

# Lifestyle Strikes Back

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## Sleep

### Now Clearly a Predictor of Performance

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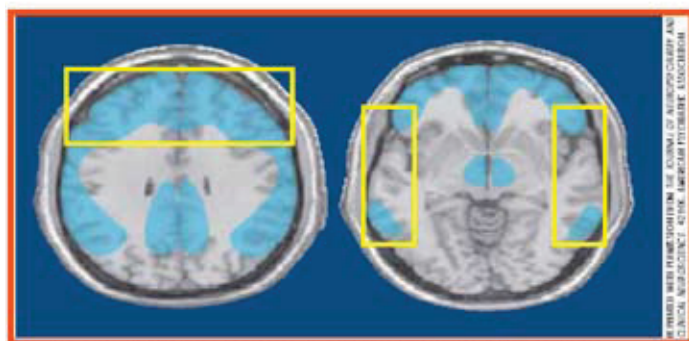
**W**ithout any question the brain and central nervous system play the most significant role in optimal physical performance. Every movement emanates from brain CNS impulses. For an elite athlete, the CNS controls every aspect of performance potential, including function of skills, biomechanical exact movements, the firing sequences of muscles during activity, reflexes and reaction and countless interrelated physiological functions, including both the central system (heart and lungs) and the peripheral system (muscles). The most significant factor in the brain and CNS functioning at an optimal level is that it is rested. This has been documented throughout decades of studies on reflexes, reaction and many other variables which measure CNS readiness. Recent studies centering on sleep and rest as a factor in optimal physical performance have proved conclusively that sleep is clearly a predictor of performance in any skill based sport.



## Sleep Now Clearly a Predictor of Performance

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When Verkoshanski published details of the five bio-motor skills detailing the Russian model of sport training, it not only detailed the individual performance variables, it also connected them.



This model truly is the basis for all sport performance.

Of course considerations also must be made for these capacities over time. This in turn requires much consideration for strength endurance, speed endurance, skill endurance and elasticity under the highest levels of fatigue. At the epicenter of all these capacities is the CNS and brain, which emits impulses serving as master control for the body.

In the past year I visited for several hours with Keijo Hakkinen, one of the world's authorities on power training, at the KIHU Olympic Sport Center at Jyväskylä University in Finland. We discussed training at the highest levels and pushing the capacities to the edge of the cliff of overstrain and overtraining which is quite common in top athletes. He had some profound observations that in the simplest way are paramount in any elite athlete training.

1. "No matter what you may believe the body is not a machine"
2. "If you are going to train very, very, hard... Of course you must rest very, very, hard"
3. "If you train too hard on your easy days... soon you will be training too easy on your hard days"

Pushing limits, peaking and optimal performance have led us to many theorizations on what factors impact optimal states of athletic performance. Fatigue is that phenomenon that an athlete must overcome and the contributing factors in fatigue are again nearly limitless.

In scientific work fatigue is described from a biological, neuro-psychological or social-emotional-psychological perspective. Athletes face issues in all three of these arenas. The basis of stress from physical training is immense, as seen in all physiological systems and especially in the central systems (heart / lungs), the peripheral system (muscles) as well as the hormonal system.

Secondarily the central nervous system and brain encounter huge deficits over time, under the highest levels of physical performance stress. The actual site of fatigue related to the central nervous system will be theorized and debated, but likely will never truly be identified. Brain, nerve or nerve junction, are those sites involved, but thus far pinpointing the actual site of fatigue is at best speculation. A combination of factors and events occur nearly simultaneously limiting optimal physiologic function.

The social-emotional- psychological impact on athlete fatigue is well documented. There are so many variables it is endless to think how many affect performance. All these factors result in decreased performance potential and are greatly increased as a result of losses of quality sleep. When the CNS is fatigued we are not just cognitively impaired (ability to think), we are physiologically impaired (ability to perform physically). Most people have experienced pulling an "all-nighter", which leaves one feeling quite dysfunctional for at least the next twenty- four hours. Confusion, inability to focus, memory glitches, concentration lapses, decreased motivation n, moodiness, irritability and emotional instability are some of the classic signs that develop. At the same time physical exhaustion, fatigue, increased perception of effort, decreased speed, power and skills ability are often symptoms of sleep deprivation or debt. It is clear that the brain and CNS deficits are major factors in failures of these physiological functions.

