

REVIEW

of the book by V.M. Kovalzon: “Neurobiology of wakefulness and sleep”
(Moscow, URSS/LENAND, 2024, 400 p.) *RUS*

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Doctor of Biological Sciences Vladimir Matveevich Kovalzon is known in scientific circles of the Russian Federation and abroad for his works in the field of sleep physiology. He has devoted more than half a century to the experimental and fundamental study of this problem (his first work on this topic was published in 1969) and knows it from the inside like no one else. Being the leading specialist in the field in our country, V.M. Kovalzon is the head of the somnology section of the Pavlovian Physiological Society, chairman of the board of the National Somnological Society, an honorary member of the SRS (U.S.A.) and ESRS, and the experience of his remarkable lectures on sleep is measured in decades. V.M. Kovalzon is the author of not only 250 scientific articles, but also the well-known monograph "Fundamentals of Somnology" (Moscow: Binom / Laboratory of Knowledge, 2011, 200 p.), published with the support of the Russian Foundation for Basic Research and dedicated to the current problems of sleep and wakefulness. This book focuses not only on the history of the issue, but also on scientific teams from different countries actively working in the field of experimental sleep research, as well as generalizations of modern approaches to sleep studies and descriptions of the most important results. The edition of this book, written in the form of a textbook, has been repeatedly reprinted, but by now it is completely sold out. The book is widely used in scientific works and dissertations not only in our country, but also in Russian-speaking countries of the former USSR (according to Google search, its citations are approaching 400 references).

And so, last year, V.M. Kovalzon published a new, first in Russian, comprehensive monograph on the neurobiology of wakefulness and sleep, which has absorbed, perhaps, all the best that has been accumulated to date in world science. The book is preceded by a wonderful epigraph taken by the author from one of Viktor Pelevin's novels, which, apparently, is intended to immediately redirect the reader's interest from fashionable reductionist models to the integrative mechanisms of the brain. The book consists of 13 chapters. In the first chapter, the author covers the development of the science of sleep (somnology) from ancient history to the present day. The author pays special attention to the formation of Russian somnology and the development of Soviet somnology, as well as its current state in the Russian Federation. In the course of further exposition in the second and third chapters of the book, the author moves from the phenomenology and definitions of somnology to the latest ideas about the ontogenesis of sleep (Chapter 4), its evolution and problems of sleep ecology (Chapter 5).

The largest, 6th chapter of the new book is devoted to the systemic mechanisms of wakefulness and sleep. It describes in detail the transformation of ideas about wakefulness and sleep, from neurophysiological and neuromorphological approaches to biochemical, molecular genetic and cellular methods, as well as to modern techniques for projecting experimental data onto clinical results and constructing their harmonious generalizations. In the first three subsections, the author tells the story of the discovery of the reticular formation

of the brainstem and the evolution of ideas about its structure and work, up to relatively little-known clinical and experimental studies of recent years, which led to a complete revision of these ideas. In subsequent subsections, the author consistently presents modern data on the mechanisms of slow wave and REM sleep, general ideas about the activity of single neurons and the release of mediators in the wakefulness-sleep cycle. Then the author moves on to a more detailed and thorough presentation of the structure and functions of the main neurochemical systems involved in the regulation of these processes: glutamatergic, orexinergic, histaminergic, dopaminergic and serotonergic. Being a biologist, and not a physician by education, V.M. Kovalzon, nevertheless, to the best of his competence, pays great attention to the fundamental aspects of a number of disorders of the central nervous system, such as coma, narcolepsy, insomnia, Parkinson's disease, depression, sleep apnea. Talking about depression, the author puts forward an interesting hypothesis about its causes and possible methods of drug-free correction, which is of particular interest to clinicians. Of course, one would like to read in this book detailed reviews of other neurotransmitters: acetylcholine, norepinephrine, GABA, nitric oxide, adenosine... But the reader, of course, understands that one author is not able to "embrace the immensity."

The final subsection of Chapter 6 is devoted to the neurobiology of dreams. The author gives a clear definition of this phenomenon and, without going into the substantive side of dreams (since the author is skeptical about the subjective "reports" of subjects), tries to provide a neuroanatomical and neurochemical basis for this complex and intriguing state of altered consciousness.

