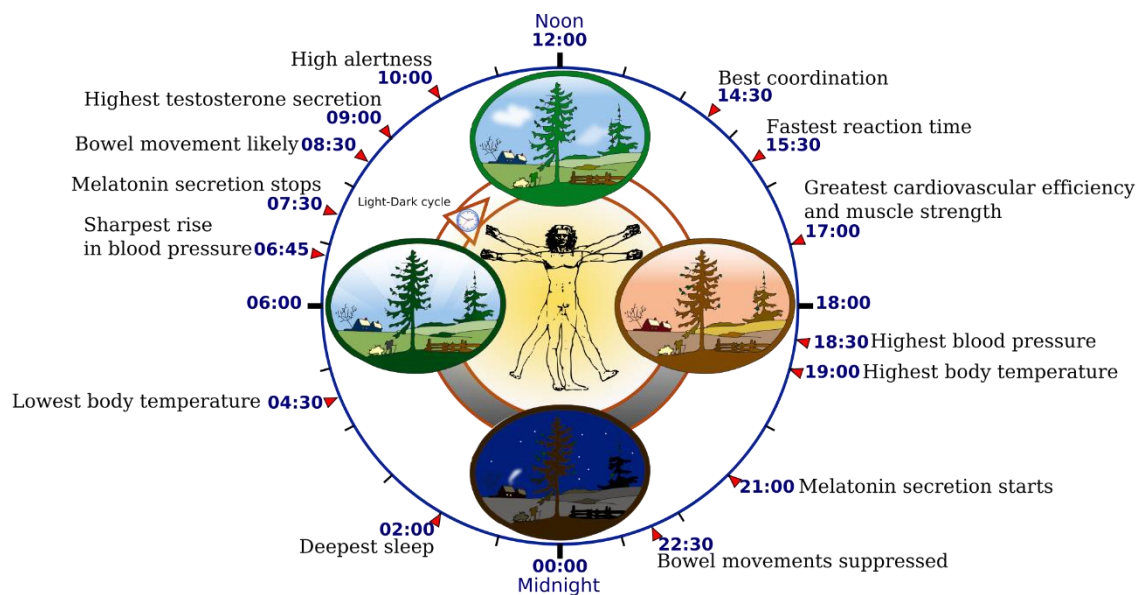




HSC Exam/Study Tip # 20: Circadian Rhythms

A brief understanding of the circadian rhythm is required for upcoming tips.

The ability to anticipate regular events, such as the availability of food and the appearance of predators has played a major role in human evolution. As shown in the diagram below, many physiological events are closely associated with the time of the day and repeat themselves every 24 hours.

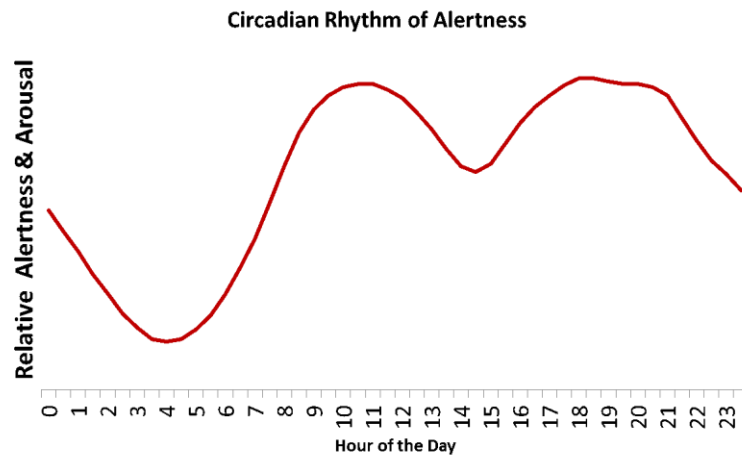


A **circadian rhythm** is any biological process that displays a cycle of about 24 hours. Examples of circadian rhythms include:

- Sleeping patterns (and hence sleep quality)
- Body temperature
- Heart rate and blood pressure
- Energy levels
- Eating patterns and mood
- Melatonin (sleep hormone) and cortisol (stress hormone) secretion