Fatigue is a state when energy loss is exceeded by energy availability. Sleep loss clearly increases this phenomenon. It seems very likely that the processes of anabolic (increasing a capacity) and catabolic (decreasing a capacity) in muscle processes are also greatly involved. An individual, who loses sleep and has no requirements for physical activity/stress, faces much less trauma than an athlete, who must train or compete despite the fact they are fatigued, even prior to a workout or competition. Cheri Mah's recent research at Stanford University with elite athletes in numerous sports has connected for the first time the fact that these energy drains may be the result of insufficient anabolic function related to insufficient sleep. Performance potential can clearly be predicted by sleep.

The catabolic hormones: cortisol, epinephrine and norepinephrine that inhibit muscle growth are present during wakefulness. The principle anabolic hormones: testosterone, human growth hormone and other muscle building hormones have their peak rates of growth and repair, during sleep. Certainly this illustrates the importance of adequate sleep. This phase of regeneration is related to the recovery phase of training which determines in a large part whether training effect takes place. It has been theorized the majority of training effect occurs in a twelve hour window after training. For most athletes that train/practice, traditionally after the school day, that timeframe includes the evening sleep phase. Most often due to the school calendar and school/ university schedules for athletes in North America, an athlete has already utilized his/her brain and central nervous system for as much as 8-10 hours prior to athletic training and/ or competition. This likely contributes to

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diminished performance daily when we go to train. The Kenyan distance runners, have in recent years, switched their main training to early morning just after waking, in order to maximize training effect, recovery and adaptation.

It is believed that sleep may be responsible for the recharging of the brain and central nervous system (CNS). Just like the four charge level bars on a cell phone or Blackberry this recharge determines how long our master control system will function each coming day. It is now evident that athletes may greatly improve performance by increasing sleep. Younger athletes, who require increased sleep time to counter the requirements of growth and body development, may experience fatigue even when they sustain adequate sleep levels due to the fact that training loads account for additional sleep debt.

The brain has a chance during sleep to shut down and repair neurons and important neuronal connections that might otherwise deteriorate due to lack of activity. Inadequate sleep leaves an athlete at a huge deficit for optimal performance. Some experts theorize that sleep gives neuronal pathways, used while we are awake a chance to repair themselves. Improper amounts of sleep may cause those same neuronal pathways to become so depleted of energy or flooded with byproducts of cellular activity that they malfunction.

A 1997 study discovered that individuals who slept only four to five hours per night for one week needed two full nights of sleep to recover performance, alertness and normal mood. Ironically teenagers in the United States today average only six hours and forty minutes of sleep per night.

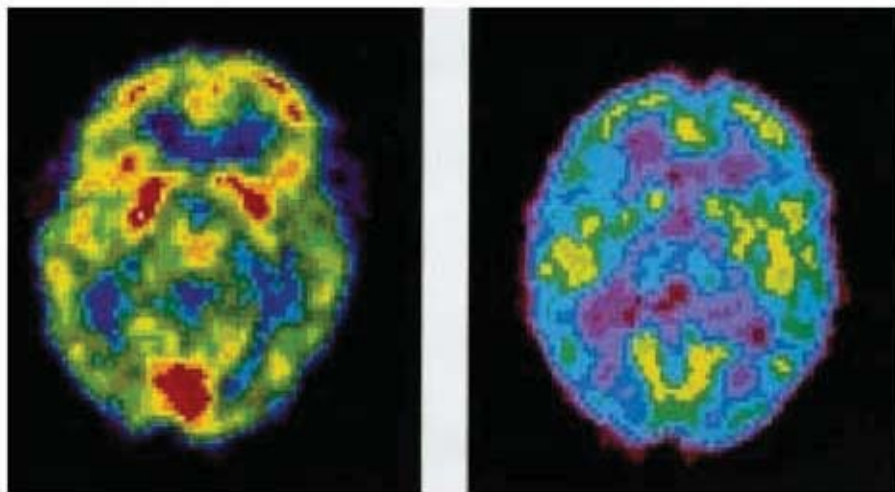
A likely causation of this sleep loss recently emerged in another recent study which determined that today's teens use electronic devices for an average of seven hours and forty five minutes per day. Connecting the dots between sleep loss and sleep debt and diminished performance is important for coaches, parents of athletes and athletes. Lifestyle changes may need to be considered.

When athletes don't get enough sleep several immediate systemic processes cause physical performance to deteriorate significantly.

First the central nervous system and brain are compromised in their ability to transmit impulses to muscles including, speed of the initiation transmission of those impulses as well as reflex/reaction time.

