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MATHEMATICAL MODELING AND COMPUTERS IN MEDICINE: EDITOR'S REMARKS

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1. OPENING REMARKS

This series began with the goal of providing a forum for the presentation of mathematical and computer models related to medical and dental topics. The "Editor's remarks", for the first volume, were written during the joint occurrence of Mathematical Awareness Week and National Science Week. This time I write my remarks in the face of budget cutbacks at NSF and NIH. Budget cutbacks that could affect fledgling programs such as mathematical modeling in biology and medicine.

As the practice of science grows more akin to the practice of medicine, in its increasing specialization, the need for interdisciplinary scientists grows even more acute. Such a need exists, will continue to exist, and can be expected to increase, particulary in the field of *mathematical medicine and dentistry*. Specialization breeds an inability for disciplines to talk to each other, an inability to communicate their needs to each other, and a greater need for the interdisciplinary scientist; *the synthesist*. Computers continue to invade all areas of medical and dental practice. As the ability of computers increases, the demands placed upon those computers increases. The new generation of computers allows researchers to address medical problems that were totally beyond practical capability 5 years ago. However, these problems require a greater knowledge of two or more fields; a knowledge that most scientists cannot find the time to acquire.

It is here that the *synthesist*, the fiber optic link between two disciplines, plays a crucial role. What mathematics has done for fluid dynamics can be done for medicine. What computers have done for aerospace can be done for medicine and dentistry. However, we must begin to train a new generation of scientists. This new generation must be a generation of interdisciplinary thinkers; a generation of individuals trained in the art of learning and thinking across disciplines. The *niche factor* is as much a part of science as it is a part of life itself. However, the time has come for the interdisciplinary synthesist to gain a niche in the scientific community. The stigma associated with such a degree, with such a way of thinking, must be put aside.

The true beauty of science rests in drawing from all of science to solve a problem. Seeing similarities across disciplines, using tools that range across those same disciplines, to solve a complex problem is truly a beautiful experience. After all, is that not what the *art of science* is all about?

2. ABOUT THIS ISSUE

This volume (Volume 2 of the series) begins with a review on the need for mathematical models for lymphocyte differentiation, repertoire development and migration. Not only does it provide a comprehensive review of the literature, but it also poses some important questions that remain to be solved. Following this paper is a mini-monograph on the inherited rate model of the cell cycle. This paper presents a two-variable, stochastic model of the mammalian cell cycle; proposed for the interpretation of correlations between the intermitotic times of related cells, as well as for the analysis of a number of other important cellular features. Next is a paper on the modeling of the influence of tridiated thymidine on cell kinetics in mouse epidermis. Following this paper, a computer simulation of the progression of an acute myelocytic leukemia in the Brown Norway rat is presented.

The next two papers address cytometric issues. The first looks at studying cell kinetics by computer analyzed flow cytometric histograms. The second paper examines general software for the analysis of cytometric data using the E–M algorithm.

The next three papers address cancer related issues. The first of these papers discusses an approach to the modeling and simulation of the spread of tumor cells in a three-dimensional tissue segment. The second paper addresses an expert systems approach for cancer chemotherapy. The third paper looks at a systems theoretic approach to the optimization of cancer treatment.

The next set of papers looks at the issues of disease modeling for various diseases. The first of these papers presents a model for estimating the upper and lower bounds of the infectivity of the HTLV-III/LAV virus for the male bisexual and homosexual population in the absence of preventative measures. The next paper examines a discrete–time model for the spread of an infectious disease containing an immature stage, an infectious stage and a recovery stage. The final paper, in this set, addresses the development of a probabilistic model to analyze breast cancer survival data.

Following this series of papers on disease modeling, there is a set of two papers on modeling thrombopoiesis regulation. These two papers present a modeling, simulation and analytical approach to addressing the mechanisms of thrombopoiesis. The next paper addresses the numerical simulation of the infusion of adriamycin using a physiological flow model. Such a model is particularly important due to the acute and chronic cardiotoxicity of the drug.

This volume closes with a mini-monograph on the statistical foundations of confounding in epidemiology.

3. FUTURE ISSUES

With each issue, we will be expanding the scope of offerings. In this issue, we add the new feature of software reviews. As always, we are looking for qualified individuals to review books and software. Suggestions for books and for software to be reviewed are also welcomed.

In upcoming issues, we will be adding a new feature called FORUM. Because of the newness of this feature, I would like to take a moment to explain the goals of FORUM. Classically, manuscripts are refereed before they are published. The author often has to rebut or make changes, in deference to the referee, in order to make his/her manuscript acceptable for publication. The field of mathematical modeling in medicine is as much an art as it is a science. Therefore, as is often true in art, there can be many opinions, each valid within its own context. Therefore, I have decided to create a section called FORUM. A refereed paper will be published in this section, along with the referee's comments and the author's rebuttal. It is important that those who are new to the field of modeling learn from those that are actively involved in the art and science of modeling. In order to learn, one must see both the model, the arguments in support of that model, and the arguments against such a model. The arguments against a model are often lost when, in the rewriting of the manuscript, the author adjusts his paper in accordance with what was requested by the referee and/or the editor; thereby negating the potential learning process. FORUM will be a feature in which all sides agree to the conditions of publication. It is hoped that this will provide an atmosphere that removes animosity and encourages true scientific discussion between all sides.

We will also be introducing a new section entitled OPEN QUESTIONS. This section will be comprised of short discussions which raise possible questions; questions which may be ammenable to mathematical/computer modeling.

4. CLOSING COMMENTS

I would like to close with the following comments. As the power of computers increases, and as the analytical tools and techniques of mathematics develop, now more than ever is the time ripe for developing a close collaboration between the fields of mathematics and medicine. Never before have both had so much to offer each other. It was with this in mind that the Advances in Mathematics and Computers in Medicine was started. And it is with this in mind that we intend to provide a forum for this interplay.