Journal of Biophotonics is the first international journal dedicated to publishing original articles and reviews from the exciting field of biophotonics, i.e. the development and application of photonic technologies in particular for (bio)medicine, but also life- and environmental sciences. The journal offers a platform where technology developers (physicists, chemists, engineers, etc.) communicate with endusers (in particular research clinicians) and where the clinical practitioner learns about the latest tools for the diagnosis and therapy of diseases. As such, the journal is highly interdisciplinary, publishing innovative research in the field of light interaction with biological material. The coverage extends from fundamental research to specific developments, while also including the latest applications or clinical trials/case reports.
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Front Cover

Instant polarized light microscopy (IPOL) allows for direct visualization of collagen with a single image encoding orientation and retardance in color and intensity, respectively, without post-processing. The high spatiotemporal resolution of IPOL makes it well-suited for quantitative imaging of collagen micro-architecture and behavior under dynamic loading. IPOL is therefore a powerful imaging tool that facilitates research on the biomechanics and pathophysiology of collagenous tissues. We demonstrate IPOL for sheep eyes, pig chordae tendineae and chicken tendon.

Further details can be found in the article by Bin Yang, Po-Yi Lee, Yi Hua, Bryn Brazile, Susannah Waxman, Fengting Ji, Ziyi Zhu, and Ian A. Sigal (e202000326).

Inside Cover

In optoacoustic imaging methods, measurement strategies are commonly implemented under limited-view conditions, leading to artifacts and distortions in reconstructed optoacoustic images. We propose a hybrid data-driven deep learning approach, termed as LV-GAN, to efficiently recover high quality images from limited-view optoacoustic images. The feasibility of LV-GAN for artifact removal in biological applications and the portability of LV-GAN was validated by ex vivo experiments based on two different optoacoustic imaging systems.

Further details can be found in the article by Tong Lu, Tingting Chen, Feng Gao, Biao Sun, Vasilis Ntziachristos, and Jiao Li (e202000325).

Inside Cover

We present a novel all-fiber probe with 710-μm outside diameter for combined optical coherence tomography and pH detection. We obtained a lateral resolution of ~10.6 μm, a working distance of ~506 μm, and a pH measurement accuracy of 0.01 pH unit for the probe. The performance of the all-fiber probe was verified through an ex-vivo experiment using the porcine brain specimen.

Further details can be found in the article by Minghui Chen, Jianping Wang, Weijie Tan, Yuanyuan Feng, and Gang Zheng (e202000239).
REVIEW ARTICLES

**e202000161**

**Laser-induced optothermal response of gold nanoparticles: From a physical viewpoint to cancer treatment application**

Somayeh Asadi*, Leonardo Bianchi, Martina De Landro, Sanzhar Korganbayev, Emiliano Schena, Paola Saccomandi

- Supporting information available online free of charge

Gold nanoparticles (GNPs) are unique therapeutic agents for minimally invasive photothermal therapy of cancer. Several GNPs parameters, for example, optical properties, coating, and concentration, in association with laser settings and tumor properties, significantly impact therapy outcomes. Understanding the physical mechanisms for heat generation in GNPs-embedded tissues is fundamental for the design of experiments and planning and monitoring tools, toward the therapy settings optimization for the final clinical application.

**e202000257**

**Strain and elasticity imaging in compression optical coherence elastography: The two-decade perspective and recent advances**

Vladimir Y. Zaitsev*, Alexander L. Matveyev, Lev A. Matveev, Alexander A. Sovetsky, Matt S. Hepburn, Alireza Mowla, Brendan F. Kennedy

- Supporting information available online free of charge

In this paper we present the two-decade perspective of the development of quantitative mapping of deformation and elasticity based on the idea of Compression Optical Coherence Elastography (C-OCE). Despite intense effort, breakthroughs in practically useful realizations of C-OCE were reported only recently and have not yet obtained due attention in reviews. Here, we focus on underlying principles of C-OCE, discuss practical challenges in its realization and present examples of various biomedical applications of C-OCE.

