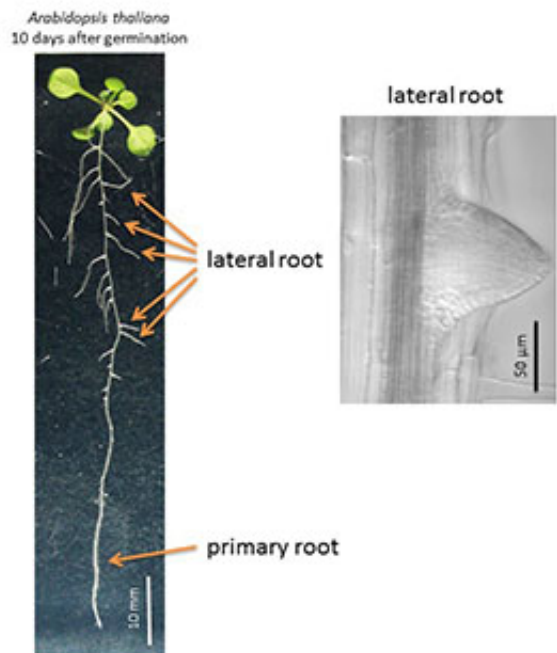


3-D live imaging reveals how plants grow new lateral roots

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Lateral roots of *Arabidopsis thaliana*. Left: the plant 10 days after germination. Multiple lateral roots are formed from the primary root. Right: an enlargement of a lateral root. Lateral roots are formed from the inner tissue of roots, growing outward from the new root. Credit: Kobe University

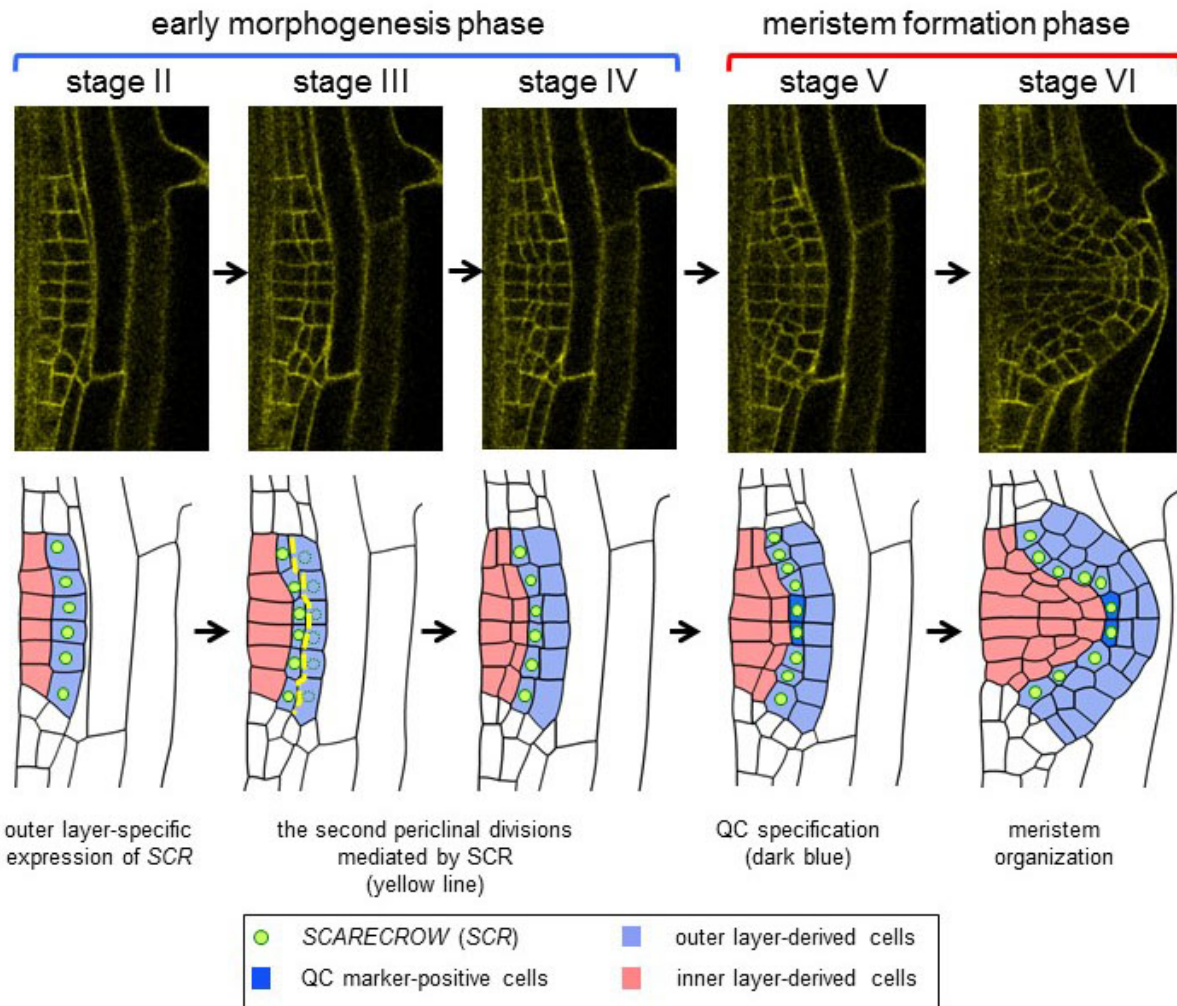
Researchers have used 3-D live imaging to observe the formation

