Biomedical Applications of Biophotonics.

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Introduction

Biophotonics is that the study of optical processes in biological systems, both people who occur naturally and in bioengineered materials. A particularly important aspect of this field is imaging and sensing cells and tissue. This includes injecting fluorescent markers into a biological system to trace cell dynamics and drug delivery.

The term biophotonics denotes a mixture of biology and photonics, with photonics being the science and technology of generation, manipulation, and detection of photons, quantum units of light. Photonics is related to electronics and photons.

Biomedical Applications

Diagnostic biophotonics is employed to detect diseases in their initial stages before actual medical symptoms occur in patients. By using optics, diagnostic biophotonics provides several advantages of sensing and imaging at the molecular level and also collects multidimensional data for evaluation. Technologies supported light are generally contact-free with less effect on integrity of living subjects and, consequently, can easily be applied in place.

Biophotonic imaging is rapidly emerging as a tool for clinical assessment of carcinoma at the microscopic and macroscopic scale. Optical biopsy uses near-infrared (NIR) light to research tumor margins and lymph nodes with micron-scale resolution intraoperatively. Optical mammography uses NIR light to realize spectroscopic information and three-dimensional images of whole breast tissues noninvasively [1].

The following chapter will review the present research within the application of biophotonic imaging methods like optical coherence tomography, multiphoton microscopy, vibrational imaging, near-infrared spectroscopy, diffuse optical tomography, and multimodal macroscale imaging for noninvasive diagnosis and intraoperative imaging of breast tumors and lymph nodes[2].

Photonic processes are those interactions whereby electromagnetic disturbance, within the sort of a wave or particulate, renders changes within the material's state and/or within the state of the incident electromagnetic wave. We call these processes light-matter interactions. Because it's indeed the change in either the state of the matter or light which will inform us of the existence of such an interaction, we've strived to improve our approach to increase sensitivity for such detection, and in that process, gain new information about the matter being probed. So we consider the photonic methods as our "Biophotonics Tools Kit".

Thus the term biophotonics covers a good spectrum of biomedical questions from understanding life processes to prevention, early recognition, and therapy of diseases. Attention should be paid to an alternate use of the term as a complement to the term biomedical optics. In that context, the sector of biophotonics only covers applications of photonics within the life sciences and fundamental biomedical research like the investigation of cellular processes, whereas the field of biomedical optics covers the clinical applications of light in diagnostics and therapy [3].

This distinction seems to possess evolved historically, because the term photonics was only coined about 50 years ago, when light-based technologies were already well established in medicine. In this book, the term biophotonics is used for both mentioned areas. Furthermore, it reaches into the fields of environmental, food and pharmaceutical analysis and thus even applies to the fields of process control and security applications. The authors consider this definition more conclusive, more purposeful and more forwardlooking, as it provides a holistic perspective. This approach advances a likewise holistic, modern health care, and particularly the groundbreaking paradigm change from the treatment of diseases towards health maintenance.

References

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