**LETTER**

**e202000342**

**Concept of photonic hook scalpel generated by shaped fiber tip with asymmetric radiation**

Igor V. Minin, Oleg V. Minin, Yan-Yu Liu, Valery V. Tuchin, Cheng-Yang Liu*

The tip shape of optical fiber determines its function since it controls the light distribution pattern on a specific sample. We demonstrate a new concept of fiber-based optical hook scalpel. The subwavelength photonic hook is obtained in the vicinity of a shaped fiber tip with asymmetric radiation. Photonic hook generated with a shaped fiber tip, easier to manipulate, shows far-reaching benefits for potential applications such as ophthalmic laser surgery, super-resolution microscopy, photolithography, and material processing.
**e202000326**

**Instant polarized light microscopy for imaging collagen microarchitecture and dynamics**

Bin Yang, Po-Yi Lee, Yi Hua, Bryn Brazile, Susannah Waxman, Fengting Ji, Ziyi Zhu, Ian A. Sigal*

Supporting information available online free of charge

Collagen fibers are the primary load-bearing component of connective tissues and central to their biomechanics and pathophysiology. Understanding collagen architecture and behavior under dynamic loading requires a quantitative imaging technique with simultaneously high spatial and temporal resolutions. Instant polarized light microscopy (IPOL) was developed to meet these needs, by allowing quantitative snapshot imaging of collagen, providing information on fiber architecture, orientation and retardance.

**e202000325**

**LV-GAN: A deep learning approach for limited-view optoacoustic imaging based on hybrid datasets**

Tong Lu, Tingting Chen, Feng Gao, Biao Sun, Vasilis Ntziachristos, Jiao Li*

Supporting information available online free of charge

A hybrid data-driven deep learning approach (LV-GAN) is proposed to efficiently recover high-quality images from limited-view optoacoustic datasets which are commonly existed in real applications of optoacoustic imaging. LV-GAN is found capable of achieving high recovery accuracy even under limited detection angles less than $60^\circ$. The high potential of a ubiquitous use of LV-GAN to optimize image quality or system design was also validated.

**e202000239**

**Miniaturized all fiber probe for optical coherence tomography and pH detection of biological tissue**

Minghui Chen*, Jianping Wang, Weijie Tan, Yuanyuan Feng, Gang Zheng

Supporting information available online free of charge

We present a novel all-fiber probe with 710-μm outside diameter for combined optical coherence tomography and pH detection. In cancer surgery, a significant challenge is how to completely remove the malignant tumor without cutting too much normal tissue. This dual-modality probe combined optical coherence tomography and pH detection of biological tissue, is expected to determine whether the tissue is cancerous quickly and accurately. The probe utilizes a typical three-segment structure.
Advanced fully integrated radiofrequency/optical-coherence-tomography irrigated catheter for atrial fibrillation ablation

Valentina Tiporlini*, Selam Ahderom, Peter Pratten, Kamal Alameh

The inability of current catheter ablation procedures to accurately monitor lesion formation limits their safety and efficacy. An advanced fully integrated radio-frequency (RF)/optical coherence tomography (OCT) ablation catheter is developed, which enables real-time monitoring during ablation. In-vitro experimental studies performed on poultry and ovine hearts demonstrate the ability of the integrated RF/OCT system to provide information on the quality and orientation of catheter/wall contact.

Photobiomodulation therapy drives massive epigenetic histone modifications, stem cells mobilization and accelerated epithelial healing

Manoela D. Martins, Felipe Martins Silveira, Marco A. T. Martins, Luciana O. Almeida, Vanderlei S. Bagnato, Cristiane H. Squarize, Rogerio M. Castilho*

Emerging evidence indicates the clinical benefits of photobiomodulation therapy (PBMT) in the management of skin and mucosal wounds. Here, we explored the effects of different regiments of PBMT on epithelial cells and stem cells, and the potential implications over the epigenetic circuitry during healing. We observed that PBMT-induced accelerated epithelial migration and chromatin relaxation along with increased levels of histones acetylation. We showed that PBMT could induce epigenetic modifications of epithelial cells and control stem cell fate, leading to an accelerated healing phenotype.

