Matyáš Fendrych is an assistant professor at Charles University’s Department of Experimental Plant Biology recently awarded an ERC Starting Grant. Funds which will go a long way in funding continuing research and will dovetail with the university’s Primus project.

In our interview, Dr. Fendrych discussed some of his research goals and, partly tongue-in-cheek, what it is like for biologists when they walk in the forest.

“My focus is the study of plants and especially what is most interesting about them: the way they grow and build their bodies. We, as animals, are of course very different from plants: our cells move through our bodies while in plants cells stick together and have to regulate really well just how they divide and how they grow and this is how they build up the shapes and patterns that we see around us. So I am most interested in the physiological and biological growth of plant roots.”

Is it fair to say that there have been a fair number of advances in terms of how cell structure and such growth are mapped?

“A lot of attention has been placed lately on plant cell walls but there are still many ‘black boxes’ which many people seem to ignore. I am trying to unlock some of these boxes and one of them is how the plant hormone auxin regulates growth in the root. Everybody has known about auxin’s role for hundreds of years, everyone has worked with that information, but nobody knows how it is happening. So that is one of the secrets I want to unlock.”

Generally-speaking, for any scientist having this kind of mystery to focus on is the attraction and the excitement.

“It is excitement and it’s interesting because it is actually kind of annoying that we don’t know how it works because it is something so basic for plant growth: how they find gravity, how they find light, this process is crucial yet we don’t understand it. Also, we can use the process to get to the physiology. What I have been focusing on for a while now has been seeing things in time, the temporal dimension of the processes. Some things may happen in completely differently
in the space of seconds, minutes and hours. If you unlock the temporal dimension you see that things are somewhat
different than was perceived.

“In this regard, microscopy helps the most: we have really advanced tools which allow us to see processes in real time. 
On the surface plants appear slow and unchanging but on the microscopic level they react to stimuli in seconds. You
give the plant something and it takes 10, 20 seconds to react, which is surprising. So that is the timeframe we deal with: 
not milliseconds but seconds and minutes.”

This is your area of expertise as a professional: “the Czechs use the term profesionální deformace to describe
professional deformation or warping. When you talk a leisurely walk in the forest to relax, how does your profession 
affect you? Do you see everything through the prism of your field?

“I think I do. Plant biologists often say ‘we’ or ‘us’ when discussing plants. We have cells that don’t move and so on 
and animals are referred to as ‘they’ and ‘them’. So you are really kind of into it all! When you walk in the forest you 
inevitably think about everything that is going on: how much water there is flowing through the trees, how everything 
is evaporating. That's pretty cool.”

If we look at your project at hand, I read you are going to be using a certain kind of root in your search. Which one is it? And what are the benefits?

“That's right. First off, we use a model system and within it the root Arabidopsis thaliana or mouse-ear cress, which was 
designated for the system some 30 years ago. It is a small plant, related to rapeseed, but not very useful on its own. 
But there are many advantages to using it in research: a relatively small genome, you can grow it in a greenhouse or 
growth chamber, it’s fast – you can get from seed to seed with two months and you can cross it genetically. It also has 
the advantage of being small, so it can fit under a microscope. It is not a huge root and within four days you can take 
the seeds from a bag, put them on an agar plate, and within four days you are working with it. So it is rapid.”

You touched upon the methodology: what are some of the methods used when studying a plant like this?

“What has emerged and what we didn’t have before in science was the use of genetically-coded proteins which can emit 
light. Readers or listeners will be familiar with the famous green fluorescent protein and you can modify it to sense its 
environment so you can use it as a small nano-robot and it can report to you the acidity of the environment or what is 
the nutrient status in the cell at the time and place that you look at it. It reports to you and you can monitor it through the 
microscope. Methodologically, that is very interesting. So we use there genetically-encoded sensors and microscopes 
which are modified so the plant can grow there happily. The microscope is tuned 90 degrees to that the root can grow 
downwards.

"Also we use special microfluidics, small chips from silicon where the roots can grow and you can treat them with 
whatever you want and look at their responses. That's the microscopic methodology and then we use all the molecular 
biology tools like next generation sequencing, cell sorting, mutation analysis, and so on. So I try and combine such gene 
discovery approaches with fancy microscopy. This combination can really give you an advantage in research.”