Philip N. Benfey is an authority on the developmental biology of plant root systems. After majoring in biology at the University of Paris, he learned the techniques of genetic engineering while doing his Ph.D. research on mammalian cell lines at Harvard Medical School. As a postdoctoral fellow at Rockefeller University, he began his studies of plant root development. He is an HHMI Investigator and the Paul Kramer Professor of Biology at Duke University. He has also founded two plant biotechnology companies.

An Interview with Philip N. Benfey

How did you begin your career path?

I felt lost as a college freshman, so after a year I dropped out to become a writer. To gain real-world experiences, I hitchhiked around the world. I worked in the iron mines in Australia, in the film industry in the Philippines, and for a gardening company in Japan. Eventually, I took the Trans-Siberian railroad across Russia and wound up in France, where I worked as a carpenter by day and tried my hand as a fiction writer by night. Many rejection letters later (and six years after graduating from high school), I decided to return to college.

Did your parents support this detour in your life journey?

They did, and I am grateful to them. I think they were wise in allowing me to explore different directions. But I will always remember the letter that my mother wrote when I announced I was going back to school to study biology. She reported that my father, an organic chemistry professor, danced a jig on the table, which gave me some sense of what their true expectations and hopes were.

How did you become interested in biology, particularly in plants?

I was, and remain to this day, very interested in the process of how a single cell becomes a multicellular organism. In the mid-1980s, I wanted to find a less-explored model system than *Drosophila*. Scientists at that time had just figured out how to genetically engineer plants. From a developmental perspective, plants were attractive because they have fewer cell types and are organized in straightforward ways.

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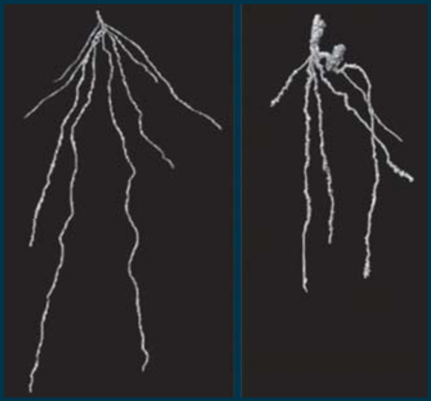
And why plant roots?

Roots have complex physiologies, yet they're formed in a really simple way: They're essentially rings of concentric cylinders, but each of those rings is carrying out a different function. Moreover, all the cells in a root are generated from stem cells at the tip of the root.

Twenty-five years later, do you still think plants are simple?

Plants are incredibly complex in their metabolism and all sorts of things. But from a purely developmental perspective, they are simpler than animals, and the developmental simplicity of roots has allowed us to address questions that would have been much harder to do in any other system, including other parts of the plant.

▼ X-rays of roots of two rice varieties. An Asian variety (left) that grows in paddies has long, fibrous roots. A Brazilian variety (right) that grows in soil has a short, dense root system.



Is it a problem that roots are generally studied growing outside the soil?

Soil is among the most complex ecosystems in the world. According to soil scientists, there are 22,000 soil types, and those are just the combinations of clay, sandy, and loamy soil, the inorganic parts. Then add in the incredible diversity of bacteria and other organisms that are there. You will never be looking at the same thing at two different places, no matter how hard you try. Recently, we have been using X-rays to image root systems in different soil types and comparing how they look in the artificial gel matrix we had been using to grow roots. We can then add in various soil components and ask, as we change one or two things at a time, how does that change the root structure?

Why is plant biology a good career to pursue?

Most of the major issues that are facing the world today—such as renewable energy, food security, and climate change—relate back to plants. Therefore, applying your energies and talents to the study of plants could change the future.