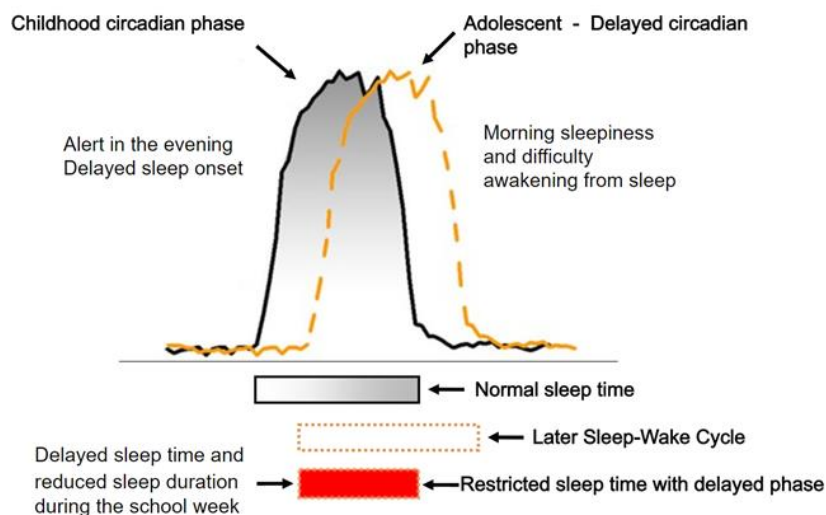
and many other important bodily functions.

Alertness and concentration levels also follow a circadian rhythm, as shown below. This graph illustrates the alertness levels in adults (20+ years) and children (< 12 years) and arises as the result of our relative need for sleep as opposed to our urge to stay awake, which also have a circadian rhythm.



The biological clock of children (< 12 years) shifts by two hours during adolescence (ages 12 to 19), leading to a later bed-time (11:30 pm or later) and a natural tendency to wake up later in the morning. Because of this shift, teenagers lose two to three hours sleep every school day. They often come to school sleep deprived and without eating breakfast, both which have a **significant impact** on memory and learning.

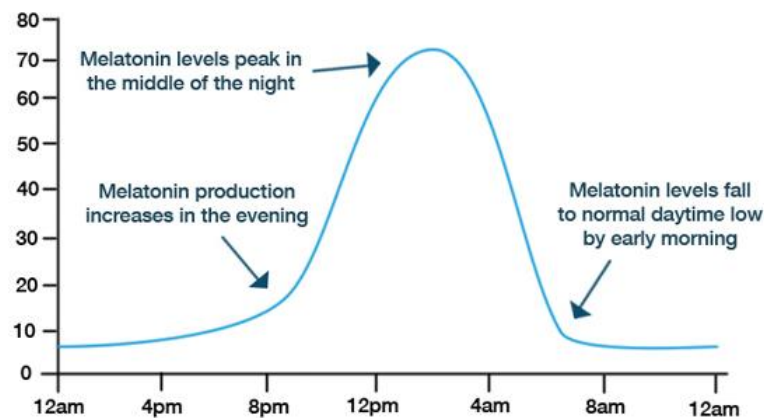
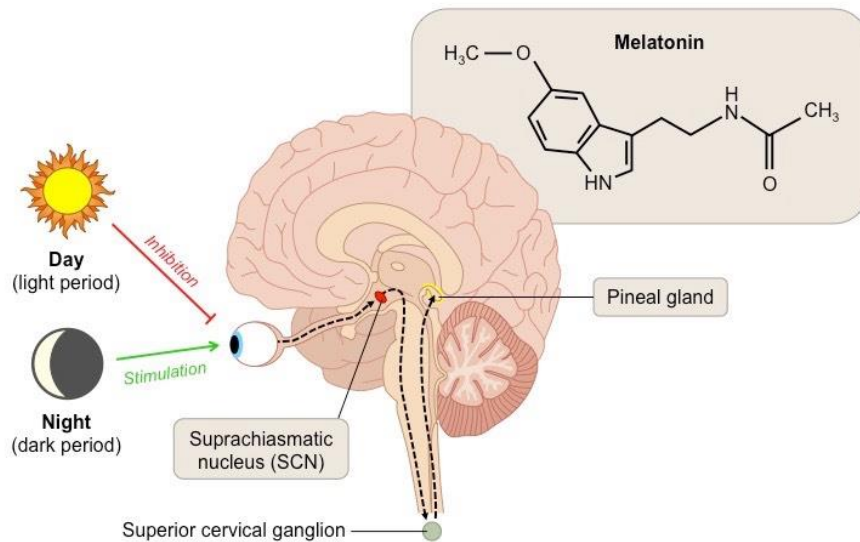
Adolescent sleep-wake cycle



What Controls the Circadian Rhythm?

