

Consequences of circadian disruption during pregnancy

[Science](#), [Biology](#)



Circadian rhythms are very important for animal activity anticipated during the day and night. It is regulated by suprachiasmatic nucleus (SCN) and can be changed by environmental cues to induce changes on expressions of clock genes such as Clock, Bmal1, Per1, 2, 3 & Cry1, 2 which can affect metabolic process and body systems. Clock and Bmal1 genes drive expression from Per1, 2, 3 and Cry1, 2 which then inhibit expression of Clock and Bmal1 through a negative feedback loop. Changes of maternal physiological processes have to be made in order to adapt to pregnancy and circadian rhythms of body temperature and glucocorticoids in pregnant women are altered. After experiments on rodents, it was found out some hepatic clock genes expressions experience changes after being pregnant and also although all clock genes are expressed in placentas, but circadian variation is minor which may due to short gestational period of rodents. Changes of maternal liver and adipose tissue were also seen. Circadian disruption during pregnancy would bring negative effects to both mother and fetuses.

Circadian rhythms are enhanced by environmental factors such as light and food which can induce changes in metabolic rhythm and may lead to negative outcomes. Although the impact of light on circadian rhythms was not explained in detailed during lecture, but I can notice the effect of light from my own experience. There was one day when I had to do my assessments until 2 o'clock in early morning, the light in my room was very bright, I did feel very sleepy and the light gave me an illusion that I was actually in the daytime. My reaction may be explained by process of photosensitive retinal ganglion cells (pRGCs). These cells receives input from

retina and express the photopigment melanopsin (OPN4) which are light sensitive and then projects to SCN via retinohypothalamic tract (RHT) where the intracellular molecular clock is entrained. If there is a photic stimulus, neurotransmitters of the RHT will be released at synapse in SCN which increases firing rate of SCN neurons and promotes expression of Clock and Bmal1 which are the genes that their expressions are promoted during the day. pRGCs do not just mediate circadian entrainment, but also regulation of sleep-wake timing and cognitive function. Therefore, abnormal light exposure can not only cause circadian disruption, but also affect sleep, cognition and increase risk of having metabolic and cardiovascular disease which is a concern in modern society as considering population of shift workers and increasing population who use laptops and phones at night. Eating food at wrong time especially late at night will not only have an impact on circadian rhythms, it will also change metabolic bring negative outcomes on the health of people who normally eat at late night. People in countries such as China start to develop habits of eating food at late night. A study that investigated the relevance of having night eating habits and negative health outcomes, it was found out that nighttime eating are strongly associated with risk of breast cancer among women with BMI less than 25, who have had nighttime eating habits after 10 o'clock at night for more than 20 years and consume diets which were rich in carbohydrates.

Shift workers have higher incidences of chronic disease such as obesity and cardiovascular disease. Shift workers also have increased risks of pregnancy complications such as preterm birth, prematurity and spontaneous abortion.

Even the people who have not learn biological knowledge should know that irregular daily routines for a long time would ruin a person's health. If a pregnant woman does shift work for a long time, it is definite that both mother and baby's health would be impacted. Developing fetuses communicate with their mothers through metabolic and hormonal information, however shift work will disrupt circadian rhythms and cause changes in metabolism of mothers' body which may disrupt organization of fetal physiology.

Also interestingly to know as fetuses develop, they become sensitive to light cues penetrating through mothers' abdomen. Since people who have shift work are more likely to work under artificial light at night, so fetuses of pregnant women who perform shift work are not only experience circadian disruptions via maternal mistimed signals, but also through their own receptions of light. Overall, this lecture showed information about circadian rhythms. From this lecture, I learned that maintaining normal circadian rhythms is very important for us, especially for pregnant women as the negative outcomes of circadian disruption can be very bad.