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**Nonlinear instability in flagellar dynamics: a novel modulation mechanism in sperm migration?** H. GADELHA, E. GAFFNEY, Mathematical Institute, University of Oxford, D. SMITH, School of Mathematics, University of Birmingham, J. KIRKMAN-BROWN, School of Clinical and Experimental Medicine, University of Birmingham — Throughout biology, cells and organisms use flagella and cilia to propel fluid and achieve motility. While the mechanics of flagellum-fluid interaction has been the subject of extensive mathematical studies, these models have been restricted to being geometrically linear or weakly nonlinear. In this talk, we study the effect of geometrical nonlinearity, focusing on the spermatozoon flagellum. For a wide range of physiologically relevant parameters, the nonlinear model predicts that flagellar compression by the internal forces initiates an effective buckling behaviour, leading to a symmetry-breaking bifurcation that causes profound and complicated changes in the waveform and swimming trajectory, as well as the breakdown of the linear theory. The emergent waveform also induces curved swimming in an otherwise symmetric system, with the swimming trajectory being sensitive to head shape - no signalling or asymmetric forces are required. We conclude that non-linear models are essential in understanding the flagellar waveform in migratory human sperm.

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