

FOREWORD

The Moon and its secrets are the goal of the Airman; the abyssal depths of the Ocean and its mysteries the goal of the Submarine Explorer.

Sir Robert H. Davis, Deep Diving and Submarine Operations, 1955

The changes in physical parameters in the aquatic environment bring a real plethora of particular physiologic and medical problems during diving. There have been important developments regarding diving techniques and technologies since humans started exploring underwater, but diving-related diseases and accidents have continued to be a problem. This is why diving medicine and diving physiology have always been irreplaceable for safe diving.

Unfortunately, diving physiology and medicine over the eras could not find a sufficient place in the current curricula for classic medical education. Therefore, medical students and young doctors require a comprehensive source of information when they are interested in diving medicine, or divers coming across examinations or on-site treatment of divers' diseases. This textbook tries to meet this need with the contents of basic knowledge about diving physics and physiology, as well as clinical information about diving diseases. The textbook includes a variety of case reports of diving diseases and accidents that will also be beneficial for recreational and professional divers, instructors, and physicians with different specialties.

When someone practices diving, diving physiology and medicine can be better understood and explained. Both authors of the book are active divers and diving instructors, also providing consultation services for diving emergencies. They also represented their countries in the European Diving Technologies Committee (EDTC), which is an independent, non-profit organization working to make professional diving safer.

The majority of diving accidents can be prevented if the underlying reasons for accidents are identified. Prof. František Novomeský is a Forensic Medicine specialist, lecturer of Forensic Medicine and Diving Medicine at Comenius University in Bratislava, Jessenius Faculty of Medicine in Martin, the state expert on diving accidents investigation in Slovak Republic. With over 60 years of diving practice (even as an instructor and lecturer for special police diving squads) and dozens of diving accidents investigated and analyzed, he is a well-recognized person in its field in Europe. Prof. F. Novomeský is a DAN Europe Medical Officer (Slovakia).

Some of the medical problems encountered during diving are also experienced in compressed air work. Prof. Akin Savaş Toklu, who is a specialist on Diving and Hyperbaric Medicine, was a medical advisor on the construction site during compressed air work in the Eurasia Tunnel Project that connected Europe and Asia underneath the Bosphorus. He also worked as a diving physician on-site in some underwater archaeological works, excavations, constructions, and salvage operations. He is a lecturer at Istanbul University, Istanbul Faculty of Medicine, where the residency program on Diving and Hyperbaric Medicine is provided. He also shares some clinical case reports from his department or diving operations. Prof. A. S. Toklu is a DAN Europe Medical Officer (Turkey).

This textbook, elaborated by two experienced and recognized specialists from both wings of today's medicine - morphology and clinics - may serve as a comprehensive basis for students of medicine with an interest in underwater medicine and even a skilled diving physician, but would also be a rich source of knowledge for diving instructors to better understand the way for safe diving procedures.

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PREFACE

On the 24th of December 1968, flying to orbit the moon, the manned space module Apollo 8 was so far away of the Earth, that the American astronauts Frank Borman, Jim Lovell and William Anders, saw the Earth as a whole planet for the first time in the history of mankind. One of their first expressive statements addressed home was that the Earth was wonderfully blue. The Earth is really blue because almost three-quarters of it is covered by sea. The World's oceans contain approximately 1 370 million km³ of water. The average depth of the World's oceans is 3 800 meters, which is approximately four and a half times more than the average height of the landscape mountains. The Earth is then a veritable "planet of water."

Water, however, is not only the liquid used and consumed in daily life. It is a strategic raw material, one of vital importance for the future, a fact clearly confirmed by the countries and continents already suffering from inadequate supplies. The World's oceans and seas, as well as inland rivers and lakes, make up the unique ecosystem of our planet, which despite the insensitive interference of civilization, still radiates life and has for the future generations of mankind an irreplaceable significance.

The unknown secrets under the water surface have stood as a challenge for humanity since time immemorial. Man has, and only in quite recent times, dared to cross the boundary of two worlds – the Earth's atmosphere and the water surface – as a historic diver in a heavy, bulky diving dress clashed with, up until then, unrecognized and impassable barriers. Depth, pressure, cold, restriction of movement, changes in sense perception, inexplicable narcotic states... and, at last, the decompression, slow and painful return of the human being to its natural environment. All this had to be paid for by divers – with health and often, with life. Somewhere here, in the historic period of the 19th century, while doctors of medicine had a chance to see the moaning wretches in diving dresses, writhing from the pain in their joints or immobilized by paralysis caused by an unknown disease, the first origins of the specific discipline of medical sciences dealing with the issue of a human staying and surviving underwater – diving medicine – began its development.

