Root system architecture arises from coupling cell shape to auxin transport

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Plants come in all shapes and sizes, from grand Redwood trees to the common Snowdrop. Although we cannot see them, under the ground plants rely on a complex network of roots. What determines the pattern of root growth has been a mystery, but a new paper published this week in *PLoS Biology* shows that the shape of the existing root can determine how further roots branch from it – because shape determines hormone concentration. The work also suggests that the root-patterning system shares a deep evolutionary relationship to the patterning system of plant shoots, something that had not been realized previously.

The paper, by Laskowski, Grieneisen, Hofhuis, et al, explores the architecture of the root system of the model organism Arabidopsis thaliana, a plant with the unusual common name "mouse-ear cress." The authors show that the curve of the root is key in provoking new growth. They used computational modeling of the transport of a well-known plant hormone, auxin, and by following the diffusion of this hormone they reveal that its accumulation leads to the specification of new growth regions in the root structure.

In particular, the initial trigger of this accumulation is a difference in cell size between the inner and outer sides of a root curve, which is then amplified by feedback responses from the hormone transport system.

Surprisingly, this new model on root architecture is reminiscent of the way leaves develop around growing tips in plant – a key feature of shoot architecture. This is exciting because it suggests that a deep connection exists between both root and shoot architectures – which have hitherto been viewed upon as being entirely separate. The work further shows that a new kind of biology, involving complete mixing of experiments and computer modeling, is a very powerful tool in probing organismal architecture.

Citation: Laskowski M, Grieneisen VA, Hofhuis H, ten Hove CA , Hogeweg P, et al. (2008) Root system architecture from coupling cell shape to auxin transport. PLoS Biol 6(12): e307. doi:10.1371/journal.pbio.0060307
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