Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Hypoxic Response of Tumor Tissues in a Microfluidic Environment[1] ADNAN MORSHED, PRASHANTA DUTTA, Washington State University — Inside a tumor tissue, cells growing further away from the blood vessel often suffer from low oxygen levels known as hypoxia. Cancer cells have shown prolonged survival in hostile hypoxic conditions by sharply changing the cellular metabolism. In this work, different stages of growth of the tumor tissue and the oxygen transport across the tissue are investigated. The tissue was modeled as a contiguous block of cells inside a microfluidic environment with nutrient transport through advection and diffusion. While oxygen uptake inside the tissue is through diffusion, ascorbate transport from the extracellular medium is addressed by a concentration dependent uptake model. By varying the experimentally observed oxygen consumption rate, different types of cancer cells and their normoxic and hypoxic stages were studied. Even when the oxygen supply in the channel is maintained at normoxic levels, our results show the onset of hypoxia within minutes inside the cellblock. Interestingly, modeled cell blocks with and without a structured basal layer showed less than 5% variation in hypoxic response in chronic hypoxia. Results also indicate that the balance of cell survival and growth are affected by the flow rate of nutrients and the oxygen consumption rate.

[1]This work was supported in part by the National Science Foundation under Grant No. DMS 1317671.

Prashanta Dutta
Washington State University

Date submitted: 27 Jul 2017 Electronic form version 1.4