Health Hints

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Texas A&M System

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Editors: Janet M. Pollard, MPH;
and Carol A. Rice, Ph.D., R.N.

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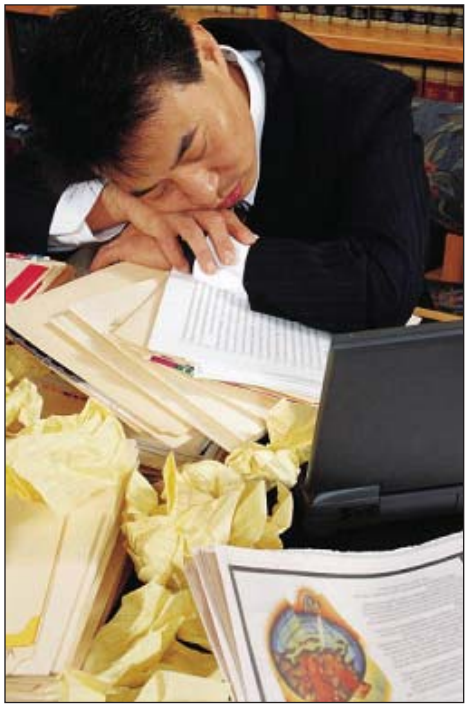
# Sleep: Part 1

## Your health & performance depends upon it

Most of us probably don't think that much about sleep. We probably think about how tired or alert we are, and we may comment on how we haven't gotten a good night's sleep – in a day or a decade – but we don't really think about the process or necessity of sleep.

Sleep is typically viewed as a time when the body shuts down and rests, and it is often viewed as something we can put off or do without if something else is more pressing or appealing. In reality, "sleep is a dynamic activity in its own right that is as essential to good health as diet and exercise, and as necessary as food and water."[1] In our 24/7 society with round-the-clock commerce, communication, and entertainment opportunities, it is easy to fall prey to sleep deprivation.[2] A single night spent out-on-the-town or surfing the Internet may not be detrimental, but added up over time, the consequences of being deprived of sleep are numerous and detrimental… while the benefits of sleep can be the difference in health, performance, and quality of life.



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### Consequences
### Insufficient sleep's detrimental effects

"Many people don't realize that a lack of sufficient sleep can lead to a range of ill effects, triggering mild to potentially life-threatening consequences." Insufficient sleep is directly linked to poor health. Research suggests that insufficient sleep increases the risk for:

- weight gain and obesity;
- diabetes;
- high blood pressure;
- heart disease;
- stroke;
- depression, anxiety, and other mood disorders;
- decreased nervous system performance;
- decreased endocrine system performance;
- decreased immune system performance; and
- premature death.[1, 2, 3, 4, 5, 6, 7]

Insufficient sleep contributes significantly to safety issues, such as:

- driving accidents;
- medical errors; and
- impaired job performance, which can result in accidents and injuries.

Insufficient sleep affects virtually every aspect of day-to-day life, including:

- mood,
- mental alertness,
- memory,
- cognitive performance,
- energy level, and
- physical performance.[1, 3, 5]

"Although we naturally think of sleep as a time of rest and recovery

from the stresses of everyday life, research is revealing that sleep is a dynamic activity, during which many processes vital to health and well-being take place."[1] "…Sleep provides more benefits than previously thought and is absolutely crucial to promoting health and bodily function."[1]

> "...Research is revealing that sleep is a dynamic activity, during which many processes vital to health and well-being take place."[1]

## What Happens When We Sleep

### REM and NREM sleep

What happens when we sleep? "Although it's common to think of sleep as a time of 'shutting down,' sleep is actually an active physiological process. While metabolism generally slows down during sleep, all major organs and regulatory systems continue to function." Sleep can be categorized into two distinct types:

- rapid eye movement (REM) sleep and
- non-rapid eye movement (NREM) sleep.

We typically alternate REM and NREM sleep throughout the night in a cycle that repeats itself every 90 minutes. This is called our sleep architecture because when measured by an electroencephalogram (EEG), which uses electrodes on the scalp to monitor the electrical activity of the brain, the brain wave pattern recorded on a computer typically resembles a city skyline (see the States and Stages of Sleep graphic).

