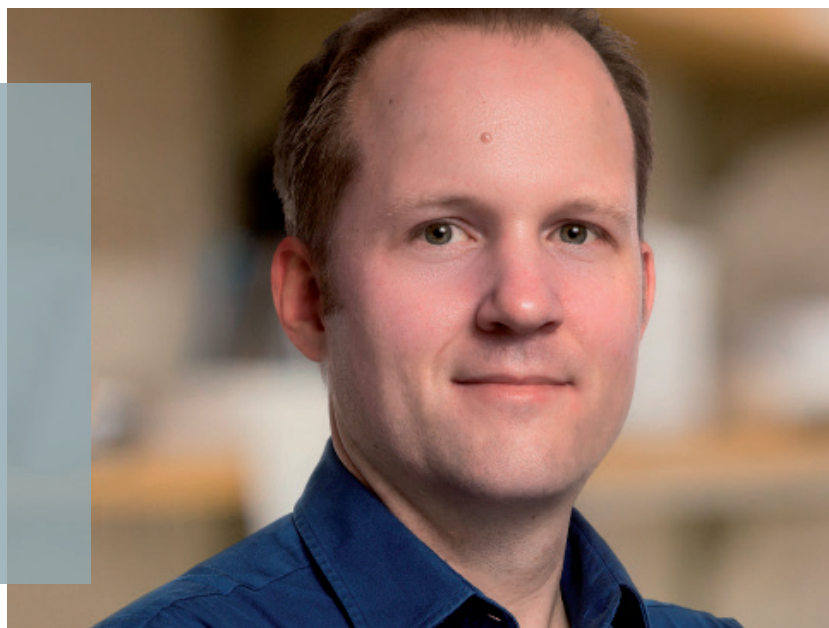


Wolfgang Busch

Associate Professor
Plant Molecular and Cellular Biology Laboratory



The Problem

While flowers and shoots are the more visible features of plants, what lies beneath the surface is just as important: Plants' roots are critical for obtaining water and nutrients from the soil. But how plants process environmental information and which genes and molecular mechanisms determine how a plant root decides to grow in a certain direction in the soil are still open questions. A better understanding of plant roots could help scientists grow more resilient food sources—an increasingly urgent problem in the face of the planet's shifting climate and more extreme environments, such as drought.

The Approach

The flowering plant *Arabidopsis thaliana* is an easy-to-grow weed, popular for plant biology research. Different strains, all with very similar genomes, grow all over the world, making the plant especially useful for studying which genes and genetic variants make plants respond to different environments and help them to thrive and survive. Wolfgang Busch uses a systems genetics approach—which combines techniques from genetics, genomics and other science fields—to understand how root growth in given environments is determined by a plant's genes.

Genome-wide association studies (GWAS) correlate genetic variation with physical characteristics, such as having long or short roots. But to be meaningful, studies have to measure the physical characteristic of interest in significant quantities. Because it

is difficult to measure roots accurately and in large numbers, Busch has employed a number of cutting-edge technologies and computational methods for evaluating roots.

The Innovations and Discoveries

- Busch developed novel methods to evaluate hundreds of thousands of roots using imaging and machine vision algorithms to automatically extract root length and shape data.
- He deployed statistical and computational methods to identify the genomic variants that determine whether an individual plant has a short or long root.
- Combining GWAS, automated confocal microscopy, and expression analyses in a pioneering way, Busch identified a novel regulator of root development in *Arabidopsis*, a member of a family of proteins with a characteristic region called an F-box.

For more information, please visit:

www.salk.edu/scientist/wolfgang-busch

Genetics, Plant Biology, Agriculture, Systems Biology