Popular Science Summary

Antimony (Sb) is an element from the group of metalloids, commonly used in the technological and chemical industries, as an alloy additive and a catalyst for the plastic production. It also has its use in medicine as an active-molecule in drugs used to combat infections with leishmaniasis, a tropical parasitic disease. Most forms of antimony are unfortunately toxic to all organisms, including humans. Due to its carcinogenic potential, long-term exposure to this element is particularly dangerous, e.g. for people living in polluted regions, near mines and contaminated water and food sources. In the course of evolution, most organisms have developed many systems to eliminate the toxic effect of antimony on cells.

The aim of our project is to study these systems, looking for genes involved in the recognition and response of the cell to various forms of antimony, and to determine the role of these genes in the general cells functioning in the presence of this metalloid. As part of the research, we will utilise model eukaryotic organism budding yeast and modern sequencing methods to look for changes in the stress response of yeast cells caused by environmental antimony. The form of antimony used in treatment of leishmaniasis shows increased toxicity to cells with a defect in the process of destroying defective RNA molecules, which is common for the yeast and humans. Thus, we plan to investigate the possible connection of this process with cellular mechanisms that reduce the poisonous properties of antimony. Little is still known about the bioaccumulation potential, mechanisms of toxicity of various antimony compounds and their long-term effects on organisms. In addition, the medical community is concerned about the increasing resistance of Leishmania parasites to antimony-based drugs, which are still one of the main methods of treatment.

A better understanding of the impact of various forms of antimony on the functioning of cells and systems for reducing its toxicity, including potential factors affecting its transport in organisms, may be of an application nature. The research results can be implemented in construction of organisms used for purification of contaminated areas, soil and water, or to create crops with reduced antimony accumulation. In addition, the knowledge gained may be used in the future to create more effective therapies for leishmaniasis and to understand the negative impact of exposure to antimony on human health.