

# Discuss the role of endogenous pacemakers

[Health & Medicine](#), [Body](#)



Discuss the role of endogenous pacemakers in the control of circadian rhythms [AO1 8 marks, AO2 16 marks] An endogenous pacemaker is an internal biological clock that controls the way in which many of our biological rhythms behave. Many of these rhythms run on a 24 hour basis, such as the sleep/wake cycle, bodily temperatures and some of our hormones. The main endogenous pacemaker in mammals is the suprachiasmatic nucleus (SCN), which is located in the hypothalamus. It receives information about lights from the eye through the optic nerve.

This happens even when our eyes are shut, due to them being so thin, meaning that if our endogenous clocks are slow (e. g. because the sun rises earlier than the day before) morning light automatically shifts the clock ahead, putting the rhythm back in sync with the day. At night, when there is no light, the SCN then sends a message to the pineal gland, causing it to increase the production of melatonin, which induces sleep by preventing the brains mechanism to promote wakefulness.

An example of the way endogenous pacemakers control our circadian rhythms is a case study on Michael Siffre. Siffre willingly spent a long period of time under ground, to find out what happens to the sleep/wake cycle when the biological rhythm is allowed to run freely without external cues. His findings showed that the free running cycle settled down to a regular rhythm which is little over 24 hours. This study shows that the circadian rhythm persists without the cues of natural light, which demonstrates the existence of an endogenous clock.

However the study also shows that external cues are also important to the sleep/wake cycle, because the clock was not perfectly accurate, meaning

<https://assignbuster.com/discuss-the-role-of-endogenous-pacemakers/>

that without the cues of natural light, it would become out of sync with day and night. This study was supported by Aschoff and Wever (1985) who placed participants in an underground bunker without any external cues, and found that many participants displayed circadian rhythms of between 24 and 25 hours. However some of the circadian rhythms of those in the bunker were as long as 29 hours, showing that individual differences can effect the results meaning this study and the case study of Michael

Siffre cannot be generalised to the wider population. Miles et al's (1977) study of a man that had been blind since birth showed that the man had a circadian cycle of 24.9 hours. The blind man was exposed to different exogenous zeitgebers such as clocks and social cues, but they found that none of these factors reduced his biological clock to 24 hours, and he had to take stimulants in the morning and sedatives at certain times at night to reduce his biological rhythm in time with the rest of the world.

This research supports the idea that the sleep/wake cycle is a circadian rhythm controlled by an endogenous pacemaker as it did not adjust when influenced with any natural exogenous zeitgebers, and was only effected when certain drugs were used to change it. However this study can be criticized as it is only a case study of one man, meaning it lacks population validity and cannot be generalised to the wider population. Morgan et al (1995) also provided evidence for the effect of endogenous pacemakers of the circadian rhythms by breeding 'mutant' hamsters that had circadian rhythms of 20 hours instead of 24.

He then cut the SCN's out of the mutant hamsters and transplanted them into normal hamsters. The normal hamsters then began to display the 20 hour

<https://assignbuster.com/discuss-the-role-of-endogenous-pacemakers/>

circadian rhythm of the mutant hamster. This proves that endogenous pacemakers play a large role in circadian rhythms, as it showed that the sleep cycle in the hamsters depended on biological factors from within the brain. However this research may raise some ethical issues as it can be seen to breach the terms of animal cruelty, as it may cause the hamsters to become psychologically unhealthy.

Also the research can be criticized as it only shows the effect of the SCN on hamsters sleeping cycles and cannot be generalised to humans as hamsters have much smaller brains and are also nocturnal animals meaning that light does not effect their circadian rhythms, the same way it does ours. In conclusion, I think that endogenous pacemakers do play a very large role in helping to maintain our circadian rhythms, however this is also with the help of various exogenous zeitgebers which help keep the rhythms precise.