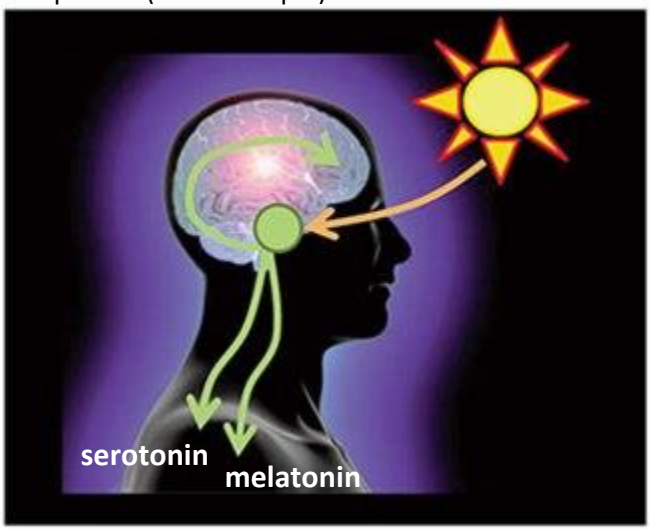
The Chemistry of Natural Sleep-Wake Cycle

There are two systems in the body which drive the daily rhythms of the human sleep-wake cycle:

1. The Homeostatic Sleep Drive (called Sleep S)
2. Circadian Rhythm Sleep Drive (called Sleep C)



Brain Clock: Sunlight Stimulates Synthesis of Serotonin and Melatonin

Both the sleep systems work together to set up a regular pattern of Sleep-Wake cycle in harmony with natural day and night cycle.

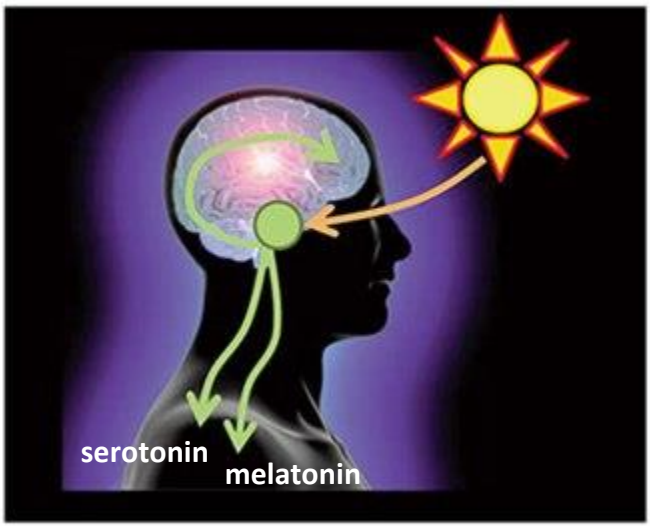
1. ***Homeostatic Sleep drive or Sleep S.*** The body has an innate drive to sleep called the homeostatic drive. This drive gets built up during the day's activity and brought down during the sleeping hours. The chemical substance adenosine controls this sleep drive. Adenosine is a byproduct of energy production in the body, so the physical activity of the wakeful state increases adenosine. Lack of physical activity during the day will not build optimal adenosine levels for a healthy sleep drive. As we stay awake longer and active, the adenosine levels will be higher, making one feel sleepier. Afternoon naps, which last longer than 30 minutes, and reduced physical activity during the day, diminish the homeostatic sleep drive.

2. ***Circadian Rhythm Sleep Drive or Sleep C.*** The natural cycle of sunlight or bright daylight and the night darkness create biological circadian 24-hour rhythms. From plants and the tiniest living organisms such as bacteria to complex living beings such as humans, each has set natural behaviors for survival. These behaviors get controlled by the circadian rhythms (*circa* means round, and *dien* signifies a day). The circadian rhythms are under the control of the master clock located in the brain. The brain clock resets itself daily to a 24-hour day cycle of light and darkness. It controls three behavior cycles of survival in all mammals, including humans:
   - **Sleep-Wake cycle**
   - **Fasting-Feeding Cycle**
   - **Activity-Rest Cycle**

"The Sleep-Wake cycle is the core survival behavior which regulates the other two behavior cycles. If the Sleep-Wake cycle gets disrupted, the other two invariably get disrupted, leading to disease and disability."

Circadian Rhythm Sleep and the Hormone Melatonin. The hormone melatonin in the brain controls the circadian rhythm sleep. Melatonin sleep is deep and rejuvenating. It is vital to health as the rest, repair, and rejuvenation of the body as a whole occurs during this sleep cycle.

The light signal from sunlight or bright daylight is the wake-up stimulation signal for the brain clock. Stimulation of the brain clock sends a message to the pineal gland in the brain to produce a mood-elevating substance called serotonin. The sleep hormone melatonin, in turn, gets synthesized from serotonin. Since the mood-elevating hormone serotonin and sleep hormone melatonin are interrelated, depression and insomnia are also interlinked. Depression, mood disorders, and suicide rates are higher in the geographic locations of the world where the sunlight and bright daylight are scarce. The melatonin gets stored in the pineal gland and gets released in response to the darkness of the night around 9 PM. Exposure to bright artificial light and blue light of digital devices inhibits the release of melatonin, depriving an individual of vital rejuvenating sleep.



The natural signals of light and darkness have a consistent pattern in most of the geographic locations of the world. These signals work with the circadian brain clock system to produce and release melatonin at appropriate times to bring about natural rhythms of sleep-wake cycles. However, the artificial bright light and blue light from digital devices, which are entirely under human control, prolong the daylight effect, disrupting the melatonin hormone release at night. Waking up late in the morning and keeping indoors in the morning inhibits the synthesis of the sleep hormone melatonin in the pineal gland of the brain. The lifestyle of modern humans interferes both with the melatonin synthesis and its release. These are the most significant disrupter of the natural sleep-wake cycle.