Enhanced temporal and spatial resolution in super-resolution covariance imaging algorithm with deconvolution optimization

Xuehua Wang, Junping Zhong, Mingyi Wang, Honglian Xiong, Dingan Han, Yaguang Zeng, Haiying He*, Haishu Tan*

This paper proposes an optimized covariance imaging for super-resolution algorithm to enhance the temporal–spatial resolution of SOFI. In the case of the simulated images, the resolution has been enhanced by 8.7-fold compared to average image utilizing only 20 simulated images. In the experiments, the proposed algorithm achieved 0.8 seconds (20 images with 40 ms per frame) temporal resolution at 58 nm spatial resolution. In comparison, while the conventional SOFI improve the spatial resolution 92 nm, 500 images were needed. Thus, improving SOFI imaging speed 25-fold, which is important for widespread application of SOFI techniques for live cell dynamic microscopy.
Development of concurrent magnetic resonance imaging and volumetric optoacoustic tomography: A phantom feasibility study

Wuwei Ren, Xosé Luis Deán-Ben, Mark-Aurel Augath, Daniel Razansky*

Supporting information available online free of charge

Optoacoustic tomography (OAT) and magnetic resonance imaging (MRI) provide highly complementary capabilities for anatomical and functional imaging of living organisms. Here, the feasibility of combining both modalities to render concurrent images is investigated. A specifically designed copper-shielded spherical ultrasound array was introduced into a preclinical MRI scanner. Phantom experiments revealed that the OAT probe caused minimal distortion in the MRI images, while synchronization of the laser and the MRI pulse sequence enabled defining artifact-free acquisition windows for OAT. Thus, the hybrid OAT-MRI system provides an excellent platform for cross-validating functional readings of both modalities.

Single probe diffuse reflectance spectroscopy to assess the effect of Sarcopoterium spinosum treatment on the cerebral tissue properties of ApoE knockout mouse

David Shemesh, Konstantin Rozenberg, Tovit Rosenzweig, David Abookasis*

Diffuse near-infrared light reflectance spectroscopy contains central single collection fiber surrounded by a circular array of illumination fibers together with biological testing have been used to quantify cerebral tissue properties in ApoE knockout mice following Sarcopoterium spinosum treatment. Five mouse groups were studied, representing different genetic, dietary, and treatment conditions. Improvement in cerebral hemoglobin level was observed in mice fed an artherogenic diet upon treatment while brain water content unchanged.

Smartphone-based multimodal tethered capsule endoscopic platform for white-light, narrow-band, and fluorescence/autofluorescence imaging

Gargi Sharma*, Oana-Maria Thoma, Katharina Blessing, Robert Gal, Maximilian Waldner, Kanwarpal Singh

Multimodal low-cost endoscopy is highly desirable in poor resource settings. We developed a smartphone-based low-cost, reusable, tethered capsule endoscopic device that allows white-light, narrow-band, and fluorescence/autofluorescence imaging. The overall cost of the capsules is approximately 12 €, 15 €, and 42 € for the white light imaging, the narrow-band imaging, and the fluorescence/autofluorescence imaging respectively. The cost of the laser source module required is approximately 218 €. This will open the possibility of imaging the esophagus in underprivileged areas.
**e202000335**

**Telecentric design for digital-scanning-based HiLo optical sectioning endomicroscopy with an electrically tunable lens**

Haw Hsiao, Chen-Yen Lin, Sunil Vyas, Kuang-Yuh Huang*, J. Andrew Yeh*, Yuan Luo*

Digital-scanning-based HiLo optical sectioning endo-microscopy with an electrically tunable for imaging ex-vivo cardiac tissues.

**e202000337**

**Monitoring the biochemical changes occurring to human keratinocytes exposed to solar radiation by Raman spectroscopy**

Ulises Lopez-Gonzalez*, Alan Casey, Hugh J. Byrne

Supporting information available online free of charge

This work monitors the impact of solar radiation at a molecular level in keratinocytes by Raman spectroscopy.

**e202000339**

**Wave optical simulation of retinal images in laser safety evaluations**

Sebastian Kotzur*, Siegfried Wahl, Annette Frederiksen

Lasers with wavelengths in the visible and near infrared region, pose a potential hazard to vision as the radiation can be focused on the retina. For determining the retinal image, the radiation is often described as a Gaussian beam and simplified analytical equations are used excluding diffraction effects at the eye pupil. In this publication, we analyze these effects and propose a general analytical calculation method for eye safety evaluations.
Harnessing DNA for nanothermometry

Graham Spicer, Sylvia Gutierrez-Erlandsson, Ruth Matesanz, Hugo Bernard, Alejandro P. Adam, Alejo Efeyan*, Sebastian Thompson*

Supporting information available online free of charge

Temperature measurement at the nanoscale, achievable by the recent development of nanothermometers, has many potential applications in cells and living organisms. Here we characterize theoretically and experimentally the thermal sensitivity of DNA bound to Hoechst dye. These findings are attractive since HOECHST is cell-permeable, non-cytotoxic, and binds to any DNA sequence. We anticipate this work to provide a basis for the extension of nanoscale temperature measurement to all DNA-based research.

