The Idea of an Essay

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Sleep and Its Effects on the Human Body

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"Sleep and Its Effects on the Human Body" by Meredith Merritt

Instructor's Notes

One of the most difficult aspects of expository writing is deciding what details to include and which to eliminate. Providing too much detail can bog down the flow of an essay, while too little can render the essay vague and unclear. In her essay on sleep, Meredith Merritt provides an appropriate amount of detail. What are some strategies you use for deciding what to include and what not to include in your essays? What are some ways to organize an essay around the details?

Writers' Biography

Meredith Merritt is a sophomore Allied Health major from Pennsylvania. She is currently preparing to enter the field of occupational therapy in the hopes of putting to good use her love for people. She enjoys a wide range of hobbies, from reading literature to carving down mountains on her snowboard. Her heart, however, remains firmly attached to working at summer church camps.

Sleep and Its Effects on the Human Body

The hour hand rests on the ten, the minute hand on the twelve. Five more minutes, then the lights go out and life once more reaches a momentary pause. Diligence or not, the drooping eyes and the groggy mind indicate the growing call for sleep and mark the arrival of the end to yet another day. While this occurrence remains an integral part of daily life, what happens during this period of rest remains somewhat of a mystery to many. In Sleep: The Mysteries, the Problems, and the Solutions, Carlos Schenck, an associate professor at the University of Minnesota Medical School, deepens this marvel: "Considering that people on average will spend 25 years of their lives asleep, it's surprising how little most of us know about what goes on when the lights go off" (1). Many people may reflect upon this "wonder" in feeling a sense of laziness from spending

such a significant portion of their lives unconscious and completely inactive. Modern discoveries concerning sleep, however, reveal that this perspective—viewing sleep as an expression of laziness—rings hollow with falsehood. The fact that humans sleep remains undeniable, but scientists continue to broaden their understanding in discovering the true details of this process. With this continually growing breadth of knowledge, scientists can now make claims as to the importance of the processes that take place during such activity and how they play into the differentiation between adequate and inadequate amounts of sleep.

In the early 1900s, the invention of a new technology, the electroencephalogram (EEG), led to a scientific breakthrough. The initial use of an EEG involved placing electrodes externally on the patient to monitor electrical impulses within his or her body. Shortly thereafter, scientists discovered certain reactions taking place within the brain that produced an electrical current similar to those studied throughout the body (Epstein and Mardon 11-12). This finding allowed for utilization of such tests in studying the brain.

Subsequently, in 1929, Hans Berger, "known as the father of EEG," used this technique to document the first ever recordings of human sleep (Pressman and Orr 12). In more recent studies, researchers utilize "a standard sleep recording, called a polysomnogram, [which] is a continuous, all-night tracing of electroencephalographic (brain-wave), electrooculographic (eye movement), and submental electromyographic (chin muscle) events" (Pressman and Orr 14). In others words, these studies involve analysis of more than simply brain waves – they also monitor patterns of eye movement as well as the electrical activity within the facial muscles. Scientists then compare such measurements to that recorded during the waking hours. According to A Good Night's Sleep by Lawrence Epstein, M.D., and his coauthor, Steven Mardon, "The brain was not passively and uniformly shutting down during sleep but rather passing through several different patterns of activity in an orderly fashion" (12-13). This confirmation of brain activity revolutionized the study of sleep.

Following the discovery of sleep's systematic nature, scientists categorized it into five major steps known as the sleep cycle. The main qualitative division they found led to the classification of the first four stages as non-REM (rapid eye movement) sleep, and the

fifth stage as REM, or dream sleep. Within each progression through this pattern, various factors mark the transition from one stage to the next. Stages one and two, for instance, represent the initial, shallow levels of sleep; stages three and four enter a much deeper level; and REM involves the intermittent, shallow, and highly active levels.

In more detail, the first stage one enters involves a period of light sleep from which he or she awakens easily. During this approximately five-minute stage, EEG studies revealed changes in the brain waves as they transitioned from alpha waves to theta waves (Epstein and Mardon 13-14). The units for such measurements are cycles per second. This designation refers to the frequency with which waves in the EEG recordings appear. Smaller waves of greater frequency and smaller amplitude (height) represent higher levels of brain activity, whereas larger waves of lower frequency and larger amplitude reveal lower levels of brain activity. In the case of specific wave types, the alpha wave pattern includes 8-12 cycles per second, while the theta wave pattern includes 4-7 cycles per second (Epstein and Mardon 13-14). Therefore, during this first stage of sleep, the transition from alpha waves to theta waves shows the decline in brain activity.

The second stage of sleep, a type of transition stage, occurs periodically throughout the night in approximately ten to twenty-five minute intervals (Epstein and Mardon 15). People typically spend about half of the night in this stage as they enter and re-enter it multiple times in between other stages. Further testing reveals that this phase involves still eyes, a slower heart and breathing rate, and sporadic brain activity (Epstein and Mardon 15). As Epstein explains it, this sporadic brain activity presents itself through multiple sets of a "brief [burst] of fast activity called sleep spindles . . . [and] a K-complex, which scientists think represents a sort of built-in vigilance system that keeps you posed to be awakened if necessary" (15). The discovery of these types of brain activity further emphasizes the level to which sleep is truly an active process.

