Abstract

In mammals, the central biological clock is located in the suprachiasmatic nuclei of the hypothalamus (SCN). Neurons of the SCN display circadian rhythmic activity and coordinate physiological functions within a day. At the molecular level, the rhythmicity of these neurons is based on transcriptional-translational feedback loops in the expression of so-called clock genes. During ontogenesis, the spontaneous rhythmicity evolves in the SCN gradually from the prenatal period and is affected by the maternal organism signals. The mechanisms of the maternal entrainment were investigated in two publications, which this thesis is based on.

The first publication aimed to determine when the clock gene expression begins to be rhythmic in the SCN during the prenatal development of the laboratory rat. Two 24-hour clock gene expression profiles in the fetal SCN were compared under physiological conditions at two different development stages. The result showed that all three measured clock genes (*Bmal1*, *Per2* and *Rev-erbα*) were expressed rhythmically on the 21st day of the embryonic development. However, only the expression of gene *Rev-erbα* was found to be rhythmic at the embryonic day 19.

In the second publication, we investigated the effect of the maternal hormone melatonin on the entrainment of the circadian clock in the SCN of newborn rat pups. The pregnant rat dams were exposed to constant light and became behaviorally arrhythmic. During the last five days of gestation, they were injected with either melatonin or vehicle regularly. After delivery, the 24-hour expression profiles of genes *c-Fos* and *Avp* were assessed in SCN of newborn pups. The comparison of both groups demonstrated, that the melatonin injections entrained the pup SCN clock to the different phase than the vehicle injections. The second experiment was performed in pinealectomized rat dams according to the same experimental scheme. The results confirmed the synchronizing effect of melatonin injections. In this case, the vehicle did not entrain the expression of the gene *c-Fos* and only slightly entrained the *Avp* expression. Altogether, the results show that the maternal melatonin plays a role in the synchronization of the fetal SCN and its effect functions at the gene expression level.