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Preface

Sports Chronobiology

Teodor T. Postolache, MD
Guest Editor

Not uncommon scenarios: athlete A is the heavy favorite but athlete B wins; team X is an overwhelming favorite but team Y wins. "How could this happen?" many of us, often the fans of the beaten favorites, wonder. The explanation is sometimes simple. Although athlete A is most of the time better than athlete B, athlete B at his peak is better than athlete A at his trough. Similarly, although team X is usually stronger than team Y, team Y is stronger at their best than team X at their worst.

Everyone's performance level has rhythmic variation, although the amplitude of these rhythms varies from one person to another. Based on their period, rhythms are classified as circadian (with a period of approximately of 24 hours), ultradian (with a period of considerably less than 24 hours), and infradian (with a period of considerably more than 24 hours, such as menstrual and annual) rhythms. For instance, basic components of performance, such as flexibility, muscular strength, and reaction time, in almost every sport have rhythmic peaks and troughs that follow a circadian pattern.

Asking for the definition of "chronobiology" became one of the subtle signs of improvement in patients in my clinical practice. New patients referred to me for treatment of anxiety or depression often look at a poster on the wall: it features swimmers arching their back in a supreme effort to try to gain an edge of a few millimeters immediately after the start of a backstroke competition. The poster, with large letters, reads "Sports Chronobiology." Patients look at the

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poster, but ask no questions. Only after several weeks, after depression has lifted or anxiety improved, do patients ask, "OK, Doc, but what's Chronobiology?" Chronobiology is the science of rhythms in biological processes, a science of time and timing.

I am honored to serve as Guest Editor for the first issue of the *Clinics in Sports Medicine* dedicated to biological rhythms in sports. I have invited as contributors a distinguished group of internationally recognized researchers in sleep and chronobiology, some of whom focus on sports and exercise. I am very pleased that several "patriarchs" and "matriarchs" of the field agreed to contribute to this issue. I have also invited gifted teachers and practitioners to contribute, including some who have worked directly with Olympic or professional athletes. My deep appreciation goes to all contributors for their effort and enthusiasm. I would also like to thank Deb Dellapena from Elsevier for her continuous assistance and Mark Goldstein for his energetic help in the early stages of the project. I am grateful to my mother for pointing out during my early childhood the interdependency between us and our environment, and to my father who may have sparked my interest in biological rhythms with his interest in economical cycles. Finally, I need to thank Tatiana Tarasova, coach of many Olympic and world champions, who helped me overcome my doubts about taking chronobiology from the lab to the arena—from very controlled to very "noisy" conditions inherent to competitive sports.

A long time ago, at bedtime, my grandmother told me a story about a prince who helped an ant queen when she was in deep trouble. The grateful queen gave him a wing to rub when he was in trouble. Much later in the story, he faced the following choice: build a gold castle in one night, in which case he would marry the princess and live happily ever after, or be beheaded. After working hard for several hours, he realized he could not finish in time.

Suddenly he remembered the queen's wing. He rubbed it, and she appeared. When she understood what needed to be done, she said, "Prince, just go to sleep. And I will take care of it. You see, they (pointing toward the many ants that began appearing from all directions) cannot work while they are being watched." It was hard for the prince to fall asleep, as he was worrying about his neck. The queen saw this. "Prince, open your eyes, look at the sky, breath slowly, and count the stars," she said. He counted the stars, his eyes slowly closed, and he fell into a deep sleep. When he awoke in the morning, the gold towers of the castle shone in the light of the rising sun. And the ants, nocturnal creatures that they are, had disappeared.

This story from my childhood resonates well with the intent of this volume. First, because sleeping right, especially before the test of our lifetime, is enormously important. And second, because sleep is not a passive but an active phenomenon that is necessary for our somatic and mental functioning, including memory consolidation of learned psychomotor skills, which is of special importance for athletes.

The goals of a sports chronobiology consultation are to reduce impairments of sports performance related to circadian adversity (eg, early morning, early

afternoon or late evening dips in performance, jet lag) and seasonal and menstrual rhythms, and to prevent and minimize sleep debt. Both goals can be accomplished with appropriate schedules that integrate practice, rest/activity, sleep/wake, meals, travel, and, for shifting circadian rhythms, timed light exposure and avoidance.

The readers may notice certain differences of opinions between reviewers, reflecting the richness of perspectives in the field. As in many areas of medicine, there are disagreements between the clinical (applicative) versus the fundamental research perspective. For instance, well-designed laboratory experiments in chronobiology are very time consuming, and it seems unlikely that elite athletes, given their busy schedules, will ever be subject to standardized research on the effects of sleep and biological rhythms on performance. Nevertheless, a great deal of theoretical and practical knowledge has now been gained on elite performers in challenging circumstances, such as astronauts and pilots, in addition to normal individuals in simulated adverse chronobiologic circumstances in the lab. Should we wait to recommend certain noninvasive and safe interventions until conclusive research has been completed on elite or highly trained athletes? Not in my opinion.

Applying sports chronobiology requires mindfulness of individual differences. For instance, one in ten people is a morning type, and one in ten people is an evening type. Younger athletes, especially adolescents, tend to have delayed circadian rhythms, go to bed later, and need to wake up later, and can easily become sleep deprived if awakened early in the morning for practice or school. Although the seminal work of my mentor, Thomas Wehr, has shown that the required duration of sleep in humans, after several weeks of paying accumulated sleep debt, is slightly above 8 hours, later studies led by my ex-colleague and friend, Daniel Aeschbach, show that short sleepers, who sleep less than 6 hours per night, and long sleepers, who sleep more than 9 hours daily, are quite different based on electroencephalographic and hormonal parameters. Therefore, although applying chronobiologic interventions to a team as a whole is expected to improve the performance of the team, better results are obtained if chronobiologic interventions are tailored to each team member.

My expectation is that our volume will contribute to at least three outcomes. First, I hope that through teaching certain natural, safe, legal, and ethical alternatives to sustain and increase stamina and vigilance, the present volume will contribute to successfully fighting doping, a major plague in contemporary sports. Second, as athletes are important role models for many people, the use of sleep hygiene and chronobiology in sports may contribute to making our increasingly 'round-the-clock society more receptive to the idea that sleep and timing are essential for performance and health.

Finally, and most of all, I hope that this volume will expand the awareness in the world of sports of the importance of sleep and circadian rhythms. It's not only practice, practice, practice that counts, but also adequate sleep and timing, timing, timing. In my view, the timing is right for certain chronobiologic principles and skills to be included in the arsenal of far-sighted sports physicians,

conditioning coaches, trainers, and sports psychologists to help their athletes stay healthy, maintain competitive longevity, and perform at the peak of their abilities when most needed.

Teodor T. Postolache, MD
University of Maryland School of Medicine
Mood and Anxiety Program
685 West Baltimore Street
Baltimore, MD 21201, USA
E-mail address: tpostolache@psych.umaryland.edu