Informatics tools offer solutions to many problems in oral health clinic and research, but also face significant challenges, linking of data from the clinical diagnostic technologies.

The field of bioinformatics will have several main areas of interest in oral medicine including the development of software and analysis tools for genomics and proteomics data related to oral tissues, in particular for the analysis of data from DNA arrays, mass spectrometry, and protein-protein and protein-DNA interactions in the analysis and interpretation of these data.

Methodologies shall focus on methods from multivariate statistics, for example testing statistical hypotheses, cluster analysis and classification, and networks as well as functional annotation of sequence data.

The in silico analysis of complex biological processes, such as gene regulatory motifs, metabolic networks, and signal transduction pathways, will play an important role in the development of diseases, infections as well as oral tissue malformations. Specific efforts have to be made for the integration of databases and experimental data into the kinetic models, for example in order to test mutations or to validate drug targets for oral cancer. The aim of the book is to gain insight into technological advances in the field of oral health informatics. We aimed this book for the clinician, and the researcher in this evolving field.

ORGANIZATION OF THE BOOK

The book is roughly divided into 5 sections:

Section One, "Informatics Tools in Oral Medical Research" introduces the basic concepts in the use of computational tools in oral medical research. Chapter 1 deals with the development of "artificial mouths". The need to develop instrumental techniques that reproduce mouth conditions is explained. In this chapter are presented the difficulties and advances in reproducing oral functions, such as mouth temperature, saliva, breathing and mastication. Chapter 2 is focused on proteomics applications by using mass spectrometry and protein microarrays in oral medicine. The emphasis of chapter 3 is on concepts from molecular biology, genetics, and traditional pathology to provide new insights into oral diseases, and the associated technologies to provide new diagnostic and prognostic information. Chapter 4 describes novel approaches to study regulation of neurotrophin expression and release from neurons by activity.

Section Two, "Informatics Tools in Oral Diagnostic Technologies" serves as a comprehensive introduction to computational methods supporting oral diagnosis. Chapter 5 discusses the methods for assessing the complexity of oral plaque biofilms. Chapter 6 describes Human Papilloma Virus (HPV) detection and genotyping using the Luminex xMAP technology. Chapter 7 provides information related to Time Sequencing and Force Mapping with Integrated Electromyography to measure occlusal parameters.
Section Three, “3D-Visualization in Oral Medicine” includes 6 chapters. Chapter 8 deals with the description of selective laser melting in dentistry. Chapter 9 introduces techniques for the generation of 3D Finite Element Meshes of human organs. In chapter 10 the author describes the Finite Element Method (FEM), a widely applied mathematical model that permit us to know the biomechanical behavior of the human mandible in various clinical situations under physiological and standardized trauma conditions. Chapter 11 gives an overview of the current literature regarding the present use of cone-beam computed tomography in the localization of impacted teeth for orthodontic purposes. Chapter 12 present different approaches for computer-assisted surgery (CAS) in dental implantology. Chapter 13 present concepts related to imaging techniques in Periodontology.

Section Four, “Bioinformatics Applications in Bacterial Identification,” describes informatics tools and techniques related to oral bacteria identification. Chapter 14 describes a developed meta-analysis approach which helps to extract sets of genes related to oral infections and interaction networks by integrating and combining quantitative data using statistical approaches. Chapter 15 discuss the potential capability of modern molecular genetic technologies utilizing bioinformatics.

In Section Five, “Informatics tools in the management of dental care”, Chapter 16 presents new innovative services in dentist appointment management.

The book “Informatics in Oral Medicine: Advanced Techniques in Clinical and Diagnostic, Technologies” contains text information, but also a glossary of terms and definitions, contributions from international experts, in-depth analysis of issues, concepts, new trends, and advanced technologies in oral medicine. This edition focuses more directly and extensively than ever on applications of informatics in oral medicine.

The diverse and comprehensive coverage of multiple disciplines in the field of oral health informatics in this book will contribute to a better understanding all topics, research, and discoveries in this evolving, significant field of study. I hope will make this book a helpful tool—not only for the student who needs an expert source of basic knowledge in oral health informatics, but also for the advanced researcher who needs clear, concise, and balanced information on which to conduct his research.

In shaping this book, I committed myself to making the reference book as useful as possible to students and advanced researchers coping with the demands of modern medical research. Thanks to a very hard-working advisory editorial board of scientists, excellent authors who fulfilled our invitations, and a very efficient publisher providing clear procedures and practices for a quality production, readers may now enjoy chapters on some of the major ideas that have concerned computing and its applications in oral medicine.

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