Classical models of drug action used to describe medicines affecting receptors in human body as fitting drug to the receptor occurring in similar manner as a key fitting to a door lock. For a long time, selective drugs were thought to be superior over non-selective ones - those fitting to one receptor (lock) only were considered to be better. It was assumed that they should have fewer side effects. However, these drugs turned out to be ineffective in some conditions, e.g Alzheimer's disease, Parkinson's disease, cancer and schizophrenia. In these cases, instead of designing a precise key, scientists search for chemical compounds which fit to a number of receptors (locks). It can be thus stated that the scientists open a few doors to health by a few copies of the same key simultaneously. Instead of a bunch of keys which can be compared to a handful of drugs, we have one drug-key which helps to avoid drug-drug interactions.

The aim of the project is to elaborate chemical compounds which act *via* a few receptors-locks and which can be developed in future as modern drugs for the treatment of schizophrenia. In preliminary studies we identified four chemical compounds which are such universal keys and which have beneficial effects on laboratory animals: these compounds are effective in treating model psychosis and to treat anxiety and cognitive impairment. We aim to modify these compounds to make them even more effective and to reduce their side effects. Applying the analogy of a key and a lock, we are going to modify our keys in such a way that they fit to receptors-locks responsible for treatment and do not fit do receptor-locks involved in mediating side effects. The compounds will be synthesized and their effects on cells will be assessed in order to estimate the degree of fitting to receptor-locks. Next, the compounds will be administered to laboratory animals to check their effect on the living organisms.

In addition, computer-aided studies are an important part of the project. All chemical compounds, including drugs and receptors, can be described by giving xyz coordinates of the atoms (as we describe the tops of the cuboid) which results in a model which can be entered to a computer. Having such models of a drug and a receptor in hand, we can use computer software to check if the drug fits to the receptor and to analyse the changes the drug causes in the receptor. Moreover, computer software can help to design new drugs-keys similarly as the architects design houses. As a consequence, application of computers and specialized software allows to reduce the cost of elaboration of a new drug by 50%, thanks to the reduction of a number of expensive experiments.

We are also going to perform X-ray studies for new compounds, so simplifying the problem to take X-ray pictures of their structure which will help us – among others – to build more accurate computer models for the compounds.

Our motivation to search for novel compounds which can be in future developed into modern drugs for schizophrenia can be explained by high prevalence of this disease: 1% of population suffers from schizophrenia. Moreover, antipsychotics are also taken by patients with bipolar affective disorder. The growing pace of life promotes mental disorders. In general, the condition of schizophrenic patients gradually deteriorates over the years. Only about 25% of patients return to full health, and scientists believe that this would be the case regardless of whether they would take antipsychotics or not. A further 25% of patients can live independently, work and even start a family thanks to the fact that they receive the right treatment. The remaining 50% of people suffering from schizophrenia spend their lives in nursing homes, places of daily living, psychiatric hospitals, prisons or on the streets. Modern medicine does not know how to help them.

Of course, as a result of the project, new medicines will not be implemented. Such a process requires 10-15 years of research and enormous financial outlays (at least 100 million euros). Luck is still necessary in discovering new drugs, although it should be stressed that this process is much more rational today than it was centuries ago. However, we believe that our research will contribute to a better understanding of schizophrenia as a disease and perhaps – in future – to development of more effective and safer treatment.