Making Neuroscience Fun

A Brain Awareness Program for All Ages

Brain Health: It's SPECtacular

Science Behind the Story (SBS)
Sleep Basics (A Physical Health Story)
(3rd Grade – 8-9 yrs)

This story describes sleep, what it is, how it changes over time and most importantly, why you do not act out your dreams.

- There are actually different stages of sleep that do different things.

  When you are asleep, your brain is actually still working. We know this because we can record the activity of your brain. We can look at the activity in your brain just by putting electrodes on your head. In this way, we can see what your brain is doing while you are awake and while you are sleeping. The "activity" that we are recording with electrodes is called an EEG (electroencephalogram). What we are actually measuring is the electrical activity that is created when the cells in your brain, called neurons, are "talking". Sleep behavior in humans is defined in stages based on the type of EEG activity that occurs. Originally, sleep was divided into 2 stages, Rapid Eye Movement (REM) and Non-REM sleep (Rechtschaffen, 1968). Non-REM sleep has subsequently been further divided into N1, N2 and Slow Wave Sleep (SWS) (Iber, 2007).

  During the course of a night, there is an organized pattern of brain activity (Colrain, 2011). The brain goes through about four to five ~90 minute cycles of N1, N2, SWS and REM activity (Breedlove, 2020; Colrain, 2011). In the beginning of the night, the SWS activity is longer and towards the middle of the night, the REM activity tends to be longer (Breedlove, 2020; Colrain, 2011).

  While there are still lots of questions about why we sleep, we do know a lot about what is going on in the brain during different stages of sleep. N1 is the stage of sleep that is a transition between sleep and wakefulness (Colrain, 2011). N2 is the stage of sleep where the brain appears to be actively trying to help you to stay asleep (Colrain, 2011). SWS sleep is the deepest stage of sleep; only loud noises will cause a person to awaken. When awake the person feels groggy and confused. This is why people advocate taking less than 30 minute naps, so that you do not reach SWS. SWS is also the period of restoration, the wear and tear to both the body and the brain, caused by activity during the waking period, is repaired during this stage of sleep. In particular, your immune system, which is body's defense system against infections, is strengthened (Ganz, 2012). The immune system attacks germs and helps to keep you healthy (kidshealth.org). Part of the restoration of the brain during SWS involves taking out the "trash" or activating the glymphatic system (Christensen, 2021). Your brain literally washes away the waste products that were made during a busy day of brain activity. REM sleep appears to be crucial in the consolidation of complex information learned during the day or information that has emotional into memory (Boyce, 2017). SWS also appears to be important for improving cognitive function, repairing pathways integral to neuroplasticity and memory consolidation (Klinzing, 2019).

- People have different sleep needs based on their age. Babies sleep up from 14-16 hours a day (and there are only 24 hours in a day!), while older people, like your grandparents, may only sleep between 6-8 hours a day.

The amount of sleep that we need as we age changes and so do the amounts of SWS and REM stage sleep. During a child's first year of life, about 14-16 hours of a 24 hour day is spent sleeping and there is almost an equal amount of SWS and REM sleep during that time (Breedlove, 2020). This corresponds to the growth and development of the nervous system (Lokhandwala, 2022). Our need for sleep changes as we age. Children and adolescents tend to average about 8-10 hours of sleep and by adulthood we average about 8 hours of sleep and about 80% of that time spent in the SWS stage (Breedlove, 2020). The need for SWS is indicative of the amount of work that your brain and body do during the day which results in the need for repair and restoration.

We have 2 kinds of dreams, the ones that are more realistic and occur during SWS (slow wave sleep) and the ones that are more bizarre and occur during REM (rapid eye movement). Your brain has a way to protect you from acting out your dreams that occur during REM sleep.

Dreams are a part of our sleeping behaviors and everyone dreams. In fact, it is thought that all mammals dream (Manger, 2020). Most dreams are usually forgotten. Unless a person wakes up during or immediately after a dream, the dream will not be remembered (Breedlove, 2020). Scientists used to think that you only dreamed during REM sleep. We now know that this is not true. You have dreams during both SWS and REM sleep. And, they are very different kinds of dreams.

Dreams that happen during SWS, which we now know is earlier in your sleep cycle, are usually more realistic (Webb, 1978). These dreams usually involve your brain going through all the information that you accumulated during the day; presumably this aids in the consolidation of the information (Webb, 1978). In doing so, you may actually be able to work through issues that happened during the day and if you can remember these dreams they may be able to resolve these issues.

Dreams that happen during REM, which happens later in your sleep cycle, are more unusual and may not involve things that happened during the day. One explanation for the more bizarre dreams that one has during REM sleep comes from a theory known as the "activation-synthesis" model (Hobson, 1977). This theory suggests dreams have no meaning at all and that there are fluctuations in activity of the pons that triggers "thoughts" that are random and then the cortex tries to fit these together into a "story" (Hobson, 1977). It turns out that during REM, you brain stops all of our voluntary muscle activity – these are muscles that we can move ourselves (Breedlove, 2020). So, during REM sleep your brain basically does not let you to move by yourself. Scientists think this happens so that you do not "act out" your dreams. Remember, during REM sleep you have bizarre dreams – like being chased by an angry grizzly bear. So, you could not get up and start running away like a bear was chasing you because you cannot move voluntarily. Your brain does this to protect you.

Dreams must serve a purpose, because we all have them. Most believe that dreams help us to process our emotions, experiences, and memories.

National Standards:

Next Generation Science Standards

- Crosscutting Concepts:
    - **Structures & Functions:** The way an object is shaped or structured determines many of its properties and functions.
        - The shape and stability of structures of natural and designed objects are related to their function(s).
    - **Cause & Effect:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

        - Events have causes that generate observable patterns.
    - **Patterns:** Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.
        - Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.
- Related Grade Level Content
    - Environment/Changes/Adaptions

National Health Education Standards (Shape America) & CDC (Centers for Disease Control and Prevention)

- **Standard 1:** Students will comprehend concepts related to health promotion and disease prevention to enhance health.
    - 1.5.1: Describe the relationship between healthy behaviors and personal health. **(CDC)**
    - 1.5.2: Identify examples of emotional, intellectual, physical, and social health. **(CDC)**
    - 1.5.4: Describe ways to prevent common childhood injuries and health problems. **(CDC)**
- **Standard 7:** Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.
    - 7.5.1: Identify responsible personal health behaviors. **(CDC)**
    - 7.5.2: Demonstrate a variety of healthy practices and behaviors to maintain or improve personal health. **(CDC)**
    - 7.5.3: Demonstrate a variety of behaviors to avoid or reduce health risks. **(CDC)**
- **Standard 8:** Students will demonstrate the ability to advocate for personal, family, and community health.
    - 8.5.1: Express opinions and give accurate information about health issues. **(CDC)**
    - 8.5.2:Encourage others to make positive health choices. **(CDC)**

References:

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