**Synthesis of new macrocylic molecular receptors with torand skeleton for selective and effective metal cation detection**

The aim of this project is to obtain molecular receptors with torand skeleton for selective and effective detection of metal cations.

Metal cations are present in significant quantities in both the environment and living organisms. They participate in or and regulate most biological processes. For example, sodium cations participate in transmission of nervous signals. Deficiency of sodium in human diet can lead to death. Magnesium ions are present in chlorophyll, to which plants owe their green color and ability to photosynthesize. Tomatoes and raspberries grow better if fertilized with magnesium-containing fertilizers. Iron and manganese ions are commonly present in groundwater. In excess, they turn tap water brown, cause stains to appear on bathroom tiles and cause washing machines to malfunction. Some metal cations can be liberated to the environment as a result of mining. These can cause very severe poisonings, diseases and ruin the environment. For example, in 1960s, Kamioka, Japan, cadmium cations were liberated to the rivers as a result of silver mining. This caused local inhabitants to develop a painful disease and shortened lives of many people. All in all, monitoring of the concentration of metal cations is important from the point of view of industry, medicine and environment protection.

Among other methods, concentrations of metal cations can be monitored using optical sensors. These sensors rely on effects such as change of color or change of fluorescence of a certain compound in the presence of a specific cation. The light can be easily processed into an electrical signal, which can be, for example, displayed or send somewhere. Such optical sensors find many uses, because they are cheap, can be very small and are easy to use. In such sensors, cation detection is commonly effectuated by employing a fluorescent “molecular receptor” – a bifunctional chemical compound capable of both fluorescence and cation binding. When it binds a cation, its fluorescence changes.

In this project, we will research a class of molecules called torands as possible molecular receptors. Torands are capable of ion-binding, but relatively unresearched and very seldomly applied as molecular receptors. We have already collected preliminary results and literature data that compels us to think that it is possible to develop very good torand molecular receptors. Now, we obtain make such molecules by the means of chemical synthesis. We will research their receptor abilities. We will collect real-life samples of water from mines, river, etc. to show that our molecules can truly measure cation concentrations in these samples. This study will result not only in the development of new molecular receptors, but also fundamental knowledge will be gained on behavior of chemical compounds from the class of torands and how to make them.