Medical Research Institute. This past spring, research divers concluded human-performance evaluations of the one-atmosphere diving system (JIM) in warm water and one week later were at work in cold water investigating physiological and psychomotor performance. For the Navy diver who's looking for unusual and unique experiences, biomedical research diving may be the answer.

The Naval Medical Research Institute (NMRI) is located on the grounds of the National Naval Medical Center in Bethesda, Maryland. The Navy's largest biomedical research facility, NMRI has on board approximately 200 military and 200 civilian personnel. Its mission, assigned by the Secretary of the Navy, is "To conduct basic and applied research and development concerned with the health, safety, and efficiency of naval personnel." As part of NMRI'S effort to carry out its mission, a biomedical diving research program has been active since the early 1940's. Within NMRI, diving support for medical investigations is primarily furnished by the Hyperbaric Support Department.

Navy divers serve a three-year tour at NMRI; most of the billets are slotted for saturation divers. On board at NMRI in the spring of 1979 were 13 divers: 2 Saturation Master Divers, 5 Saturation Divers, 2 Divers First Class, 1 EOD Diver, 1 SEAL/UDT Diver, and 2 Diving Medical Technicians. When the new 1500-psi saturation system becomes operational later this year (*Faceplate*, Fall '77), the number of diver personnel will be increased fourfold. The operational testing and subsequent diving of this new system will provide a unique opportunity for the divers to be part of "state-of-the-art" system technology, and aid in pushing forward the frontiers of diving physiology and medicine.

The present contingent of divers at NMRI is called upon to perform a variety of tasks in support of bio-medical research, in addition to the usual duties associated with a diving facility. Divers at NMRI often are asked to volunteer for diving medical experiments, experiments which may demand the utmost in diver stamina and fortitude. For example, during the past year NMRI divers participated in studies evaluating commonly used drugs (*Faceplate*, Spring '79), cold water performance, flying after diving, heat loss in water, blood gas exchange, and diver/operator performance in the one-atmosphere diving system. The tasks NMRI divers perform in these studies are rarely pleasant; moreover, the studies may call for extensive physiological monitoring of diver performance via electrodes and probes under conditions of extreme environmental stress (eg. water temperature, fatigue). Successful biomedical research divers at NMRI exhibit patience in the face of lengthy and involved experimental procedures and a dedication to accomplishing the tasks in an exemplary manner. Without the cooperation and professionalism of the NMRI diver, applied biomedical diving research would falter.

Although no single investigation is typical of the experiments under way at NMRI, a study can be chosen to illustrate the tasks NMRI divers are called upon to perform. Recently, MRI(DV) Weaver participated in a study evaluating the effects of water temperature on physiological, cognitive, and motor performance by a wet-suited, scuba-equipped diver. During the experiment he completed 14 dives in water ranging from 77°F to 41°F. On each dive he performed tasks including top hatch transfer, tooker patch removal and installation, time estimation, learning and memory performance on an underwater response acquisition paddle, and torque wrench estimation. Before each dive ECG electrodes and temperature probes were applied; bottom times ranged from 30 to 50 minutes. The data gathered from this study will assist researchers in understanding the nature and extent of environmental stressors on diver performance. Once validated, this information will be passed on to the fleet with recommendations for appropriate action.

When not actively engaged in a research project, NMRI divers can be found conducting pressure and O₂ tolerance tests for US Naval Academy midshipmen and diver candidates, requalification dives for Naval District Washington MC and MSC officers, hyperbaric Vickers treatments for various disorders (eg. gas gangrene, bone necrosis), requalification dives for NMRI personnel, and recompression treatments for both military and civilian diving accidents. In addition, NMRI divers have the opportunity for travel. Among the TAD locations visited by NMRI research divers in the past year were Isle of Shoals, Maine; San Antonio, Texas; Panama City, Florida; and Columbus, Ohio.

What do the NMRI researchers think of the support provided by the research divers? The comments of Dr JM Walsh are illustrative: "NMRI divers do an excellent job for us. They are cooperative and highly motivated, despite numerous discomforts and indignities they must endure for reliable data to be gathered." The NMRI biomedical research diver fills a unique and important role in advancing our understanding of the effects of hyperbaria on the human body.

WE THANK THE SUPERVISOR OF DIVING, US NAVY, FOR PERMISSION TO USE THIS ARTICLE, WHICH WAS ORIGINALLY PRINTED IN *FACEPLATE*, SUMMER 1979.

OPINION CORNER: QUIS CUSTODIET CUSTODES?
Douglas Walker

Reading the article by Dr Michael Curley about his work using Biomedical Research Divers set me thinking about the responsibility of those running such investigations. Work involving risk of some sort to the subject is a necessary concomitant of seeking to advance physiological knowledge, and is unavoidable in the testing of new decompression procedures or the investigation of the course and the treatment of hypothermia, to mention two examples effecting diving medicine. Some seemingly extraneous facts influenced the decision to write, namely re-reading an article concerning experiments using rats¹, the publication of a book on CIA experiments², and the paper by Drummond Rennie³ (Deputy Editor of the New England Journal of Medicine). The notation about the responsibility of all doctors to resist illegal and immoral acts on persons⁴ was perhaps the stimulus to precipitate into print.

