Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Deterministic Aperiodic Sickle Cell Blood Flows LOUIS ATSAVES[1], WESLEY HARRIS[2], MIT — In this paper sickle cell blood flow in the capillaries is modeled as a hydrodynamical system. The hydrodynamical system consists of the axisymmetric unsteady, incompressible Navier-Stokes equations and a set of constitutive equations for oxygen transport. Blood cell deformation is not considered in this paper. The hydrodynamical system is reduced to a system of non-linear partial differential equations that are then transformed into a system of three autonomous non-linear ordinary differential equations and a set of algebraic equations. We examine the hydrodynamical system to discern stable/unstable, periodic/nonperiodic, reversible/irreversible properties of the system. The properties of the solutions are driven in large part by the coefficients of the governing system of equations. These coefficients depend on the physiological properties of the sickle cell blood. The chaotic nature of the onset of crisis in sickle cell patients is identified.

[1]Research Assistant
[2]Professor of Aeronautics and Astronautics

Wesley Harris
MIT

Date submitted: 21 Jul 2013 Electronic form version 1.4