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Contraction driven flow in the extended vein networks of *Physarum polycephalum* KAREN ALIM, GABRIEL AMSELEM, FRANCOIS PEAUDECERF, School of Engineering and Applied Sciences, Harvard University, ANNE PRINGLE, Department of Organismic and Evolutionary Biology, Harvard University, MICHAEL P. BRENNER, School of Engineering and Applied Sciences, Harvard University — The true slime mold *Physarum polycephalum* is a basal organism that forms an extended network of veins to forage for food. *P. polycephalum* is renown for its adaptive changes of vein structure and morphology in response to food sources. These rearrangements presumably occur to establish an efficient transport and mixing of resources throughout the networks thus presenting a prototype to design transport networks under the constraints of laminar flow. The physical flows of cytoplasmic fluid enclosed by the veins exhibit an oscillatory flow termed "shuttle streaming." The flow exceed by far the volume required for growth at the margins suggesting that the additional energy cost for generating the flow is spent for efficient and/or targeted redistribution of resources. We show that the viscous shuttle flow is driven by the radial contractions of the veins that accompany the streaming. We present a model for the fluid flow and resource dispersion arising due to radial contractions. The transport and mixing properties of the flow are discussed.

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