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Hydraulic pulse induced by bending in synthetic and natural branches: role in plant mechano-perception[1] JEAN-FRANCOIS LOUF, GEOFFROY GUENA, YOEL FORTERRE, Aix Marseille Université, CNRS, IUSTI UMR 7343, 13453, Marseille, France, ERIC BADEL, INRA, UMR547 PIAF, Université Blaise Pascal, F-63100, Clermont-Ferrand, France — Plants can detect mechanical stimuli such as wind or touch and respond to these stimuli by modifying their development and growth. A fascinating feature of this mechanical-induced-growth response is that it is not only local, but also non-local: bending locally a stem or a branch can induce a very rapid ($\sim$ min) modification of the growth far away from the stimulated area. The nature and mechanism of this long distance signal is not well understood, but it has been suggested that it could result from a purely hydraulic pressure signal, in response to the mechanical bending of the hydrated wood tissue. To address this issue, we investigate the poroelastic response to sudden bending of both natural tree branches and synthetic branches made of PDMS elastomer perforated with longitudinal micro-channels and filled with a viscous fluid. In both systems, we observe that the bending of the branch generates a sudden increase of the mean pore pressure, which scales with the beam elasticity and increases quadratically with the bending amplitude. We propose a simple non-linear model to explain the generation of this hydraulic pulse and discuss our results in the context of plant mechano-perception.

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