The inner circadian timekeeping system rules all physiological proccesses that repeat in our body regularly every day. This system works at many different levels, from the molecular level to the level of complex behavior. Although the central clock is located in the hypothalamic brain area, the molecular mechanism responsible for the rhytmicity per se is present in almost every cell in the body. In humans, the misalignment of inner clock due to irregular daily schedule might lead to development of severe disorders including sleep problems, obesity, breast cancer and neurologic and psychiatric disorders. Therefore, intensive research of the circadian system is necessary for our understanding of underlying mechanisms involved in the connection between misaligned inner clock and these diseases.
During my PhD studies, we ascertained that during prenatal development in rats, fetal central circadian clock is sensitive to periodic maternal feeding. This occurs specially under conditions when the maternal circadian system is disturbed and entraining signals from the maternal central clock are lacking.
Moreover, we studied the functional state of the circadian system in children with neuropsychiatric disorders. In 10-12 year-old children with attention deficit hyperactivity disorder (ADHD), we found a shortened nighttime signal of a hormone melatonin compared with age matched control children. This might result in a shorter subjective night and consequently in a shorter sleep duration.
In children with Smith-Magenis syndrome (SMS), we proved the severely altered melatonin profiles. Moreover, we found desynchronized profiles in clock gene expression in peripheral clocks. Therefore, it is possible that the molecular clockwork of the central clock is altered in SMS children.
Finally, we ascertained that the peripheral circadian clock may sense the individual chronotype in humans even under real-life conditions.