Eating alive – Plant cells eating themselves

Popular scientific report by David Solbach

When we are hungry, we go to the fridge to cook something or go to a restaurant and order a meal. The leftovers are usually thrown away since we have enough of everything anyway. The same goes for broken devices like PCs – we just throw them away and buy a new one instead of keeping some of the old parts of it to build a new PC. In nature, plants are bound to grow and live at exact the same position where they were born. Therefore they use the given nutrients more efficiently and have well-functioning recycle mechanisms.

One of these mechanisms is the so called “autophagy”. The origin of the word derives from Greek and means “to eat oneself”. It has this name because it is a recycle mechanism that degrades everything from the small tools used in cells (the proteins) to old or malfunctioning organelles within cells, for example the power plants of living cells, the mitochondria.

Autophagy does not only fulfill its task as a recycling machinery, it is also involved as part of the defense machinery against invading pathogens. Due to plants’ ability to re-grow lost organs like leaves plants can specifically kill their own cells in case of pathogen infections in order to prevent for example a virus to spread and infect other cells.

Since autophagy is such a powerful tool for plants, it needs to be tightly controlled. In plants, over 30 different autophagy related proteins are present, all involved in different steps of autophagy. A broad range of these proteins are already described and characterized but not all of them. Among the uncharacterized ones is one with a unique structure, ATG9. Within my project, I characterized ATG9 and described where in the plant cell it is localized under “normal” conditions and where does it go in case of activated autophagy.

In a second project, I tried to find possible interaction partners of ATG9 in plants, by testing known interaction partners of other species like the yeast we use for baking bread. By doing this I tried to get a better understanding of the function of ATG9 in plants.

A third project focused on the role of ATG9 during pathogen infections. Here I tried to find possible interactions between ATG9 and plant pathogens to test if ATG9 is also able/necessary to recognize pathogens.

After finishing my project, we have now a better understanding of ATG9. We know now where in the plant cell it resides and have good ideas where it goes in case of activated autophagy. We also found possible interaction partners which have not been shown before in plants.

Degree project in Biology – Molecular Genetics and Plant Science (45 hp), Master of Science, 2015
Uppsala University, Biology Education Center and Swedish University for Agricultural Science Uppsala, department of plant biology
Supervisor: Prof. Daniel Hofius