The vast majority of psychiatric drugs was developed decades ago based on serendipitous discoveries in times when little was known about their mechanism of action. This was also a time when the neurobiology and pathophysiology of psychiatric disorders were emerging. Today, mood and anxiety disorders remain one of the leading threats to public health worldwide. As a result of the Covid-19 pandemic and political tensions, a significant influx of patients suffering from depression, post-traumatic stress disorder (PTSD), or substance use disorder (SUD) is to be expected. This necessitates a search for viable solutions. Psychiatric drugs can only provide a temporary relief[1] of symptoms and only for some subset of patients. What is more, most of these substances must be taken for several weeks before the first effects are observed, and the mechanism of their action is usually limited to alleviating the symptoms of a given disease but not curing the disease itself. Worse yet, bout 30% of patients will not respond to antidepressant medication in the first place.[3]

The introduction of psychedelics into therapy is perhaps one of the most promising and exciting developments in the field. Psychedelics used as medicines seem to provide both of the desirable outcomes sought in therapy: long-lasting effects and an almost instant response[4,5]. This unique combination of effects is not observed with any other psychiatric medications. Psychedelic drugs were intensively studied in the 1950s and 1960s, but due to unfavorable legal regulation, their study was almost abandoned globally. However, the last decade has been a veritable renaissance of psychedelic drug research. The atrophy of neurons in the prefrontal cortex (PFC) is one of the key components in the pathophysiology of depression and mood disorders. It is believed that psychedelics have the ability to induce synaptic plasticity which underlies the effectiveness of their action. Currently, we are observing a significant number of studies and clinical trials with ketamine, LSD, psilocybin, etc. The mechanism of action, and how exactly the brain is affected by these powerful substances are not understood yet. In light of the many ongoing clinical trials, and the promising effects of therapy, it seems only reasonable to intensify research work in this area. This in turn requires an interdisciplinary approach and the usage of all of the tools available to modern science. While the physiological and clinical effects of psychedelic drugs are studied to a greater extent, the level of molecular information, and in particular that of proteomics remains largely unexplored.

The aim of this project is to study how the cellular response to psychedelic drugs works and what proteins interact with psychedelics. Changes depending on the region of the brain, the type of substance administered, and the time after administration will be revealed. The study of interactions between proteins, changes in the quantitative profile of proteins, and finally the way in which they are modified is crucial from the point of view of molecular biology. It's hard to find a biological process that doesn't involve proteins. Proteins are the "workhorses" of organisms. Therefore, in order to understand a given biological process, it is necessary to identify the components that determine its course. Psychedelics are not ideal drugs. They have sometimes significant side effects, but they are well described. Understanding how individual substances affect the brain, what signaling pathways are stimulated, and which of these changes are responsible for the desired effects and side effects can be used in the drug design or the selection of the most promising substance to be administered to a specific patient.