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Optimality and universal scaling for osmotically driven translocation of sugars in plants TOMAS BOHR, Department of Physics and Center for Fluid Dynamics, Technical University of Denmark, KAARE HARTVIG JENSEN, HENRIK BRUUS, Department of Micro- and Nanotechnology, Technical University of Denmark, JINKEE LEE, Division of Engineering, Brown University, MACIEJ ZWIENIECKI, Arnold Arboretum, Harvard University, NOEL MICHELE HOLBROOK, Department of Organismic and Evolutionary Biology, Harvard University
— The growth of plants depends on efficient translocation of sugars. The current belief is that this takes place predominantly through osmotically driven flow, passively generated by differences in sugar concentrations (the so-called Münch mechanism). We show that optimization of translocation speed predicts a universal scaling between the width of the conduits (phloem cells), the length of the plant and the length of the "loading zones" (the leaves). This unexpected scaling is verified by data from plants over several orders of magnitude is size, from small green plants to large trees.

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