Secondly the cognitive (thinking) functional processes of the brain are greatly affected. Processing, evaluation, determination, focus, visual tracking, and many skill related functions are compromised immediately.

Blood flow in an exhausted brain is greatly decreased. The confusion and physical inability the day after pulling an "all nighter" may be explained simply from this lack of blood flow.



Scan showing blood flow in brain in subject ( Left) that slept eight hours and (Right) no sleep.

*Note: the lack of blood flow in frontal areas (thinking skills as well complex chains of motor movements).and the areas on right and left side responsible for specific motor skills and biomechanics.*





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Non-athletes would find significant recuperation from sleep debt compared to an athlete. The physical stress that elite athletes deal with daily puts them at much greater level of sleep debt and fatigue. In non-athlete populations, even brief periods of sleep provide significant recuperation. There are also of course many individual differences in the degree of susceptibility to decreased performance related to sleep loss and debt. Special Ops populations in the military for instance, learn to function at high levels of their performance potential after acclimatizing to sleep debt. This is not as common, however in athletes. Lack of sleep can interrupt a myriad of physiological variables that can limit training adaptation as well as performance potential.

Differences in sport performance may reflect the normal status of many biological factors. Of course many factors affect athlete readiness to train and compete daily. Marked differences between time of training and time of competition also may affect an athlete's performance. Studies have shown that when athletes are allowed to sleep at unlimited levels, their mood, energy level, and performance levels increase. Does the well-rested athlete have an advantage? It appears so. Sleep is now clearly a predictor of performance in skill based sport.

Participants in a study on the elite Stanford University NCAA men's and women's swimming teams illustrates the magnitude of sleep as a performance predictor.

For the first two weeks of the study, the students maintained their usual sleep-wake pattern. The athletes then extended their sleep to 10 hours per day for six to seven weeks.

Athletic performance was assessed after each regularly scheduled swim practice. After obtaining extra sleep, athletes swam a 15-meter sprint 0.51 seconds faster, reacted 0.15 seconds quicker off the blocks, improved turn time by 0.10 seconds and increased # of kicks by 5.0 kicks.

"These results begin to elucidate the importance of sleep on athletic performance and, more specifically, how sleep is a significant factor in achieving peak athletic performance," said lead author Cheri Mah of the Stanford Sleep Disorders Clinic and Research Laboratory. "While this study focuses specifically on collegiate swimmers, it agrees with data from my other studies of different sports and suggests that athletes across all sports can greatly benefit from extra sleep and gain the additional competitive edge to perform at their highest level."

"It is interesting to note that many of the athletes in the various sports I have worked with, including the swimmers in this study, have set multiple new personal records and season best times, as well as broken long-standing Stanford and American records while participating in this study," she said.

"Typically, many athletes accumulate a large sleep debt by not obtaining their individual sleep requirement each night, which can have detrimental effects on cognitive function, mood, and reaction time," said Mah. "These negative effects can be minimized or eliminated by prioritizing sleep in general and, more specifically, obtaining extra sleep to reduce one's sleep debt."

Mah added, "Many of the Stanford coaches are definitely more aware of the importance of sleep," she said. "Coaches have even started to make changes to their practice and traveling schedules to allow for proper sleep habits. For many athletes and coaches, this study was the first time they truly understood how large of an impact sleep can have on their performance and results."

These are some suggested these tips to help athletes improve their performance by maximizing their sleep:

Monitor and be aware of sleep (add it to your training log data)

- Make sleep a critical part of your regular training regimen.
- Extend nightly sleep for several weeks to reduce your sleep debt before competition and especially sport travel to other time zones.
- Maintain a low sleep debt by obtaining a sufficient amount of nightly sleep (seven to eight hours for adults, nine or more hours for teens and young adults).
- Keep a regular sleep-wake schedule, going to bed and waking up at the same times every day.
- Take brief naps to obtain additional sleep during the day, especially if drowsy.

Don't use stimulants, alcohol or marijuana prior to sleep.

Don't use Stimulants to try to overcome the deficits of sleep debt.

## Sleep... Sleep... Sleep

Athlete lifestyle contributes to the mythical "1% FACTOR" which truly exists. It is the foundation of any athletes' future potential. To imagine that sleep is not a critical factor in the readiness to train or compete would be foolish. It all comes down to understanding optimal performance.

Are you doing things off the field that ruin what you do on the field?

Lifestyle  
Strikes  
Back...