The next two stages fall under the category of deep sleep. As the name implies, stages three and four involve a deeper level in which much of the restorative properties come into effect. For the average sleeper, the sum of these thirty-minute segments typically constitutes about twenty percent of a single night of sleep (Epstein and Mardon 16). During this time, the brain waves transition again,

this time from theta waves to delta waves (Epstein and Mardon 15). Delta waves are even larger, slower brain waves. Their rate usually ranges from 0.1 to 3.5 cycles per second (Pressman and Orr 17). Succession into this stage usually involves a reduction in breathing rate, blood pressure, and pulse, and the entrance to a level of sleep from which waking is more difficult (Epstein and Mardon 15).

Finally, the nature of the last stage in this pattern, REM, distinguishes it as a unique process in itself. Epstein describes this stage as an "active brain in a paralyzed body" (17). During REM, many seemingly unusual occurrences take place: darting eyes; increased body temperature, blood pressure, heart rate, and breathing rate; a highly active sympathetic nervous system; and a temporary paralysis of the majority of the body's muscles (Epstein and Mardon 17). One of the most notable characteristics of this stage lies in its facilitation of both memory and learning. Overall, REM occurs about every 90 minutes throughout a night of sleep, with its duration increasing as the night progresses. While the duration and frequency of each of the five stages differ, a single night of sleep usually involves several cycles. Each cycle, in turn, consists of multiple transitions between the different stages.

Progression through these stages enables the body to carry out several psychological and physiological processes. The consideration of these effects places crucial emphasis on levels of adequate and inadequate sleep. On one hand, adequate amounts of sleep enable the body to restore and revive itself. Modern studies reveal such processing time as an essential aspect to formulating new, long-term memories: "Memory consolidation takes place during sleep through the strengthening of the neural connections that form our memories" (Harvard Medical). This reveals the association between sleep and memory improvement. However, sleep not only aids in memory formation, but it is also shown in several studies to affect physical performance. In the article "Sleep: The Athlete's Steroid," published in the IDEA Fitness Journal, Mike Bracko discusses several studies conducted concerning the effects of varying amounts of sleep on an athlete's performance. One such study noted that when researchers increased the length of sleep for members of a swim team to "10 hours per day for 6-7 weeks . . . results showed that the swimmers swam the 15-meter sprint 0.51 seconds faster, reacted 0.15 seconds sooner off the start blocks . .

. and increased kick strokes by 5 kicks" (Bracko). These findings reveal the direct relationship between sleep performance in not just sports, but also the physical activities associated with everyday living.

Moreover, sleep's effect on performance may lie in direct relation to the impact it has on the internal body systems. In the Sleep Disorders Sourcebook, Sandra Judd explains that sleep affects the endocrine system, the renal system, and the digestive system (9-10). The impact on and regulation of all of these systems ultimately alters the functioning of the entire body. One such example, according to Gerard Lombardo, M.D., in his book Sleep to Save Your Life, states, "Tissue cells, which are worn out during the normal wear and tear of living, need sleep to repair themselves" (22). For instance, during sleep, the pituitary gland secretes a substance known as the growth hormone, which promotes the growth and repair of tissue (Epstein and Mardon 16). Therefore, such a seemingly simple task as sleep represents an incredibly complex period in the day during which people unconsciously carry on the diligent work involved in maintaining life.

Inadequate sleep, on the other hand, deprives a person of the above-mentioned restorative properties and the associated impacts they have on the body. According to the article "Healthy Sleep" by Harvard Medical, "A sleep-deprived person cannot focus attention optimally and therefore cannot learn efficiently." This inability ultimately limits the productivity of a person throughout the day, in studying, in performing, or even merely in holding conversations. Not only does lack of sleep lead to drowsiness throughout the day, but it also denies an individual the opportunity he or she needs to process the information and experiences of the day. As previously mentioned, such processing time is the enabling factor in learning and growth.

Another study from Sleep to Save Your Life states, "Tests conducted at the Walter Reed Army Institute of Research in Silver Spring, Maryland, show that physical and thinking ability diminishes an average of 25 percent for every 24 hours without sleep" (26). This finding reveals that sleep deprivation hinders both mental and physical competence. Scientists have further supported these findings in studies involving lab rats. Lombardo says that these rats "survive only about five weeks on average when they don't get any

REM sleep. When deprived of all sleep stages, they live only about three weeks." (19). Even though such functional decline manifests itself differently in humans, it still poses a serious danger. Epstein describes this negative trend in saying, "Lack of sleep is directly linked to poor health" (5). In other words, inadequate amounts of sleep place individuals in a state of risk, both mentally and physically. Thus, the effects of inadequate sleep over time lead one to an overall lower quality of life.

The fact of the matter is this: sleep remains one of the daily activities in which everyone participates to some degree. Through the progression of technology, a more effective means of studying the brain has added several new dimensions to the study of sleep. Scientists not only look at what specifically occurs during this process, such as the five stages, but they now look beyond to discover the biological activities associated with each stage. Identifying such information enables researchers to improve society's understanding of the importance of sleep and its influence on day-to-day living as a whole.

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