Circadian rhythms are controlled by internal body clocks. These body clocks are affected by environmental cues like temperature and the availability of food, and are **most strongly influenced** by the amount of light and darkness in an organism's environment.

When the pineal gland in the brain detects the prolonged absence of light, it starts to secrete melatonin, otherwise known as the 'sleep hormone'. In the presence of the blue wavelengths in light, the production of melatonin stops. It is these changes in melatonin that regulate our sleep-wake cycle, which then influences the majority of circadian rhythms in our body.



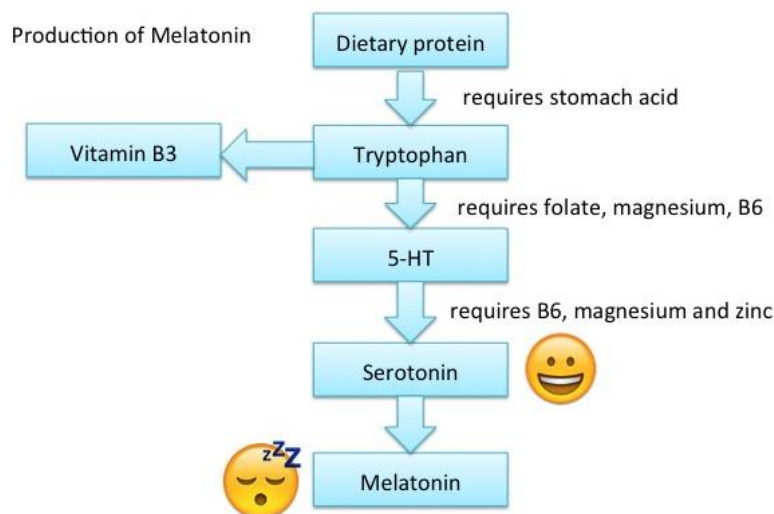
The circadian rhythm can be disrupted by:

- Exposure to blue light at night. Blue light emitted by TV and computer screens, mobile phones etc. suppresses melatonin production, making it more difficult to fall asleep.
- Not receiving enough natural light in the morning.
- Exposure to light at abnormal times.
- Jet lag.
- Shift work.
- Lack of exercise.

Maintaining a Regular Circadian Rhythm

Maintaining a regular circadian rhythm involves minimising the factors that disrupt circadian rhythms, and include:

- Reducing exposure to blue light at night. Either avoid blue light emitting devices 1 to 2 hours before sleep, or invest in a pair of blue-light filter glasses, which are designed to stop blue wavelengths of light from reaching your eyes. Melatonin can then be produced, and you'll soon be on your way to a great night's sleep!
- Making sure your bedroom is completely dark at night. Science has shown that even a tiny bit of light can throw off your circadian rhythm and impact the quality of your sleep.
- Waking up and going to sleep at about the same time every day – including weekends. Do not change these times by more than 1 hour.
- Exposing yourself to sunlight as soon as you wake up. This will help clear the melatonin from your system and lend your brain the clarity it needs to start learning.
- Getting plenty of exercise and exercising at the same time each day.
- Maintaining a quality diet. To produce melatonin, the body needs an adequate supply of:
 - Magnesium (green leafy vegetables such as spinach and kale, nuts and seeds, legumes, vegetables, seafood)
 - Zinc (Meat, shellfish. Legumes, nuts and seeds, dairy, eggs, whole grains)
 - Vitamin B6 (fish, poultry, pork, wholegrain cereals, eggs, soybeans, vegetables)
 - Tryptophan (an amino acid that must be supplied in our diet). Foods rich in tryptophan include turkey, cos, spirulina, parmesan, mozzarella cheese, pork, beef, soybeans.



Having a strong circadian rhythm makes an **enormous difference** to health, energy levels, willpower and the ability to focus and learn, so optimise your biology and become happier, healthier and more productive, and maximise your HSC marks.

Regards, TSFX.