2014학년 1학기

수학전공 Colloquium

◆ 제 목 : **Mathematical modeling of tumor growth: examples in Glioma and Breast Cancer**

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◆ 초 록 :

In this talk, two types of mathematical models of tumor growth and cancer invasion are presented:
Breast cancer: Ductal carcinoma in situ (DCIS) is an early stage noninvasive breast cancer that originates in the epithelial lining of the milk ducts, but it can evolve into comedo DCIS and ultimately, into the most common type of breast cancer, invasive ductal carcinoma. Understanding the progression and how to effectively intervene in it presents a major scientific challenge. The extracellular matrix (ECM) surrounding a duct contains several types of cells and several types of growth factors that are known to individually affect tumor growth, but at present the complex biochemical and mechanical interactions of these stromal cells and growth factors with tumor cells is poorly understood. Here we develop a mathematical model that incorporates the cross-talk between stromal and tumor cells and focus on the EGF and TGF-beta signaling pathways. We show how up- or down-regulation of components in these pathways affects cell growth and cancer invasion.
Glioblastoma is the most aggressive type of brain cancer with the median survival time of one year. A particular microRNA, miR-451 and its downstream signaling molecules, AMPK complex and mTOR, are known to determine a balance between rapid proliferation and aggressive invasion in response to metabolic stress in the harmful microenvironment. The model identifies a key mechanism behind the molecular switches between proliferative phase and migratory phase in response to metabolic stress and
biophysical interaction between cells. Analysis of the model predicts that patterns of the cell cycle critically depend on the high and low glucose levels under normoxic and hypoxic conditions. Model also predicts the best therapeutic results may come from bring those migratory cells back by targeting miR-451-AMPK-mTOR signaling pathways to the original site if it is not too late.

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