Programmed cell death (PCD) plays a crucial role in plant development, immunity or defense response. Toxic factors such as heavy metals could negatively affect plants leading to their death as a result of necrosis – unorganized, accidental cell death, or PCD – regulated and genetically controlled cell death. Although necrosis is a common manifestation of heavy metal toxicity in sensitive plants, leading to fast death, heavy metals could also lead to PCD as a defense response in tolerant species. It is proved that PCD could prevent plant tissues from deleterious effect of some biotic factors e.g. pathogens, but almost nothing is known about the PCD involvement in response to abiotic stresses. Our project aim is to determine if PCD plays a role in plant defense response to environmental stress such as heavy metal – Cd, very toxic, commonly occurring on heavy metal waste heaps in Poland.

For our study we chose species sensitive to heavy metals (*Arabidopsis thaliana*) not occurring on heavy metal rich soils and species tolerant to high concentrations of heavy metals e.g. Cd (*Arabidopsis arenosa*). *A. arenosa* is a facultative metallophyte, which can occur on metalliferous and nonmetalliferous sites and has a high tolerance to heavy metals. In our project we would like to identify the biochemical and molecular bases of plant PCD induced by Cd and its role as a defense mechanism in metallicolous plant populations (*A. arenosa*) compared to nonmetallicolous ones (*A. thaliana*). The main questions of the project are: 1) Could metal tolerant individuals protect themselves against heavy metals *via* PCD whilst intolerant ones do not develop such a mechanism of removing some cells to protect the others? 2) Do intolerant species affected by metals experience mostly necrosis leading to death in the long term or is PCD also activated? 3) Are there specific genes, related to PCD, activated during heavy metal stress? 4) Which caspase-like enzymes are activated during PCD induced by cadmium? 5) Is it possible to block PCD process in plants sensitive to high concentrations of heavy metals? 6) If PCD inhibition is feasible, would it not affect negatively plant metabolism?

In the current project we would like to examine several aspects related to the plant PCD as well as to find the molecular and biochemical pathway of plant PCD in tolerant and intolerant plant species. We would also try to block PCD events to improve plant survival in harsh conditions such as high concentrations of heavy metals in the environment.