Here's a look at the important role each state and stage of sleep plays from the National Sleep Foundation:[8]

**NREM-Non-rapid eye movement sleep (75% of night).** As we begin to fall asleep, we enter NREM sleep, which is composed of stages 1-4:

**Stage 1**
- between being awake and falling asleep
- light sleep

**Stage 2**
- onset of sleep
- becoming disengaged from surroundings
- breathing and heart rate are regular
- body temperature drops (so sleeping in a cool room is helpful)

**Stages 3 and 4** (also called "*slow wave sleep*")
- deepest and most restorative sleep
- blood pressure drops
- breathing becomes slower
- muscles are relaxed
- blood supply to muscles increases
- tissue growth and repair occurs
- energy is restored
- hormones are released, such as growth hormone that is essential for growth and development, including muscle development.

**REM-Rapid eye movement sleep (25% of night).** REM sleep first occurs about 90 minutes after falling asleep and recurs about every 90 minutes, getting longer later in the night. REM sleep:

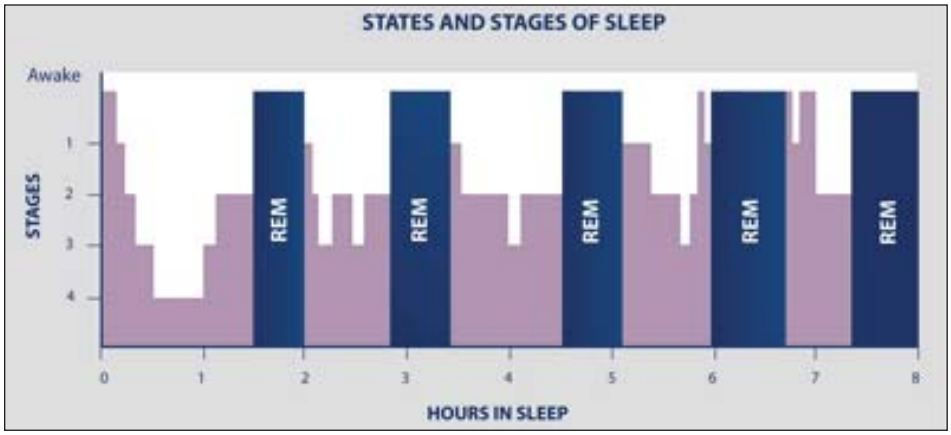
- provides energy to brain and body
- supports daytime performance
- brain is active and dreams occur
- eyes dart back and forth
- body becomes immobile and relaxed, as muscles are turned off

In addition, levels of the hormone cortisol dip at bed time and increase over the night to promote alertness in morning.[8]

## The Brain and Body at Work...

### As we rest

As we sleep, the brain and body work toward restoration of both the brain and body, while keeping our body chemicals (e.g., hormones, neurotransmitters, etc.) in balance.




National Sleep Foundation (2008).[12]

**Restoring the Body.** Slow wave sleep (also called deep sleep) occurs in stages 3 and 4 of the


NREM cycle. "Slow-wave sleep seems to be a time for your body to renew and repair itself. Blood flow is directed less toward your brain, which cools measurably. At the beginning of this stage, the pituitary gland releases a pulse of growth hormone that stimulates tissue growth and muscle repair. Researchers have also detected increased blood levels of substances that activate your immune system, raising the possibility that slow-wave sleep helps the body defend itself against infection."[9]

**Restoring the Mind.** While slow-wave sleep restores the body, REM or dreaming sleep is thought to restore the mind. There is still a lot to be learned about what happens during sleep, but this may happen "in part by helping clear out irrelevant information. Studies of students' ability to solve a complex puzzle involving abstract shapes suggest the brain processes information overnight; students who got a good night's sleep after seeing the puzzle fared much better than those asked to solve the puzzle immediately. Earlier studies found that REM sleep facilitates learning and memory. People tested to measure how well they had learned a new task improved their scores after a night's sleep. If they were roused from REM sleep, the improvements were lost. On the other hand, if they were awakened an equal number of times from slow-wave sleep, the improvements in the scores were unaffected. These findings may help explain why students who stay up all night cramming for an examination generally retain less information than classmates who get some sleep."[9]

**Keeping Balance.** Our bodies are designed to regulate blood pressure, body temperature, and the release of hormones in the appropriate amounts and at the appropriate times.[9] When we go without sleep, this balance can be interrupted, resulting in negative health consequences.