Optimization of spatial resolution and scattering effects for biomedical fluorescence imaging by using sub-regions of the shortwave infrared spectrum

Benjamin Musnier, Maxime Henry, Julien Vollaire, Jean-Luc Coll, Yves Usson, Véronique Josserand, Xavier Le Guével*

Supporting information available online free of charge

We showed a quantitatively significant reduction of light scattering from endogenous tissues at longer wavelengths in the shortwave infrared window using an artificial model and in mice. We confirmed the improvement of spatial resolution in depth using Monte Carlo restoration treatment.

In vitro effects of photobiomodulation therapy on 50B11 sensory neurons: evaluation of cell metabolism, oxidative stress, mitochondrial membrane potential (MMP), and capsaicin-induced calcium flow

Luisa Zupin*, Egidio Barbi, Raffaella Sagredini, Giulia Ottaviani, Sergio Crovella, Fulvio Celsi

The photobiomodulation therapy effects on 50B11 sensory neurons: increment of ATP, ROS, MMP and decrement of capsaicin-induced calcium peak.
In vivo sun protection factor and UVA protection factor determination using (hybrid) diffuse reflectance spectroscopy and a multi-lambda-LED light source

Carolin Maria Throm, Georg Wiora, Carina Reble, Johannes Schleusener, Sabine Schanzer, Hans Karrer, Ludger Kolbe, Georg Khazaka, Martina C. Meinke, Jürgen Lademann

A UV-LED based system was developed that is suitable to determine UV reflectance spectra of skin with sunscreen products in a non-invasive way in vivo. Sun protection factors can be calculated based on in vivo data combined with in vitro data. The measurement setup is compact and adjustable.

High-fluence light emitting diode-red light inhibits cell cycle progression in human dermal fibroblasts

Natasha Masub, Evan Austin, Alisen Huang, Jared Jagdeo

Light-emitting diode red light (LED-RL) has demonstrated promising evidence as a potential treatment for skin fibrosis. We previously reported LED-RL significantly decreased cutaneous dermal fibroblasts without inducing apoptosis. Herein, we demonstrate that LED-RL is capable of inhibiting cell cycle progression in fibroblasts, further elucidating the mechanism by which LED-RL induces its anti-proliferative effects on fibroblasts.

Raman spectroscopy of human skin for kidney failure detection

Lyudmila A. Bratchenko, Ivan A. Bratchenko, Yulia A. Khristoforova, Dmitry N. Artemyev, Daria Y. Konovalova, Peter A. Lebedev, Valery P. Zakharov

The object of this paper is the in vivo study of skin spectral characteristics in patients with kidney failure by conventional Raman spectroscopy. Our studied results indicate that the utilization of conventional Raman spectroscopy for in vivo skin analysis can be a universal method of cost-effective and accurate detection of diseases associated with kidney pathology and for monitoring the status of hemodialysis patients.
Hyperspectral imaging as a diagnostic tool to differentiate between amalgam tattoos and other dark pigmented intraoral lesions

Johannes Laimer, Emanuel Bruckmoser, Tom Helten, Barbara Kofler, Bettina Zelger, Andrea Brunner, Bernhard Zelger, Christian W. Huck, Michelle Tappert, Derek Rogge, Michael Schirmer, Johannes D. Pallua

Goal of this project is to identify any in-depth benefits and drawbacks in the diagnosis of amalgam tattoos and other pigmented intraoral lesions using hyperspectral imagery collected from amalgam tattoos, benign and malignant melanocytic neoplasms. Hyperspectral imaging is presented as a diagnostic tool for the rapidly growing field of digital pathology. In this preliminary study, amalgam tattoos were reliably differentiated from melanocytic lesions of the oral cavity and the lip.