INTERNATIONAL CENTRE OF EXCELLENCE FOR EDUCATION IN MATHEMATICS

A Six Species Model of Wound Healing

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Many elements are thought to be involved in the healing process of soft-tissue wounds. During the course of the AMSI vacation scholarship, attention was focused on six such components: capillary tips, capillary sprouts, fibroblasts, chemoattractant, oxygen and the extracellular matrix. This work forms the basis for a study of the use of hyperbaric oxygen to accelerate wound healing. The governing set of equations were taken from the paper by Pettet, Chaplain, McElwain and Byrne ("On the role of angiogenesis in wound healing" (1996) *Proc. Roy. Soc. Lond. B* **263**, 1487-1493)

The initial boundary value problem was solved using three different methods. The first was using a NAG routine, D03PCFE.F on QUT's supercomputer. This algorithm is designed to integrate a system of either linear or nonlinear parabolic partial differential equations in one spatial dimension using the method of lines.

The second method was to use MATLAB's inbuilt partial differential equation solver, pdepe.m. This routine solves initial boundary value problems for small systems of parabolic and elliptic partial differential equations in one space variable also using the method of lines.

The third method was to implement a finite volume algorithm. The finite volume method also aims to obtain an approximate solution to a set of partial differential equations on a discrete grid. Under a finite volume implementation, particular physical quantities are conserved over the mesh.

The finite volume results did not agree with the results attained using the FORTRAN routine d03pcfe.f or the Matlab PDE solver pdepe.m. Further effort needs to be spent on the finite volume method implementation in order that there be agreement between the different techniques for solving the wound healing initial boundary value problem. This further work will be undertaken as part of the honours thesis to be completed in 2005.

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