G-protein coupled receptors (GPCR-s) comprise a large family of transmembrane proteins involved in regulation of signal transduction through the cell membrane in response to various extracellular stimuli. The focus of our research is elucidating the role of GPCR in neuroscience and reproductive medicine.

Technologies and assays based on fluorescence give us the possibility to investigate the systems of interest from different aspects with unprecedented precision and high sampling rate. This has in turn led to the adoption of a "systems" approach in our research with an increasing trend towards study of entire GPCR signaling pathways: ligand binding, receptor interaction with G-protein, G-protein dissociation and the role of individual subunits, properties of adenylatecyclase in conversion of ATP into cAMP, cAMP production and its role in protein expression, etc. However, this approach also led to an explosive increase of raw data. To integrate data from multiple measurable signals into meaningful actionable knowledge that can yield real insight into studied processes, we use multivariable global data analysis combining various fluorescence readouts (intensity and anisotropy based).

To achieve cellular expression of receptors and biosensors (Melanocortin, Dopamine, Neuropeptide Y and Follicle stimulating hormone receptors; G protein subunits mutated to give interaction with FlAsh/ReAsh dyes, FRET based functionally active cAMP-sensor (Epac-camps) and reporter-gene luminescent sensors) we use viral systems. For our research we have chosen the baculovirus expression vector system that is widely used for protein production in insect cells (Sf9), and with minor modifications also in mammalian cells (BacMam System).

Viral systems can also be used to improve signal-to-noise ratio of fluorescence signal. We have adopted baculoviruses (budded from Sf9 cells) and virus-like particles derived from mammalian viruses (HIV, RSV, MMLV) for surface display of GPCR-s. This further decreases the complexity of studied system in comparison to the natural cellular environment.

Now we are working on implementing microscopy in our research, thereby reaching new scopes of data quality and acquiring deeper understanding of cellular function and the impact of potential drug candidates on their target GPCR-s.