

## **Describe and critically assess the evidence that suggests the circadian rhythm is controlled by endogenous factors.**

The Circadian rhythm is a 24 hour cycle which occurs in humans in hormone levels, body temperature, heart, respiration and metabolic rate and sleep pattern. The circadian sleep-waking pattern is of most interest to psychologists because of the dramatic changes in behaviour it produces. The circadian sleep-wake pattern is said to be governed by many different factors, both endogenous and exogenous, which both have input into the circadian cycle in different ways.

There are many endogenous pacemakers which can be said to have great effect on the 24 hour circadian sleep-wake pattern. The first is the biological clock, which is the interaction between proteins. Darlington et al., 1998, described one clock. They thought two proteins, Clock and Cycle linked together in the morning, due to this binding two other proteins increase their production during the day, they are Per and Tim. As these levels of Per-Tim increase, they decrease the production of Clock-Cycle which means as they slow as does the production of Per-Tim. As Per-Tim decreases, Clock-Cycle rises ready to begin the next cycle. Even if the details may vary from organism to organism, this core loop appears to be the centre of the endogenous biological clock mechanism in organisms.

Another endogenous pacemaker, said to be the main is the suprachiasmatic nucleus (SCN). The SCN is a tiny cluster of nerve cells which lies in the hypothalamus. It is a pair of structures with one half on the left side of the brain and one on the right. Its job is to information on light from the optic nerve, even if your eyes are closed. If our endogenous clock is running slowly then the morning light will automatically shift the clock ahead putting the rhythm in step with the outside world.

Light is an exogenous factor and recently has been seen as one of the most important of the exogenous factors to affect the circadian rhythm. Wever et al., 1983, proved that exposure to bright light restrains melatonin production meaning that daylight will re-set the biological clock as seen by SCN but dim artificial light is less effective. Light is said not just to affect the SCN, but also certain proteins in the body have detected changes in light as proved by Hall, 2000. The importance of light as an exogenous zeitgeber can be seen in the experiment conducted by Miles et al., 1977. They proved that the lack of information given by light ruins their sleeping patterns.

A final endogenous factor is the pineal gland and melatonin which as well as the SCN is another pacemaker in the brain. It is also light sensitive, as when light is sensed the production of melatonin in the pineal gland is inhibited. When the level of light decreases melatonin is produced by the pineal gland. Melatonin stimulates sleep by reducing the brain mechanisms that encourage vigilance. Therefore, light, the pineal gland and melatonin regulate the sleep-wake pattern.

Exogenous zeitgebers are environmental factors which help the 24 hour circadian rhythm. They help the endogenous pacemakers to create a steady 24 hour rhythm. One exogenous zeitgeber is light which has already been dealt with and these days is seen as the most dominant. Until fairly recently however social cues were seen as the main zeitgebers. Our daily rhythms are often determined by such every day habits as eating our meals and getting up and going to bed. Our meals are eaten at socially determined times, we go to bed and wake up at times designated appropriate for our age. These all contribute to our circadian rhythm. A final exogenous zeitgeber is temperature which can determine different effects of our circadian rhythm. For example, deciduous trees have leaves which change colour and drop off because of the changes in temperature. Temperature is also a factor in the beginning of hibernation, however there is little evidence that temperature affects human biological rhythms.

Both endogenous and exogenous factors contribute to and control the circadian rhythm. However, endogenous pacemakers due to their fundamental position within the body appear to dictate the circadian rhythm a lot more than the exogenous factors. Often the two coincide and combine, for example, in SCN light is a strong factor and without it an organism would not adapt truly to how the world is. It seems clear that endogenous factors are slightly more important than exogenous zeitgebers, particularly for example temperature which is said to not play a part in human biological rhythms at all in the circadian rhythm. Endogenous pacemakers seem to govern the circadian rhythm more but exogenous zeitgeber appear necessary also for an organism's cycle to adapt to the outside world.