The *Pars Tuberalis* (*PT*) is a discrete area of the adenohypophysis involved in hormonal homeostasis. Due to the presence of cells secreting luteinizing hormone (LH) and follicle stimulating hormone (FSH) which regulates reproductive activity of animals, it is postulated that the fundamental function of the *PT* is promotion and regulation the secretory activity of the *Pars Distalis* of the pituitary. In animals which exhibit the seasonal changes in reproductive activity, the *PT* is involved in annual regulation of physiological processes. It is postulated that the factor adjusting the activity of secretory cells located in the *PT* to seasonal changes in the light conditions is melatonin. This hormone is synthesized in the pinealocytes of the pineal gland during darkness and released into both the cerebrospinal fluid and peripheral blood. In the presence of light, the synthesis of melatonin is inhibited. The melatonin secretion in sheep depends on photoperiodic conditions. The highest level of melatonin and the longest duration of its presence in the organism occur in winter, under short day conditions. In summer, during the long day photoperiod, the concentration of melatonin is significantly lower. Melatonin affects cells via specific membrane receptors (MT) type 1 and 2, which occur only in this part of the pituitary. Numerous studies have shown that melatonin regulated the reproductive activity of the seasonal breeders by disrupting the natural rhythm of gonadotropins secretion.

The adaptation of the animals to the seasonal and circadian changes in the environmental condition is possible due to the presence of the biological clock occurring in various tissues. The proper action of the biological clock depends on the rhythmical expression of clock genes which then, correlating with each other, create the molecular oscillator mechanism. In the ovine *PT*, the expression of seven clock genes was determined which take a part in decoding of melatonin signal. These genes are: period *(PER) 1* and *2*, *CLOCK* and *BMAL1*, mammal cryptochrome (*CRY) 1* and *2* and casein kinase *ε* (*CK) 1ε*. All of these genes, show rhythmic expression; wherein *PER* reach a peak expression during the first half of the light phase and the *CRY* during the beginning of the dark phase. Moreover, the work carried out on transgenic mice with knockout of *PER1* gene, showed the reversion of the *TSHβ* gene expression rhythm, what suggests that melatonin influences thyrotrophic hormone homeostasis in the *PT* via *MT1* receptor and *PER1* protein.

In my earlier work, I showed the occurrence of the mRNAs encoding proinflammatory cytokine such as interleukin (*IL)-1β, IL-6*, tumor necrosis factor *(TNF)*α and their corresponding receptors in the *PT* cell. Additionally, these genes expression were usually modulated by inflammation associated with administration of bacterial endotoxin – lipopolysaccharide (LPS). These results suggest that the *PT* is a place of integrations between both photoperiodic and immunological signal, which may affect on the secretory activity of the *PT* cells. Numerous studies revealed the existence of the bilateral relationship between the gene expression of the biological clock and the activity of the immune system. Clock genes expression was found in spleen, lymph nodes and macrophages of mice and rats and in human immune cells. The presence of the autonomous clock in the immune system organs allows the regulation of cyclic cytokines production in response to inflammation caused by LPS. Moreover, the lack of some clock genes disrupts proper functioning of immune system. However, it was also found that inflammation may also affect the gene expression of the clock genes in the liver.

The potential ability of immunological stress to disturb the proper decoding of melatonin signal in the *PT* cells could have a significant impact on the secretory activity of the pituitary. Because, the photoperiodic conditions affect both the strength of melatonin signal and sensitivity of different tissue (including *PT*) to this hormone action, , the influence of inflammation on the biological clock activity in the *PT* may be depend upon the season and phase of day (light / dark). Due to the importance of the proper decoding of melatonin signal in the *PT* for reproductive process in seasonal breeders, obtained results may significantly expand the knowledge of the pathophysiology of reproduction disorders with commonly accompanying the inflammatory state.