Preface

"**A** good night's sleep" has been pursued for thousands of years. And it is well known that the inability to sleep well can have an immediate and potentially chronic impact on the health and mood of most individuals. Furthermore, it has been proven that sleep disorders, such as obstructive sleep apnea syndrome (OSAS) can affect human health by inducing cardiovascular diseases, including high blood pressure and heart disease. In addition, the mortality rate of people who snore and of those with severe OSAS is three to four times higher than healthy adults after stroke. Recent evidence has also shown that people with diabetes are more frequently co-morbid with OSAS than those without diabetes, and have a tendency of difficulty controlling their blood sugar levels when with OSAS. In response to such findings, Backer IDI Collaborating Center of WHO in Australia is now actively setting up a new health policy and launching new research projects on the relationship between diabetes and OSAS. Another group that also has sleep problems is shift workers which comprise around 20% of the entire workforce in USA and over 30% in Taiwan and other countries. Due to disturbances with regards to the circadian system, shift workers have an abnormal body metabolism which could result in high cholesterol and other blood lipids, some types of malignant tumors, including breast cancer, endometrial cancer in females, and non-Hodgkin lymphoma and prostate gland cancer in males. Sleep disorders or sleep deprivation not only endanger the health and well-being of most individuals, but also have a negative impact on public safety. Driving while being sleepy is a common problem among those who are sleep deprived or have sleep disorders. The consequences of sleepy driving, in some circumstances, might be even much more serious than drunk driving. According to records from the US National Highway Traffic Safety Administration, every year more than10,000 registered traffic accidents were related to driving when sleepy or due to drivers nodding off. These accidents led to 76,000 injuries and 15,000 deaths, resulting in medical expenses and lost work costs in excess of one billion USD. Therefore, the importance of sleep science cannot be overemphasized, especially when examining how to help those who suffer from sleep disturbances.

With the rapid advancement of technology during recent decades, we can further improve the quality of sleep of many individuals by developing technology for sleep

medicine. However, current sleep technology focuses mainly on the polysomnography and sleep-technician related issues which are important but cannot represent the term "sleep technology" per se.

Over the past few years, a brand new trend of sleep technology has emerged focusing on cross-domain collaboration. The sleep technology SIG (special interest group) of INSIGHT (innovation and synergy for intelligent home and living technology) center at the National Taiwan University has extended the concept of sleep technology to "Modern Sleep Technology" as being the field of developing new and improved ways to monitor, analyze and assess sleep and circadian rhythms in individuals, in addition to any intervention that may be used to promote sleep, to prevent, diagnose or treat sleep disorders, or for rehabilitation or long-term care of sleep conditions in specific groups. This includes the use of pharmaceuticals, devices, techniques, procedures and organizational systems (adapted from the Proposal for the "Engineering and Information Science in Sleep (E-ISiS) Special Interest Group of World Sleep Federation). Under this definition, "Modern Sleep Technology" is:

1. Sleep technology used in the evaluation and management of sleep disorders, as in traditional sleep technology, including: diagnostic tools (such as polysomnography, actigraphy, and so on.) and therapeutic interventions (such as positive airway pressure, surgical and pharmacologic treatments, and so on.) and patient education
2. Sleep technology for *prevention* of sleep disorders and *reduction* of morbidity caused by sleep disorders
3. Sleep technology that improves the quality of sleep, *sleep environment*, daytime performance, workplace safety and *quality of life*

This book includes the contributions of well-known professional scholars from six different countries. The aim of this textbook is to integrate the various disciplines that are involved in modern sleep technology – sleep science (including the field of sleep medicine, psychology, lucid dreaming and consciousness research), engineering and information science, industrial design, technology management, instrumentation and sleep industry, and to provide this integrated information to people who are interested in or wish to involve themselves in the broad field of modern sleep technology.

This textbook is divided into four parts. Part I introduces the history of sleep technology, the scope of modern sleep technology and the importance of it. Part II covers the evaluation instruments for sleep disorders, including the history and application of polysomnography (PSG), and actigraphy. Part III presents the methodology of management for sleep disorders from the point of view of technology, including cPAP (continuous positive airway pressure), surgical concepts and instruments (including some methods in evaluation of the upper airway), positional therapy, cognitive behavioral therapy, light therapy and the biofeedback. Part IV of this book extends modern sleep technology to daily life. In this part, the application of sleep technology is introduced, including sleep environment control, the application

of biosensors, sleep technology in drowsy driving, sleep technology related to the elderly, education on sleep technology, and the sleep technology industry.

All of the authors in this book are the most prestigious experts in their fields related to sleep science. In each chapter, the most up-to-date works and opinions are presented after critical review by at least two internationally well-known scholars in their respective fields. The goal of publishing this book is to further enhance the knowledge of clinicians and researchers with regards to modern sleep technology and to provide this data in a compact and concise format. Recent research has proven that the advancement of sleep medicine might be able to be facilitated by applying the technology. Furthermore, the interdisciplinary collaboration will also be the future trend of sleep research. With the proceeding of modern sleep technology, the E-ISiS SIG (Engineering and Information Science in Sleep Special Interest Group) was proposed in World Sleep Federation during the Kyoto's "World Sleep 2011 Conference" in October, 2011. Another new global society – ISSTA (International Sleep Science and Technology Association) – will be registered in Berlin, Germany in 2012. All of these are to recruit more experts with and without a medical background to shape and energize the field of sleep technology. With such advances and ongoing studies, modern sleep technology will clearly continue to be enhanced.

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