In the Royal Navy and the US Navy there are strict regulations to reduce the possibility for excessive enthusiasm on the part of those running or taking part in projects involving possible risk. In the RN there is an independent medical team with power to terminate any experiment/project deemed to involve undue risk of morbidity, and the same holds true for the US Navy. However much work is undertaken in secret projects where, certainly in wartime, such rules do not apply. University and Grant sources also exercise control over experiments performed, though possibly are easier to mislead than are military scrutineers if Drummond Rennie's comments are taken as evidence. And certainly one has only to read some of the material that is published to be aware of the doubtful value of some work on the physiology of, say, the Dive Reflex.

As an example of the physiological work which could reasonably be considered as better discussed than performed one could read the paper by Hughes, Stein and Lynch, "Hopelessness-induced sudden death in Rats", which was a well designed series of rat drownings repeating the work of a famous and too revered physiologist, CP Richter. Apparently the original work was quoted by authority after authority in the best Medieval tradition without anybody questioning the work. These authors standardised the experiment and showed that it was not necessary to suppose that rats had to "give up hope" in order to explain that they drowned when submerged for a sufficient time. They showed that the bradycardia observed terminally was only while submerged and was known as the "dive reflex" by physiologists with a wider knowledge of their subject than most of those interested in ascribing feelings of Hope etc. to rats, seemed to possess. They showed that the LD50 for rats subject to an inescapable stream of water was a 6 psi jet pressure and that the rats barely able to remain with their nostrils at the surface tended to drown if they were denied the tactile input from their vibrissae. They also showed that rats suffered stress, and increased mortality, if they were handled sparingly, and tended to get entangled in ECG leads and drown. All this at the cost of watching 200 rats drown. Are such experiments justified?

But these were respectable workers fully believing in the worth of their experiments. Some may find it a little strange that one was a Postdoctoral Fellow and Instructor in Child Psychiatry and Paediatrics, the second was working for a doctorate in Physiology and that the third is a Professor and Director of a Psychophysiological Clinic who was interested in rats because of the pulse changes in patients in a Cardiac Intensive Care Unit. The paper raised no eyebrows when given at two symposia, before the Animal Behaviour Society and the American Psychological Association. As the work was performed to debunk ill-performed work by many who followed Richter, one can have reasonable doubts on the worth of much published work or the justification for such experiments. To be totally fair, the authors did observe that rats, like humans, can be resuscitated after "dry" drowning. Nothing they discovered was new, and the experimental design, though modelled apparently on the original work, was incapable of answering the question of their paper's title. But they knew this 200 rats earlier!

The description of the CIA's medical ventures, as detailed in John Mark's book "The Search for the Manchurian Candidate" and extracted in newspaper reports, shows that there are sufficient medical persons, and others, about who

are only too willing to treat people like people treat rats. One may consider Shakespeare's words appropriate to the victims, who well could say of such arrogant people,

"As flies to wanton boys, are we to gods,
They kill us for their sport."

(King Lear).

While it is to the credit of many that the CIA experienced trouble in obtaining trained medical help, it is discreditable that so many were willing to become involved and to publish heavily bowdlerised versions of what was occurring. It is stated that an eminent and respected figure, Dr Ewen Cameron (then director of the Psychiatric Institute at McGill University and one-time President of the World Psychiatric Association) was among those deeply involved in experiments which could be considered immoral and illegal by most. The book reports that many of the CIA experiments were performed on unwilling subjects with a ruthless disregard for accepted restraints of medical practice. In one study, for which it would have been impossible to attract college student volunteers seven prisoners were kept for 77 straight days on LSD. On another occasion LSD was given to unsuspecting persons, at least one of whom suicided. The response of Admiral Luis de Flores, the CIA's research chairman, to this tragedy was that it "would be an injustice" if the person responsible were to be reprimanded as this would hinder "the spirit of initiative and enthusiasm so necessary in our work."

As well as the problem of attracting researchers (sic!) there was that of finding enough guinea-pigs. The most convenient source was the flotsam and jetsam of the international spy trade and petty criminals who would be powerless to seek revenge. One of the project directors felt that only by testing subjects "for whom much is at stake" could he obtain reliable results. He called such tests "terminal experiments", as the subject's life was possibly at stake, a code name which should have alerted those in authority with any moral scruples. Dr Cameron is said to have used electroshock, undeterred by the screams of the victims. He is also credited with leaving one woman in a sensory deprivation box for 35 days. He died in 1967, much honoured by his peers.

So it seems that there may be a problem in that one cannot always rely on the official monitoring procedures to act efficiently. It is greatly to the credit of the American system that, in due time, the information was made public, something that would be possible in few, if any other, countries. As a fall back should the Establishment fail to act, who is to act as the "stirrer", who should we expect to make a stir about some animal or human experiment that seems to offend sense or morality? Those who look at TV reconstructions of Old Tyme Music Hall will know the answer. At the end of the evening, when every resource is being mobilised to ensure a loud and effective final rendition, the Master of Ceremonies lists the performers and concludes "but chiefly, YOURSELVES". Now you know where the buck stops!

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