The author then moves on to the classical description of the body's biological clock (Chapter 7), the suprachiasmatic nuclei and the pineal gland, critically comments on the supposed role of melatonin in sleep regulation, and in a separate subsection similarly examines the problem of scientifically based timekeeping. The latter is of great social importance, especially in our vast country, stretching from West to East across a dozen time zones. In the next section (Chapter 8), the author examines the question of the interaction of circadian and homeostatic mechanisms of the brain, which is very important for both somnology and chronobiology. Chapter 9 discusses the molecular genetic and cellular mechanisms of sleep, the influence of some mutations in humans and experimental animals on sleep, and, in particular, such an amazing, extremely rare disease as fatal familial insomnia. Chapter 10 covers sleep deprivation in healthy subjects and in rigorous animal experiments, and Chapter 11 provides a critical review of the literature on the effects of sleep on learning and memory. Chapter 12 provides a brief overview of the effects of sleep and circadian rhythms on endocrine regulation.

V. M. Kovalzon has his own opinion on every issue in the area the book is devoted to, and is not shy about expressing it. And his generalizations are distinguished by amazing depth and at the same time scrupulousness. Therefore, his new book is characterized, on the one hand, by its encyclopedic nature, and on the other - it is read in one breath, like a detective story, when each chapter reveals the previous one, setting the reader up for an approaching exciting ending. And it really does exist! This is the final, 13th chapter. In it, the author returns to the evolution of sleep, talks about its adaptive function and comes to an extraordinary conclusion, which differs significantly from all previously expressed hypotheses about the nature and purpose of sleep. The hypothesis proposed by the author, in contrast to the widespread anthropocentric points of view on the functions of sleep, is based entirely on the evolutionary concept, and in this sense continues the development of the ideas of the classics of Russian physiology I.M. Sechenov, I.R. Tarkhanov, I.P. Pavlov, L.A. Orbeli, N.A. Rozhansky.

Of course, V.M. Kovalzon's book cannot compete in terms of the breadth of the problem's coverage with the 2000-page "Bible" of scientists and sleep medicine doctors "Principles and Practice in Sleep Medicine" (the latest, 7th edition of this book in two volumes was published in 2022), but, in addition to the fact that the reviewed monograph is written in Russian, it has another significant advantage: it is written by one author and contains a holistic view of the subject under consideration. While in the American "ledger" each chapter has its own authors, and their interpretations and general views on the same problems are sometimes difficult to reconcile, or even contradict each other.

The book by V.M. Kovalzon "Neurobiology of wakefulness and sleep" is a landmark event not only for Russian somnology. After all, it significantly expands the horizons of neuroscience, combining wakefulness and sleep, the cyclic alternation of which is one of the greatest mysteries of life on our planet, continuously rotating around its axis, not only for humans, but also for all warm-blooded organisms. Therefore, this publication will be of interest not only to mature specialists, but also to young scientists. And excerpts from some sections can be understandable and useful to uninitiated readers who are concerned about the problems of their own sleep-wakefulness and who are not indifferent to the sleep characteristics of their relatives and friends.

In the 19th and the second half of the 20th century, several monographs devoted to the fundamental aspects of sleep regulation were published by the St. Petersburg/Leningrad and Rostov schools, which our science can be proud of. These are the book by the pioneer in the experimental study of sleep Marya Mikhailovna Manasseina "Sleep as a Third of Human Life" (1892), which made the name of this Russian woman famous throughout Europe; the monograph by Alexander Nikolaevich Shepovalnikov "Activity of the Sleeping Brain" (1971), the very title of which was revolutionary, rejecting the traditional approach to understanding the nature of sleep as a purely passive process; two innovative books by Ida Gavrilovna Karmanova, laureate of the L.A. Orbeli Prize, who was the first to attempt to recreate the phylogenesis of sleep, which were translated into English and received positive reviews in the foreign press: "Evolution of Sleep" (1977) and "Physiology and Pathology of the Wakefulness-Sleep Cycle. Evolutionary Aspects" (1994) (the latter - together with G.A. Oganessian); as well as the collective monograph of Nikolai Nikolaevich Demin, Alexander Borisovich Kogan and Natalia Ivanovna Moiseeva "Neurophysiology and Neurochemistry of Sleep" (1978), the first on this topic in Russian-language scientific literature.

There is no doubt that the book under review will also take a worthy place in this series. Its author was awarded the title of laureate of the Annual readings named after Academician V.E. Sokolov in the field of general biology and ecology for 2024. His contribution to Russian physiology should also be noted.