

## **DESCRIPTION FOR THE GENERAL PUBLIC**

Plant ontogenetic development can be divided into a few stages: embryonic stage, germination, vegetative development, generative development, and senescence. The last stage, senescence, directly precedes death of a specific group of cells, organs or the entire plant. Although senescence is a destructive process, it is also very ordered and precisely regulated. Senescence of plant organs, i.e. leaves and petals, involves the mechanisms responsible for programmed cell death (PCD). A cell undergoing PCD activates a number of physiological and molecular processes aimed at a degradation of its protoplast and finally its death. This is accompanied by multiple changes at cytological, physiological and molecular level, such as degradation of cellular structures, fluctuations in phytohormone level or activation of expression of specific genes.

**There is, however, very little information on the senescence of fine roots.** Fine roots are the fine roots of the first, second and third order with a diameter smaller than 1mm. They are characterized by a lack of secondary structure, the presence of mycorrhizae and high surface to weight ratio. These properties allow them to efficiently perform their function that is to absorb water and minerals from the soil. At the end of the growing season, when demand for these substances decreases, significant portion of these roots shrink and die.

Our preliminary results suggest that, similarly as in leaves and petals, **senescence of fine roots may be associated with activation of programmed cell death (PCD)**. This, however, cannot be confirmed based on the current knowledge. The planned research will explain the mechanisms regulating seasonal senescence of leaves and fine roots in *Populus trichocarpa*. Moreover, comparative analyses will identify similarities and differences between senescence controlling mechanisms in these plant organs. Therefore, this project will involve a series of physiological, chemical, histochemical and molecular experiments that will improve our understanding of this process that has been so far considered mainly from the ecological perspective. To achieve this, the project will be divided into four research tasks, the aim of which will be: **(1)** To figure out the role of phytohormones in the regulation of plant senescence, **(2)** To determine the effects of carbohydrates on the regulation of plant senescence, **(3)** To evaluate degradation of cellular structures via autophagy, and **(4)** To investigate the process of remobilization activated to recover valuable chemical elements. Fine roots accumulate large amounts of elements that are released to the environment upon the root death. For this reason, the project may also provide new important information on the natural cycle of elements.