Biomath Coffee

Date: 29 July 2024
Time: 15:30

Title: Constructing mathematical models from small data sets: Inhibition of melanoma

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Abstract: Constructing useful mathematical models is typically guided by the objectives of
(a) representing adequately the biological processes of interest;
(b) identifying the values of the involved parameters.
These two objectives are often in competition. On the one hand, due to the complexity of the biological processes, objective (a) leads to models involving many unknown parameters. On the other hand, only a limited number of variables can be measured, and obtaining these measurements requires costly, time-consuming, and labour-intensive experiments. The challenge is not new. Quoting Einstein: "It can scarcely be denied that the supreme goal of all theory is to make the irreducible basic elements as simple and as few as possible without having to surrender the adequate representation of a single datum of experience."[1, page 384]

In this presentation we are confronting the competing objectives (a) and (b) in the setting of mathematical modelling of inhibition of melanoma. More precisely, we consider the treatment of the B16F10 melanoma cell line by MAZ-51 (a synthetic molecule derived from indolinone). This work is part of a broader ongoing research project on inhibition of cancer, with some results on other inhibitors already reported in [2,3].

The cell viability of cancer cells is an important quantitative measure of efficacy of any treatment they are subjected to. Determining cell viability as a function of time and drug concentration is a crucial stage in the development of new cancer drugs and is our main goal for the stated treatment by MAZ-51. The model is established after several iterative loops from model to data to model improvements, while incorporating knowledge of the physiological processes and assumptions suggested by the data.

References:
[1] A. Calaprice, The Ultimate Quotable Einstein, Princeton University Press, Princeton and Oxford, 2011.
[2] Anguelov, G. Manjunath, A. E. Phiri, T.T. Nyakudya, P. Bipath, J.C. Serem, Y.N. Hlophe, Quantifying assays: inhibition of signalling pathways of cancer, Mathematical Medicine and Biology: A Journal of the IMA, 40(3):266–290, 2023.}
[3] Basson, A. E. Phiri, G. Manjunath, R. Anguelov, J.C. Serem, P. Bipath, Y.N. Hlophe, In vitro effects and mathematical modelling of CTCE-9908 (a chemokine receptor 4 antagonist) on melanoma cell survival, Clinical and Experimental Pharmacology and Physiology, (May 2024, online)