Together with advancements in technology, in the second half of the 20th century, diving ultimately spread also as a popular recreational activity all across the world. It is difficult to attain more precise figures concerning the overall number of active recreational divers; the international organization Divers Alert Network (DAN) estimates more than 4 million recreational divers worldwide. There are also thousands of divers with a varied spectrum of professional activities; from various public safety or military/naval underwater specialists, up to pure commercial divers. This significant group of divers – both recreational and professional – introduces to contemporary medical science a set of particular medical problems overly similar to the problems of aeronautical and space medicine. Contemporary medicine of diving already has its stable place in the medical sciences and the numerous problems connected to man underwater ascended from the shaded contours of hypotheses to the clear world of serious, scientifically justified and clarified facts.

Regardless of the latest advances in the medicine of diving, the reality is somewhat less promising. The hyperbaric chambers in many coastal countries are regularly occupied by diving "clients", mostly in the months of the diving season. Every year, a large number of fatal accidents occur during diving, both in coastal and inland states of the world. Being underwater still presents a very delicate condition for human survival and the medicine of diving is in these circumstances a highly actual, specific discipline of the medical sciences, with sufficient immanent attributes for its own existence. At most medical faculties in the world, however, diving medicine is not a specific subject of medical education. The medical issue of the stay and survival of a human being underwater is ordinarily atomized in various other subjects of the medical sciences, where it is given only marginal attention. The result is that the new doctors of medicine, coming into the practice, have minimal knowledge of the medicine of diving, which in case of their possible professional contact with divers, they have to laboriously acquire from various sources.

Moreover, the current medical scene is so far missing a textbook of diving medicine, aimed in particular at students of medicine.

This textbook of diving medicine is written by two university teachers, both with dozens of years of academic educational practice and professional diving activities as well. Thus, the textbook was written with the aim of offering to the readers a compact description of the current medical knowledge about diving and its influence on human beings, viewed from the perspective of various medical disciplines.

Diving is one of the greatest successes of mankind, similar to flying or journeys to outer space. It is symptomatic that it is man who dares to go beyond the borders of its terrestrial existence and take off to the heavens or dive into the depths, then together with him, on this journey full of obstacles and sacrifices, medical science must follow in his footsteps.

The authors very much hope for the content of this textbook to be shown in practice as a legibly composed and sufficiently informative material also for doctors of medicine in all specializations, who due to any reasons come into contact with divers, or solve their health problems. Equally, they wish that some passages of this book will be considered fundamental also to students at medical faculties. The authors expect a doctor of medicine of the 21st century to contrive to explicitly define different mechanisms of gas bubbles forming in the blood of a diver in overpressure lung damage or in decompression sickness, that they will understand the principles and benefits of treatment in a hyperbaric chamber for the afflicted divers. The final chapter of the book can bring some valuable information's also for the respective police forces and forensic experts investigating diving fatalities. The authors believe, perhaps immodestly, that there are numerous passages of this book that might be a source of valuable guidance also for advanced divers and diving instructors. Since the knowledge of facts and their rational application in practice is the "water of life" for the truly serious prevention of diving accidents—and that is, when diving, perhaps the most important point. After all, there is always someone waiting for us on shore.

The authors wish to present this textbook to all the above-mentioned groups of readers.

Both authors have taught, lectured and trained hundreds of divers of all categories – recreational, up to police and military divers, mine rescue diving teams, as well as commercial divers. They always emphasized that if they wanted to dive safely, they had to dive with a deep theoretical and practical knowledge, equally with a deep humbleness to the amazing watery element, to the secrets of which the divers are allowed, for a short time, to take a look inside.

The authors have always claimed that a diving career is not crowned by the number of dives carried out, but by the number of successful, safe resurfacing. Even today, after decades of effort underwater as well as in diving medicine, they stand by this statement.

Because diving medicine is primarily about safe resurfacing.

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