Abstract Submitted
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An experimental and theoretical approach to a simplified model of human birth[1] ALEXA BAUMER, ANDREA LEHN, George Washington University, JAMES GROTBERG, University of Michigan, MEGAN C. LEFTWICH, George Washington University — his study investigates the effects of amniotic fluid and vernix caseosa, as well as the uterine contraction wave dynamics, on the forces associated with human birth. An experimental model of the fetus passing through the birth canal is represented as concentric cylinders with a fluid filled gap. The rigid inner cylinder moves through the highly flexible outer cylinder while stabilized on a track. The inner cylinder is pulled through the system with constant velocity. As it moves, the rigid cylinder's position is recorded with a high-speed camera and the force is simultaneously measured. A perturbation solution considers the upper boundary as the uterine wall with a peristaltic wave. The lower boundary is the fetus traveling at constant velocity. Assuming lubrication theory and a small Reynolds number, the Navier-Stokes Equations and conservation of mass are solved for an expression for shear stress at the wall. This solution, and the experimental results, are compared to the exact Couette flow solution for constant gap width. This model can be used as the foundation for predicting the force needed to deliver a fetus in the final stages of parturition. From the concentric cylinders representation of human delivery, more complex and geometrically accurate models can be generated.

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