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Propulsion in a generalized Newtonian fluid JUAN RODRIGO VÉLEZ-CORDERO, ERIC LAUGA, University of California at San Diego — The two-dimensional dynamics of an undulating surface has been used as a simplified model to study the transport of fluid by the movement of cilia carpets (so-called envelope model). The collective motion of cilia is idealized as a surface that displaces waves in one direction and whose material points (tips of the cilia) perform a combination of normal and tangential motion with respect to the mean plane. We calculate the mean pumping velocity and rate of work done by an undulating surface in a Generalized Newtonian fluid modeled by the Carreau equation. The influence of the variable viscosity appears only to fourth order in the wave parameter, Ak, where A and k are the wave amplitude and wavenumber respectively. The non-Newtonian effects appear only if both modes of motion, normal plus tangential, are active. The mean rate of work always diminishes for different combinations of normal and tangential motion if the fluid is shear-thinning. Surprisingly, this is not similar for the mean velocity, which for certain motion patterns increases if the fluid is shear-thinning, but for others increases if it is shear-thickening.

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