

Vincenzo Capasso

UNIVERSITY OF MILAN

e-mail: vincenzo.capasso@unimi.it

Edoardo Beretta

CIMAB, ITALY

Nadya Morozova

CNRS, FRANCE

Population behaviour of cancer stem cells

Stem cells are cells with two specific features - the ability to differentiate into all range of specialized cell types and the ability to renew themselves. There are several possible scenarios of cancer stem cells evolution, among which the asymmetric cell divisions providing self-renewing, is the main one. The main theory for today for either normal or cancer stem cells is that they differentiate when they receive some kind of "instructive" signal influencing the pattern and speed of cell divisions in the given conditions. All current experiments reporting the dynamics of cancer stem cell populations in culture allow to conclude that the main feature is the same - the stability of the percentages of these cell populations in the whole population of cancer cells, independently of the starting conditions. In this paper we compare the qualitative behavior of mathematical models of stem cells evolution, without and with an underlying signal. In absence of an underlying field, we propose a mathematical model described by a system of ordinary differential equations, while in presence of an underlying field it is described by a system of delay differential equations, by admitting a delayed signal originated by the existing cells. In particular we show the stability of percentages for the ODE system, and the possibility of oscillations in the cell populations only in presence of an underlying field. The hope is that the results of this paper may stimulate further experiments to either validate or not the existence of the above mentioned "instructive" signals.

Keywords: Cancer stem cells, delay differential equations, qualitative behavior, stability, oscillations.