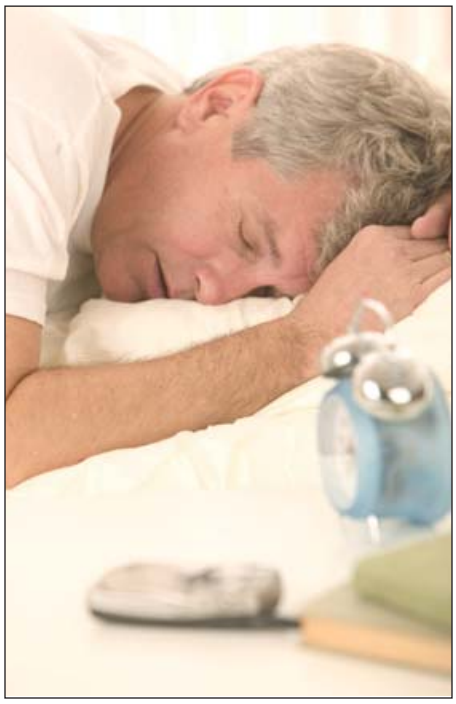
As we sleep, the brain and body work toward restoration of both the brain and body.

- **Immune system** – "Sleep helps us thrive by contributing to a healthy immune system."[8] Without sleep, this system suffers and it becomes harder for our bodies to fight off illness and infection.
- **Weight gain and obesity** – Sleep can also "balance our appetites by helping to regulate levels of the hormones ghrelin and leptin, which play a role in our feelings of hunger and fullness…. When we're sleep deprived, we may feel the need to eat more, which can lead to weight gain."[8] "…Insufficient sleep affects growth hormone secretion that is linked to obesity; as the amount of hormone secretion decreases, the chance for weight gain increases."[10] In other words, there is an increase in the hormones responsible for the feelings of hunger and a decrease in the hormones that suppress hunger.[11]
- **Blood pressure and heart** – "Blood pressure usually falls during the sleep cycle; however, interrupted sleep can adversely affect this normal decline, leading to hypertension [high and blood pressure] and cardiovascular problems."[10]
- **Diabetes** – "Research has also shown that insufficient sleep impairs the body's ability to use insulin, which can lead to the onset of diabetes."[10]

## Insufficient Sleep

### Finding out more

"More and more scientific studies are showing correlations between poor and insufficient sleep and disease."[10] The one-third of our lives that we spend sleeping, far from being "unproductive," plays a direct role in how full, energetic, and successful the other two-thirds of our lives can be.[8] "If sleep is cut short, the body doesn't have



time to complete all of the phases needed for muscle repair, memory consolidation, and release of hormones regulating growth and appetite. Then we wake up less prepared to concentrate, make decisions, or engage fully"[8] in school, work, social, and relational activities.

Go on to Sleep: Part 2 to find out how much sleep you need and how to go about getting it.

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## Sleep Resources
## Effects on Learning, Memory, and Disease

Want to see more research and thoughts about how and why sleep affects our ability to learn, remember, and stay healthy? See the following resources for more in-depth information:

Brain Basics: Understanding Sleep

Deep into Sleep: While Researchers Probe Sleep's Functions, Sleep Itself Is Becoming a Lost Art

From ZZZ's to A's: Sleep and Learning

Short Sleep Duration Is Associated with Reduced Leptin Levels and Increased Adiposity

Short Sleep Duration Is Associated with Reduced Leptin, Elevated Ghrelin, and Increased Body Mass Index

Six Reasons Not to Scrimp on Sleep

Sleep and Learning

Sleep Deprivation: A Cause of High Blood Pressure?

Sleep-Wake Cycle: Its Physiology and Impact on Health

To view the references used in this newsletter, go to: http://fcs.tamu.edu/health/healthhints/2009/feb/ref.php