Foreword

Dental Science, like much of the evolution of human civilization, progresses in steps that are often the result of the complex relationship between science, empirical knowledge, and advances in technology. Over the years some of these have been peculiar to dentistry, but most of the time they have been part of wider movements, associated with the driving impact of discoveries and technological development. In the history of science there have been leaps forward linked to improvements in observation, such as the telescope and the microscope, or in measurement with the invention of accurate time pieces. Perhaps no development (since Aristotle laid the foundations of modern science nearly two and a half millennia ago) has had such a far reaching and in-depth impact on scientific thinking, research and practice as the advent of the computer. Computing has modified our perception, the sense and use and interpretation of time and enabled scientists to perform existing procedures far faster and more accurately than ever; it has allowed them to make a reality of things they had only dreamed of before; and perhaps of greater consequence and more excitingly, it has often stimulated them to perceive and focus on their subject with new eyes; to see it on a different scale from a completely different perspective.

The almost meteoric speed of improvements in hardware following Moore's Law and the parallel developments in software have meant that previously unimaginable amounts of computing power are now available to scientists and practitioners in a form that can be carried around in a briefcase. The burgeoning development of "cloud computing" currently underway means that the individual at their practice, in the laboratory, in office or at home, will soon have the power of a mainframe computer at their fingertips. Thus, quantitative and qualitative information can be gathered via constantly developing resources, tools and support to create a much more realistic and detailed picture of health and disease.

Dentistry is a particularly complex and sophisticated applied science; every problem to be solved is as unique as the individual, no two faces, two mouths or even two teeth are identical. To navigate from observation to diagnosis and then to the most appropriate therapeutic solution in a situation with multiple variables and degrees of freedom, the dentist has to draw on scientific knowledge from a wide range of specialist disciplines. This knowledge has to be combined with experience and judgement and the resulting diagnosis and treatment planning implemented in the form of therapy by means of the clinical wisdom and manual dexterity accrued through years of training and practice. Furthermore, in many cases the success of the final result will also depend on the dentist's sense of colour and aesthetics.

This book amply illustrates how the use of computing related technology in dentistry has expanded beyond statistical number crunching and information retrieval to make an imaginative and creative contribution to almost every aspect of dental science. In some of these areas, digital technology may go much further than enhancing current approaches and technologies and fundamentally change many of the factors that make up the way the subject is conceived. Scientific knowledge from other areas such as engineering and mathematics and biology can now be more easily applied to dental and oral and maxillofacial problems. Computers will not only transform the way dentists will work in the near future, they

also have the potential to reformulate the ways that we think about many aspects of our continuously broadening and deepening medical discipline.

It is a privilege and a pleasure to write a foreword to a book that makes a significant contribution to the shape of things to come in dentistry. Contributions in this book illustrate the progress that has been made in applying computing to such diverse areas and topics as chephalometric, 3D-time, finite element and image analyses, 3-D reconstruction and guided surgery, modelling and shrinkage and stress of materials, intraoral registration, tissue engineering of teeth, clonogenic assays, health records, a library for dental biomaterials, rapid prototyping , unicode characters for human dentition and even virtual dental practices and environments. All of these document the creativity and persistence of dedicated scientists pursuing the goal of unravelling the dynamics of living structures and functions and supporting problem solving processes and management in oral and maxillofacial surgery, oral radiology, restorative and prosthetic dentistry, orthodontics, endodontics, dental implantology and practically every field of dental practice, research and education.

The dentist of the future will have new and powerful tools to help in the processes of diagnosis, analysis, calculation, prediction and treatment. Computing and its related technologies will help dentists to work faster, with greater knowledge and awareness of the situation they are dealing with to implement solutions that are more effective and have a more certain prognosis. With such a complex and multifaceted science however, the role of the individual practitioner in selecting, orchestrating and implementing this array of exciting new possibilities will be enhanced, but remain unchallenged.

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