

EML WEBINAR

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WEDNESDAY, 14 OCTOBER 2020

9:30 AM BOSTON, 2:30 PM LONDON, 9:30 PM BEIJING



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FLUID DYNAMICS OF SPEECH: MECHANISMS UNDERLYING PATHOGEN TRANSMISSION

Speech is a potent route for viral transmission in the COVID-19 pandemic. Informed mitigation strategies are difficult to develop since no aerosolization mechanism has been visualized yet in the oral cavity nor has the relationship of speech to the exhaled flow been documented. Here we show first with high-speed imaging how phonation of common stop-consonants form and extend salivary filaments in a few milliseconds as moist lips open or when the tongue separates from the teeth. Both saliva viscoelasticity and airflow associated with the plosion of stop-consonants are essential for stabilizing and subsequently forming centimeter-scale thin filaments, tens of microns in diameter, that break into speech droplets. These plosive consonants induce starting jets and vortex rings that drive meter-long transport of exhaled air, tying this drop-formation mechanism to transport associated with speech; the transport features, including phonetics, are demonstrated using order-of-magnitude estimates, numerical simulations, and laboratory experiments. We believe that this work will inform thinking about the role of ventilation, aerosol transport in disease transmission for humans and other animals, and yield a better understanding of ``aerophonetics."

Manouk Abkarian, Director of Research at CNRS, works at the Centre de Biologie Structurale in Montpellier. Dr Abkarian is a soft matter physicist working at the interface between physics, mechanics and biology. He was awarded the bronze medal of the CNRS in 2012 for his work on blood flow.

Simon Mendez is a Researcher at CNRS working at the Institute of Montpellier Alexander Grothendieck (University of Montpellier). His research is mainly dedicated to numerical simulations of blood flows at the macroscopic and microscopic scales.

Howard Stone is the Donald R. Dixon '69 and Elizabeth W. Dixon Professor in the Department of Mechanical and Aerospace Engineering at Princeton University, where he is currently also Chair of the Department. He works mainly in fluid mechanics of small-scale systems.

Discussion leader: **Howard Stone**, Princeton University

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