Abstract Submitted
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Transpiration through hydrogels[1] MERLIN ARAGON ETZOLD, M. GRAE WORSTER, PAUL F. LINDEN, DAMTP, University of Cambridge — We present experiments and theory relating to transpiration through hydrogel beads in contact with a water reservoir below and evaporating into air above. Experimentally, we find that saturated hydrogel beads shrink until a steady state is reached in which water flows continuously through the beads. The size of the beads in steady state is very sensitive to the evaporation rate, which depends on the relative humidity and speed of the air, and is measurably sensitive to the pressure in the fluid reservoir. Specifically, the beads are smaller when the evaporation rate is larger or the reservoir pressure lower. Our conceptual 1D model proposes that transport in the hydrogel is driven by gradients in osmotic pressure, therefore by gradients in polymer concentration in the hydrogel, which correspond to gradients in swelling. If the evaporation rate or the bottom pressure changes, the adjustment of this gradient requires the bead to change shape. Smaller beads have larger gradients of osmotic pressure, which drive higher transpiration rates and can draw water against larger hydraulic heads.

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Merlin Aragon Etzold
DAMTP, University of Cambridge

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