Monitoring of the concentration of caesium cations is important from the viewpoint of human health and protection of the natural environment. It has been well documented that compounds composed of caesium cation are present in the plant wastes coming from the reprocessing of irradiated fuels. Importantly, significant concentrations of radioactive ^{137}Cs were found in the post-disaster areas, especially in the case of an accident in Fukushima-Daiichi nuclear plant in Japan in 2011. This accident was accompanied by an uncontrolled release of radioactive ^{137}Cs to the environment including groundwater. The radioactive waste containing dangerous ^{137}Cs will be present in the environment for the next 20 years. Moreover, some select caesium salts, which are present in dietary supplements (caesium chloride) or organic wastes from organic syntheses (caesium fluoride or caesium carbonate), are also dangerous for human health and environment. Therefore, the researchers have focused on the design of molecular receptors that would enable selective recognition of caesium cations in real samples, *i.e*., the samples simultaneously containing caesium cations and other cations such as rubidium, potassium, sodium, barium, or magnesium cations. However, the molecular receptors reported to date do not feature the ability to selectively recognize caesium cations in the presence of other cations. Sumanene is the bowl-shaped compound that is a fragment of fullerene C_{60}, a Nobel-prize winning molecule (Smalley, Curl, Kroto, Nobel Prize in chemistry in 1996). Principal Investigator of this project is an author of innovative concept in which sumanene was used as the highly selective molecular receptor of caesium cations. The Principal Investigator is the only researcher in Poland that conducts the research on sumanene chemistry, and the only researcher worldwide studying its applied supramolecular chemistry towards caesium cation recognition. Our preliminary research revealed that the analytical device (electrochemical sensor) composed of sumanene derivative featured selective, rapid, and effective recognition of caesium cations. Those works opened up new avenues not only in the organic chemistry of sumanene, but also in the applied supramolecular chemistry of this molecule in important fields.

This interdisciplinary project meets the top current trends in chemistry. Our project will be pioneering in terms of synthesising very new libraries of sumanene derivatives and will significantly improve the state-of-the-art of organic and supramolecular chemistry. The ultimate goal of this project is therefore to synthesize a library of fully innovative derivatives of sumanene that will feature improved abilities towards highly effective and selective caesium cations recognition. In this project we will achieve important goals within sumanene chemistry, such as the synthesis of sumanene derivatives featuring improved electrochemical properties, push-pull fluorophore architecture, or making sumanene water-soluble. Since the first synthesis of sumanene in 2003 by Sakurai and co-workers its chemistry has developed remarkably, but there are still important synthetic transformations that have not been studied in sumanene chemistry yet. A library of six types of fully innovative sumanene derivatives will be synthesized within this project. In this project we will investigate the reactions that have not been reported in the sumanene chemistry yet, as well as we will characterize the interactions between the as-synthesized derivatives and caesium cations in aqueous or organic solutions. Note that all those compounds, as well as their interactions with caesium cations have not been reported yet. Therefore, this project will highly contribute to the further development of the sumanene chemistry, as well as organic, materials, and supramolecular chemistry, and scientific discipline *chemical sciences* in general. This project combines different branches of chemistry and covers fully innovative studies on applications of the synthesized molecules as molecular receptors of caesium cations. The research works within this project will be conducted in international collaboration with prof. Hidehiro Sakurai (Osaka University, Japan) – the author of the first synthesis of sumanene, and the world-class expert in the chemistry of curved aromatic compounds, the so-called “buckybowls”.