Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Parametric Study of Wall Shear Stress in Idealized Avian Airways[1] MICHAEL S FARNSWORTH, Brigham Young University, TOBIAS RIEDE, Midwestern University, SCOTT L THOMSON, Brigham Young University — Because wall shear stress (WSS) affects cell response, WSS patterns in avian respiratory airways may be related to the origin of the syrinx and corresponding voice-producing tissue structures (e.g., membranes or vocal folds) in birds. To explore possible linkages between WSS patterns and the locations of avian voice-producing structures, a computational model of flow through an idealized portion of the avian respiratory airway, including trachea and primary bronchi sections, has been developed. The flow is governed by the Navier-Stokes equations, with velocity boundary conditions derived from pressure-flow data in an adult zebra finch during quiet respiration. Geometric parameters such as tracheal/bronchial diameter and length, as well as bronchial branching angle, are parametrically varied based on data for different avian species. Simulation results predict elevated WSS in the vicinity of the tracheobronchial juncture, the location at which voice-producing tissues are found in avian species. In this presentation, the model will be described and spatial distributions of WSS during inspiration and expiration will be presented and compared for different geometric configurations and respiration rates and waveforms.

[1]Funding for this project from the Gordon and Betty Moore Foundation (Grant 4498) is gratefully acknowledged.

Scott Thomson
Brigham Young University

Date submitted: 31 Jul 2017 Electronic form version 1.4