Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

A two-phase mixture model of avascular tumor growth DENIZ OZTURK, M. BURCIN UNLU, SIRIN YONUCU, UGUR CETINER, Bogazici University, Bebek, 34342 Istanbul / Turkey, MEDICAL & BIOLOGICAL PHYSICS RESEARCH GROUP TEAM — Interactions with biological environment surrounding a growing tumor have major influence on tumor invasion. By recognizing that mechanical behavior of tumor cells could be described by biophysical laws, the research on physical oncology aims to investigate the inner workings of cancer invasion. In this study, we introduce a mathematical model of avascular tumor growth using the continuum theory of mixtures. Mechanical behavior of the tumor and physical interactions between the tumor and host tissue are represented by biophysically founded relationships. In this model, a solid tumor is embedded in inviscid interstitial fluid. The tumor has viscous mechanical properties. Interstitial fluid exhibits properties of flow through porous medium. Associated with the mixture saturation constraint, we introduce a Lagrange multiplier which represents hydrostatic pressure of the interstitial fluid. We solved the equations using Finite Element Method in two-dimensions. As a result, we have introduced a two-phase mixture model of avascular tumor growth that provided a flexible mathematical framework to include cells' response to mechanical aspects of the tumor microenvironment. The model could be extended to capture tumor-ECM interactions which would have profound influence on tumor invasion.

Deniz Ozturk
Bogazici University, Bebek, 34342 Istanbul / Turkey

Date submitted: 22 Nov 2011 Electronic form version 1.4