PREFACE

Biophotonics is revolutionizing the field of medicine, biology and chemistry and creating a new breed of medical engineers while at the same time getting engineers a taste of medicine. From an engineer's perspective, biophotonics is the application of photonics – the technology of generating and harnessing packet of light energy called photons – to image, detect and manipulate biological materials. In biology the understanding of molecular mechanisms, function of proteins and molecules has seen great new advances. In biomedical engineering detection, diagnoses and treatment targeting both macro-objects like the teeth or bone as well as micro-objects such as bacteria have seen better understanding through the development of new tools. There is another school of thought, albeit much smaller that defines biophotons as a quantum of light that is permanently and continuously emitted by all living systems. For example, humans emit radiation similar to a blackbody with maximum power being emitted at a wavelength of about 10 μm.

Regardless of definition, biophotonics is a multi-disciplinary field that bridges engineering, the sciences and medical fields. This diversity of sciences and technologies usually makes for challenging and interesting projects – that could be driven by engineers and clinicians alike. However, there is still the need that clinicians understand some concepts in photonics while engineers get a feel for medical and bio-chemical sciences. Towards this end, this book is written by persons from different fields such as engineering, sciences and medical field.

The book is roughly divided into two sections – the first introduces the readers to some basic concepts in the field of biophotomechanics. As the name suggests, this topic looks at the use of optical methods (photo) for the study of mechanical behaviour (mechanics) of biological objects

in the macro-scale such as teeth and bone. The next chapter introduces some recent techniques on bioimaging such as fluorescence microscopy and optical coherence tomography amongst others. Chapter 4 introduces spectroscopy – a erstwhile tool in biophotonics while chapter five deals with lasers and laser tissue interaction. Finally Chapter 6 provides an introduction to Photodynamic therapy a growing technology for targeted application of photonic radiations.

The second half of the book applies some of these basic concepts to the field of dentistry to highlight some of the features and adaptation of photonics in this area. Dental photomechanics provides an understanding of mechanical and thermal characteristics of dentine and permits a better understanding of the causes of damage and failure of certain treatments. Chapter 8 uses spectroscopic methods specifically Micro-Raman spectroscopy for a better understanding of the materials aspects of dentine and adhesives. The next chapter on Dental and Oral Optics describes tools and techniques for imaging and optical properties of dentine and enamel. The final chapter on fiber optic sensors explores new sensor development for effective and fast ways of detecting and diagnosing oral bacteria.

We, as editors, feel that the book would be just as informative for final year undergraduate, graduate students in bioengineering as it would to clinicians and dental surgeons to gain a better understanding of a process or treatment.

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