Biomedical Applications of Light

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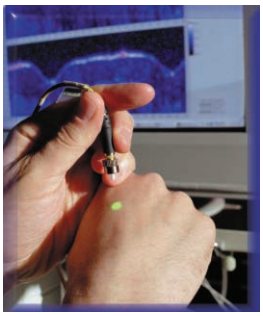
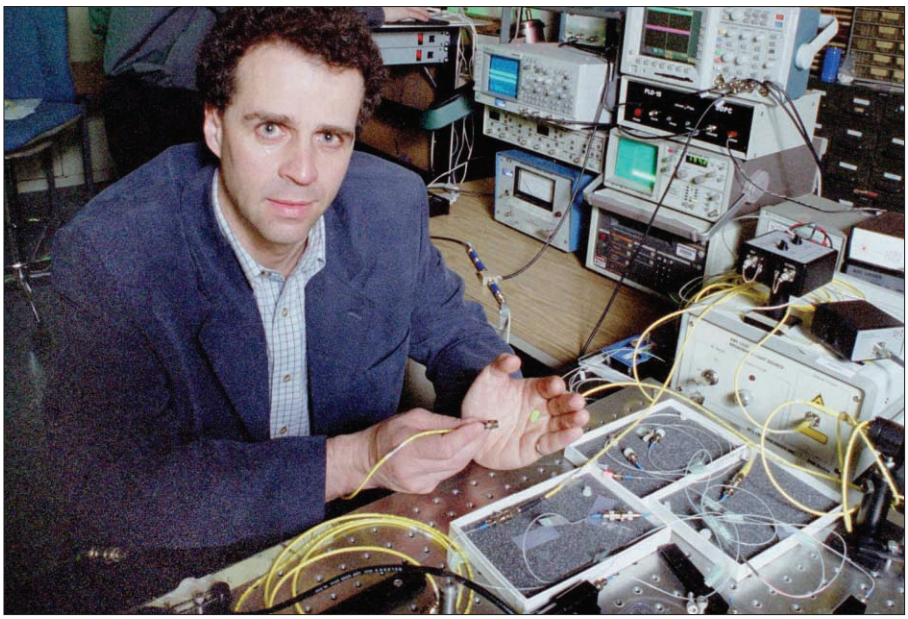


This special issue of OPN, along with our new supplement, *OPN Trends*, will give readers an overview of emerging directions in biomedical optics, offer a snapshot of the research activity in the field, and provide specific clinical and biomedical examples of biophotonic applications.

Welcome to OPN's special issue on biophotonics, including the new supplement, *OPN Trends*. The applications of light in biology and medicine have just begun to enter the arenas of optical diagnostics and therapeutics, where photonics may permit a more accurate, less invasive measurement than other technologies, or enable a precise delivery of optical energy to treat the body. This special issue of OPN will give readers an overview of trends and emerging directions in biomedical optics, offer a snapshot of the research activity in the field, and provide specific clinical and biomedical examples of biophotonic applications.



Over the past several decades, our understanding of the interactions of optical radiation with tissue has advanced considerably. The absorption and scattering properties of tissues, the models and measurements of light propagation, and the resulting photothermal, photochemical, and photomechanical effects, have been extensively investigated.

Despite many remaining grey areas, this has resulted in a new level of sophistication in biomedical laser applications. In combination with advances in solid-state laser, fiber-optic, and photodetector technologies, new instrumental systems are emerging in both clinical practice and research. Largely as a result of advances in fiber-optic delivery systems, many of these biophotonics technologies are suitable for controlled examinations or precise alterations of intact tissues deep within a patient, thus enormously expanding their clinical utility.

The articles assembled in this special issue of OPN magazine and its new supplement, *OPN Trends*, provide ample illustration of past accomplishments, present activity, and possible future uses of photonic technologies at the frontiers of the health sciences. We've come a long way from the early days of biomedicine, when CO_2 lasers were used as optothermal scalpels to "slash and burn" tissues in a relatively unselective way. The introductory overview article on optical imaging of tissue makes recent progress in the field abundantly clear. The effects of *light on tissue* (optical therapeutics) and the effects of *tissue on light* (optical diagnostics) are then discussed in a series of articles dealing with specific applications. On the diagnostics side, we have examples of optical technologies for glucose monitoring in diabetic patients, combined imaging and spectroscopy measurements via hyperspectral imaging and 3D optical imaging of cataracts. In the therapeutic domain, there are descriptions of a novel laser technique in cardiology known as transmyocardial recanalization and uses of ultraviolet radiation for tuberculosis control. The exposition of multiphoton effects in biomedicine illustrates how these interactions can be exploited for both tissue examination and tissue alteration. The article on two-eye optical devices nicely illustrates the interdisciplinary nature of biophotonics, as it describes the confluence of optical and vision science.

These articles are but a glance into the diverse and fruitful area of biophotonics. An interested reader should consult the many OSA publications that explore the biomedical optics field, such as *Applied Optics* (OTBO), *Optics Express*, and *TOPS*. We hope you enjoy the biophotonics snapshot featured in this special issue of OPN.

— Alex Vitkin
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