



The University of Western Ontario

Faculty of Science

Department of Applied Mathematics

APPLIED MATHEMATICS COLLOQUIUM

Date: Friday, November 23, 2007

Time: 2:30 pm

Location: Middlesex College Room 204

Mathematics in Medicine: Modelling of Cancer Treatment

Graeme Wake

Maclaurin Fellow, NZIMA & Centre for Mathematics in Industry,
Massey University @ Auckland, New Zealand

Abstract:

Improved treatment of cancer is one of the most important challenges for medical science. Tailoring treatment for individual patients has long been an objective for oncologists. While many biological techniques and mathematical models have been devised to predict the course of treatment, none have been applied routinely to clinical oncology. Our model, which describes the complexities of the responses of tumor cells over time to both anticancer drugs and radiation, has considerable impact on our ability to advance individualization of cancer therapy. This process is in advanced stages of implementation. Over the last few years, we have developed sophisticated mathematical equations describing the behavior of cancer cells as they progress through the cell division cycle. Which stage in the cycle the cells are actually in, can be differentiated by their DNA content and this enables model outcomes to be compared directly to experimental results. These equations describe the response of human tumors to chemotherapy and radiotherapy. Firstly we incorporate programmed cell death (apoptosis) into the model. We then consider perturbations of model parameters by treatment and compare model results with data. This research will provide significant new analytical and computational insights into the area of non-local equations, where cause and effect are separated in space and time, as well as underpinning support to oncologists concerned with treatment, drug companies producing drugs and management of clinics.

This work is in conjunction with Britta Basse and Bruce Baguley (Auckland School of Medicine), Ronald Begg and Bruce van-Brunt (Massey University), and David Wall (Canterbury University). I acknowledge support from the NZIMA through the Maclaurin Fellowship scheme and a Fulbright Travel Award.