PREFACE

For many decades the technical advancement of diving has been prevented or, at least, discouraged by a lack of far-sighted interest by scientific, industrial and military leaders around the world. However, stimulated by peculiar episodes of history, such as wars and maritime perils, but not by a steady and well-balanced developmental process of understanding amongst its leaders, a period has at last been reached in which scientific, operational, engineering, commercial and military goals are beginning to coalesce towards a major extension of human undersea capability.

The characteristic kind of diving in Japan is breath-hold diving which has been practiced since ancient times. Japan is, figuratively speaking, a land of the Ama divers who have existed for at least 2,000 years. Even today, approximately 15,000 male and female Ama divers are harvesting abalone, shellfish, seaweed, and other marine resouces. Many Japanese scientists have conducted extensive research on these divers and have contributed much to the understanding of the various medical and physiological problems associated with breath-hold diving.

The history of modern helmet diving in Japan began at around the middle of 19th century in Nagasaki for the construction of docks. Afterwards, the development of diving apparatus and procedures was accelerated. However, along with the development of diving technology, medical problems, in particular decompression sickness emerged.

At around the beginning of 20th century many more diving related medical problems emerged. In Showa era, the main subject of research was the epidemiological study of decompression sickness caused by working in compressed air during the undersea excavation of the Kanmon Tunnel which connects Kyushu and Honshu islands.

The Japanese Imperial Navy conducted labor, physiologic, and hygienic studies on underwater and salvage workers until the end of World War II. When the Japanese Maritime Self-Defense Force was established in 1954, submarine and diving medicine became an important subject, involving many discipline related peoples. Concurrently, experimental studies on submarine medicine, deep-sea diving medicine, and saturation diving are being carried out by Japanese Maritime Self-Defense Force Undersea Medical Center at Yokosuka.

In 1965, the Japanese Society of Hyperbaric Medicine was established. The society is made up of scientists engaged in research on the medical treatment and prevention of decompression sickness caused by diving and caisson work, and by physicians and technologists who practice hyperbaric oxygen therapy. Later, many surgeons, anesthesiologists, physicians, dentists, etc. joined the society. Many papers regarding the epidemiology of decompression sickness, in particular by Professor I. Nashimoto of Saitama Medical School and by Professor Y. Mano of Tokyo Medical and Dental University, have been reported to the meetings of this society. On the other hand, a group at Kyushu Rosai Hospital at Kitakyushu, including Dr. Kawashima (now, President of Kawashima Orthopedic Hospital) and I, have been engaged in the treatment and prevention as well as pathological studies of spinal cord damage and bone necrosis in decompression sickness, and have presented many papers to the meetings.

In 1971, the newly established Japan Marine Science and Technology Center developed a

project called "Seatopia" which concerned experiments on underwater living. Dr. M. Mohri has been engaged in this Center in submarine and diving medicine. He is also an epidemiologist and he has been engaged in the study of breath-hold divers and published a lot of papers.

In addition, I would like to introduce the hyperbaric chamber set up in 1985 at Emergency Department of Kagoshima University Medical Hospital. Since 1991, Associate Professor K. Arikawa has been engaged in hyperbaric oxygen therapy of divers with decompression sickness and also of non-divers with various other diseases including sudden deafness, carbon monoxide poisoning, gas gangrene, osteomyelitis, malignant tumor, etc. and has presented many papers on his clinical activities.

I suggest that now is the time for administrative organizations and industrial users to invest in studies of illnesses of diving in order to obtain the critically important information, which can only be gained by step-by-step cumulative investigations. The desired next phases of research and application must be carried out with continuous investment by them. New and prominent supporting roles for the health-related agencies must emerge, to ensure continuity of basic and applied investigations; they need to conduct research on the long-term as well as acute consequences of extreme high pressure exposure as well as provide for the long-term case and hospitalization of patients who suffer from the ill effects of deep sea diving in their policies.

The need now is for a coalition of scientific, medical and technical leaders —university, industrial, administrative and national— to carry out effectively manned undersea activities and research to its varied limits. These leaders must develop progressive and imaginative reseach and the means for its application, and ways to consolidate information on the methods of shallow- and intermediate-depth diving, as well as methods for deep sea diving. They must also develop working systems so engineered as to contain and protect humans against the exposure to pressures, found in deep sea diving as we can not tolerate the pressures involved. For these ventures it is now necessary to bring together the experience of basic and applied science (including undersea medicine and hyperbaric physiology), operations, economics and engineering.

This compendium of papers presented at the Symposium on "Decompression Sickness in Divers" held on January 22, 1994 at Kagoshima University Dental School comprises a broad spectrum of interest which parallels the natural evolution of cooperation between the diving and medical communities all over our country. The name of the Symposium was chosen to reflect the many facets of diving, from diving physiology and medicine, the history of diving and undersea science, actual and practical conditions and states of breath-hold divers (Ama), hygienic and pathological problems of air-divers, to hyperbaric champer environments of high oxygen partial pressures involved in the therapy of diver's diseases. Clinical papers were encouraged in both diving medicine and hyperbaric oxygen therapy, and chronic bone and joint distress due to diving were also addressed. At the same time, the basic physiology traditional to this kind of symposium was maintained in order to a basic forum for scientists throughout Japan to communicate their research results.

In seeking a location for the Symposium, it became apparent that close communication between divers, scientists and physicians was needed. The well-established history of both breath-hold diving and air diving, the large program in medical hyperbaric oxygen therapy at Kagoshima University Medical Hospital, and commitments to ongoing research in diving and hyperbaric medicine all favored Kagoshima as the choice for the Symposium. It was

clear, as the Symposium proceeded, that the choice was well made. Our sponsor, Kagoshima University Research Center for South Pacific with the excellent support of Kagoshima University Dental School proved to be the catalyst needed to make the Symposium successful. Support from both units of Kagoshima University exceeded expectations. The excellent social activities, the precise operation of the program, and unseen but ever-present work of the Research Committee of the Research Center produced an excellent meeting.

The proceedings begin with Professor I. Nashimoto's paper derived from his keynote address, which sets the theme of the Symposium —combining the history of the science of undersea medicine and hyperbaric physiology in Japan in order to enhance knowledge and improve applications of pressure and oxygen in both preventive medicine and clincal settings.

The papers herein do not represent all aspects of undersea medicine and hyperbaric physiology in Japan, but provide an accurate assessment of our science during this brief interval in the history of undersea and hyperbaric medical science. It is our hope that the presented data are to be quickly overlaid by new knowledge.

Motoo Kitano

Footnote:

As for the description of history of undersea and hyperbaric medical activities in Japan, I referred to "Foreward "written by Matshuda, M. in *Underwater and Hyperbaric Physiology IX* (Edited by Bove, A. A., Bachrach, A. J., and Greenbaum, Jr. L. J, Undersea Medical Society, Inc., Bethesda, Maryland, 1987).

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