Avian pineal gland, together with retina and the hypothalamic suprachiasmatic nuclei, is a partially autonomous component of the endogenous master clock. The pineal gland synthesizes its indoleamine hormone, melatonine, rhythmically throughout the L:D cycle, with a peak at night and a low basal level during the day. This hormone is not stored in the pineal gland, but is released immediately into the peripheral circulation; thus, the elevation of its level in the blood corresponds to the night period. Consequently, melatonin conveys information about external lighting conditions and the activity state of the central oscillator. Moreover, bidirectional communication between the pineal gland and immune system were found in all vertebrate classes investigated until now. For many years it has been thought that these activities are the most important functions of the pineal gland. However, investigations conducted for the last couple years have indicated that the pineal gland is a major organ of neurosteroidogenesis. At least 11 different derivatives of cholesterol have been demonstrated to be synthetized *de novo* in the pineal gland. Among them pregnenolone, 7α-hydroxypregnenolone, 7β-hydroxypregnenolone, allopregnanolone and epipregnanolone seem to be the most important. It was demonstrated that 7α-hydroxypregnenolone activated locomotor activity of chickens, quails and newt, probably via the induction of dopamine release from their terminals in rostral brain regions. Neuroprotective features of allopregnanolone in the brain of young birds were also found. This compound prevented Purkinje cells against apoptosis. This neurosteroid may be crucial in the formation of neuronal circuit in the developing cerebellum. Additionally, in human it was found close correlation between changes in the level of allopregnanolone in the brain and development of neuropsychiatric disorders e.g. depression, anxiety and panic.

Although the synthesis of neurosteroids has been investigated for many years, there is a lack of research concerned on regulation of the expression of the genes encoding enzymes participating in synthesis of neurosteroids or classical steroids outside the nervous system. Thus, the aims of the proposed study are to verify the following: (1) whether all genes encoding enzymes of the neurosteroids synthesis pathway are expressed rhythmically over the daily cycle and if these expression remain under control of pineal molecular clock; (2) whether the inflammation may influence the neurosteroids genes expression; (3) which potential transcriptional factors may interact with the promotores of the genes encoding enzymes of the neurosteroids synthesis pathway and (4) to examine the involvement of potential transcription factors in the transcriptional regulation of genes encoding enzymes of the neurosteroids synthesis pathway.

All experiments will be carried out on the pineal glands of 16-day-old male Hy-Line chicken kept in controlled light (L:D 12:12) conditions or on primary pinealocyte cultures. We will use molecular biology techniques and genetic engineering methods including: real time PCR, cloning and analysis of interaction between promoter DNA elements and transcription factors using reporter gene system.

Execution of the proposed studies will have many advantages. First of all it will allow us to understand regulation of *de novo* neurosteroidogenesis in avian pineal gland. Secondly, we will create background for future, more advanced investigations of possible functions that neurosteroids may play in avian brain. Thirdly, we hope that the execution of the project will permit us to better understand the mechanisms underlying the development of inflammation in birds as well as the relationships between immune system and pineal gland.