process of lateral roots in plants, and clarified part of the mechanism that creates new meristematic tissue. If the root formation mechanism in plants is revealed further, this could potentially be used to control plant growth by artificially altering root system architecture. These findings were published on August 10 in the online version of *Development*.

The research group included Professor FUKAKI Hidehiro (Kobe University, Graduate School of Science), Project Assistant Professor GOH Tatsuaki (Kobe University, currently Assistant Professor at Nara Institute of Science and Technology), the University of Nottingham and the University of Montpellier.

Plants develop a root system adapted to their environment by growing new branched roots from existing roots. Root systems consist of the primary root, which is the first to grow after germination; lateral roots, created from internal tissue in existing roots such as the primary root; and adventitious roots, which sprout from above ground tissues. There is only one primary root, but after plant germination many lateral roots and adventitious roots are created. Since these latter types make up the majority of the root system, they have a large influence on its structure.

For a root to grow, new cells must be created in the root's meristematic tissue, located at the tip. In contrast to the primary root's origins as a radicle created in embryo, lateral roots are made from a subset of inner layer cells after germination. Thanks to research in genetics and plant tissue our understanding of the mechanism that creates the primary root has advanced, but there are still many unknown factors in the mechanism that creates lateral roots from a small number of cells.



Formation mechanism for the meristem in the lateral roots of *Arabidopsis thaliana*. When lateral roots grow in this plant, after 4 layers of primordia are formed, the quiescent center is established, and the meristem is formed. Credit: Kobe University

The research group established a method enabling long-term observation of the developmental process of new roots (lateral roots) formed after germination of the model plant *Arabidopsis thaliana*. Their method is based on 3-D live imaging technology using confocal laser microscopy.

By comparing plant variants that showed abnormalities in the morphogenesis of lateral roots to plants with a natural development process, they elucidated part of the mechanism that develops lateral roots and the root meristem. Notably, they clarified the mechanism that establishes the "quiescent center cells" – important cells for the functioning of the meristem.

Now we can observe the development process of [lateral roots](#) over time on a cellular level, our understanding should deepen regarding various processes: how individual cells divide, how they mutate, and how the cells coordinate to create new roots. In the future, if we can fully decode the mechanism for increasing roots, we could potentially regulate the growth of various crops and garden plants by artificially altering [root development](#).

More information: Quiescent center initiation in the Arabidopsis lateral root primordia is dependent on the SCARECROW transcription factor: doi: 10.1242/dev.135319

Provided by Kobe University

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