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Deformation-driven solute transport in soft porous media MATILDE FIORI, SATYAJIT PRAMANIK, CHRISTOPHER MACMINN, University of Oxford — Solute transport plays an important role in many soft porous materials, including the movement of contaminants in soils and the movement of nutrients and waste in living tissues and tissue-engineering scaffolds. These systems are also often exposed to large, periodic loading and deformation, which drives nontrivial fluid motion and changes in pore structure. Here, we study the strong coupling between fluid flow and mechanical stimulation during periodic deformations using a 1D continuum model based on large-deformation poroelasticity. We show that these reversible deformations lead to non-reversible spreading and mixing, even in a homogeneous medium. We analyse the three primary mechanisms of solute transport (advection, molecular diffusion, and mechanical dispersion) and study their separate impacts on the solute distribution. We also identify the key dimensionless parameters that govern deformation-driven transport, and we study their qualitative and quantitative impacts on solute spreading and mixing.

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