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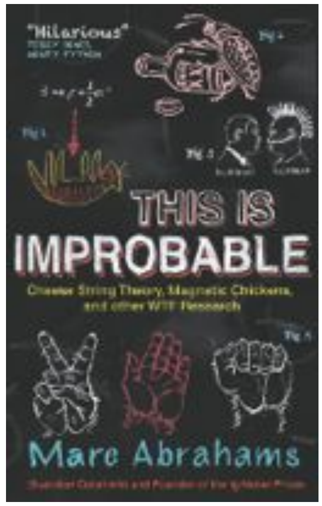

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Birth-Fluid Dynamics, and the Splashy Hydrodynamics of Urination

Aatish Bhatia (of Empirical Zeal) alerts us to an outpouring of soon-to-be-announced birth-centric and micturation-modulation fluid dynamics insights.

Anne Staples [pictured here], of Virginia Polytechnic Institute and State University, will chair a session on "**Pumping Phenomenon**", at the American Physical Society's 66th Annual Meeting of the APS Division of Fluid Dynamics,in Pittsburgh, Pennsylvania, on Sunday, November 24, 2013.

Three sub-topics highlight the affair:

"**The Role of Amniotic Fluid in Force Transfer During Human Birth**," Alexa Baumer, Andrea Lehn , Megan Leftwich. The researchers, from George Washington University, will elaborate on this abstract (which might, we suggest, give insight also into the engineering of the **Blonsky Birthing Device**):

> "This study seeks to understand the fundamental fluid dynamic processes involved in human birth. We begin by examining the importance of amniotic fluid. This is done using two experimental techniques that approximate the laboring human uterus to different degrees of anatomical correctness. The first, in which a latex uterus is filled with fluid and a solid fetus is extracted, investigates the importance of both amniotic fluid properties and fetal position in the force required to remove a fetus. The second experiment simplifies the geometry of birth even more. In this case, a solid cylindrical rod is pulled through a highly flexible outer tube. The force to pull the inner cylinder as a function of the gap fluid properties is measured. By carefully controlling the fluid properties of the experiment, the study will provide further insight into the roles of amniotic fluid in human birth."

"**The Hydrodynamics of Urination: to Drip or Jet**", Jonathan Pham, Patricia Yang, Jerome Choo, David Hu. The researchers, from Georgia Institute of Technology, will elaborate on this abstract:

> "The release of waste products is fundamental to all life. How are fluids released from the body quickly and efficiently? In a combined experimental and theoretical investigation, we elucidate the hydrodynamics of urination across five orders of magnitude in animal mass. Using high-speed videography and flow-rate measurement at the Atlanta Zoo, we report discrete regimes for urination style. We observe dripping by small mammals such as rats and jetting by large mammals such as elephants. We discover urination duration is independent of animal size among animals that use jetting. We rationalize urination styles, along with the constant-time scaling, by consideration of the relative magnitudes of the driving forces, gravity and bladder pressure, and the corresponding viscous losses within the urethra. This study may give insight into why certain animals are more prone to diseases of the urinary tract, and how the urinary system evolved under the laws of fluid mechanics."

"**Urinal Dynamics**", Randy Hurd, Kip Hacking, Benjamin Haymore, Tadd Truscott. The researchers, from Brigham Young University, will elaborate on this abstract:

> "In response to harsh and repeated criticisms from our mothers and several failed relationships with women, we present the splash dynamics of a simulated human male urine stream impacting rigid and free surfaces. Our study aims to reduce undesired splashing that may result from lavatory usage. Experiments are performed at a pressure and flow rate that would be expected from healthy male subjects. For a rigid surface, the effects of stream breakup and surface impact angle on lateral and vertical droplet ejection distances are measured using high-speed photography and image processing. For free surface impact, the effects of velocity and fluid depth on droplet ejection distances are measured. Guided by our results, techniques for splash reduction are proposed."

BONUS (added October 15): At the same meeting, also see — at a different session (Bubbles I: Cavitation, Nucleation and Ventilation) — this discussion (Thanks to Hanno Essén for bringing it to our attention):

"**Why does a beer bottle foam up after a sudden impact on its mouth?**" Javier Rodriguez-Rodriguez, Almudena Casado-Chacon, Daniel Fuster. The researchers, from Carlos III University of Madrid, Spain and Universite Pierre et Marie Curie, France, will elaborate on this abstract:

> A sudden vertical impact on the mouth of a beer bottle generates a compression wave that propagates through the glass towards the bottom. When this wave reaches the base of the bottle, it is transmitted to the liquid as an expansion wave that travels to free surface, where it bounces back as a compression wave. This train of expansion-compression waves drives the forced cavitation of existing air pockets, leading to their violent collapse. A cloud of very small daughter bubbles are generated upon these collapses, that expand much faster than their mothers due to their smaller size. These rapidly growing bubble clusters effectively act as buoyancy sources, what leads to the formation of bubble-laden plumes whose void fraction increases quickly by several orders of magnitude, eventually turning most of the beverage into foam.

Posted by **Marc Abrahams** on **Sunday, October 13th, 2013 at 10:35 am** under **Boys Will Be Boys**, **News about research**.

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