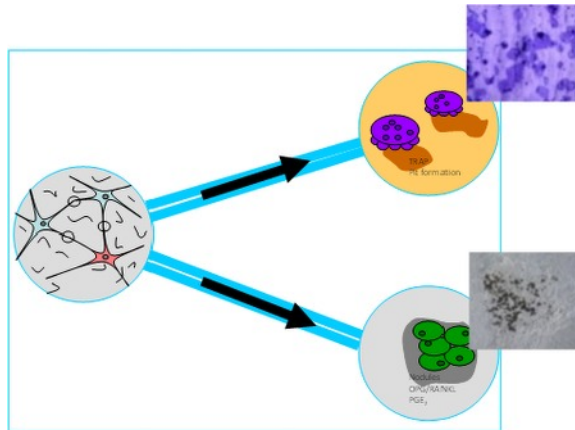
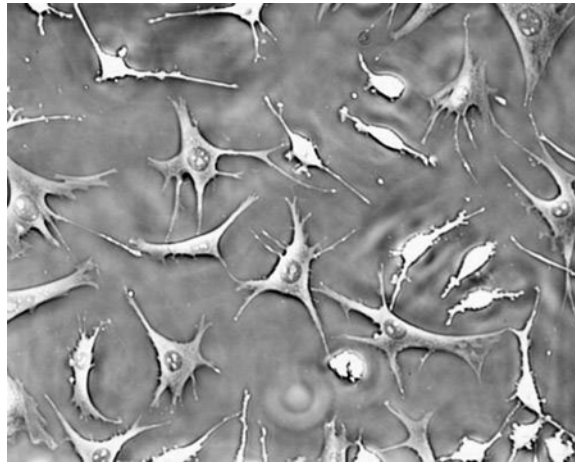
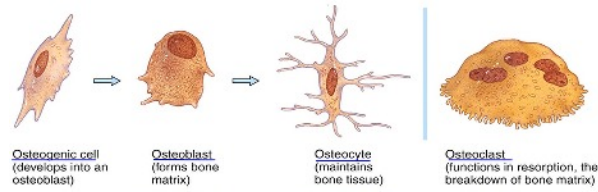


MATH MONDAY

Alicia Prieto Langarica



Associate Professor
Department of Mathematics & Statistics
Youngstown State University



APRIL 15, 2019

3:10 - 4:00

Hayes Hall 109

Franklin Miller, Jr. Lecture Hall

A CELLULAR AUTOMATA MODEL OF BONE FORMATION

Abstract: Bone remodeling is an elegantly orchestrated process by which osteocytes, osteoblasts and osteoclasts function as a syncytium to maintain or modify bone. On the microscopic level, bone consists of cells that create, destroy and monitor the bone matrix. The manner in which these cells interact to bring about a change in bone quality and quantity has yet to be fully elucidated. But efforts to understand the multicellular complexity can ultimately lead to eradication of metabolic bone diseases such as osteoporosis and improved implant longevity. Experimentally validated mathematical models that simulate functional activity and offer eventual predictive capabilities offer tremendous potential in understanding multicellular bone remodeling. Here we undertake the initial challenge to develop a mathematical model of bone formation validated with in vitro data obtained from osteoblastic bone cells induced to mineralize and quantified at 26 days of culture. A cellular automata model was constructed to simulate the in vitro characterization. Permutation tests were performed to compare the distribution of the mineralization in the cultures and the distribution of the mineralization in the mathematical models. The results of the permutation test show the distribution of mineralization from the characterization and mathematical model come from the same probability distribution, therefore validating the cellular automata model.