IMAGE AND VIDEO ACQUISITION AND PROCESSING FOR CLINICAL APPLICATIONS

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Supplement Aims and Scope

This supplement is intended to focus on image and video acquisition and processing for clinical applications.

Biomedical Engineering and Computational Biology aims to provide researchers working in this complex, quickly developing field with online, open access to highly relevant scholarly articles by leading international researchers. In a field where the literature is ever-expanding, researchers increasingly need access to up-to-date, high quality scholarly articles on areas of specific contemporary interest. This supplement aims to address this by presenting high-quality articles that allow readers to distinguish the signal from the noise. The editor in chief hopes that through this effort, practitioners and researchers will be aided in finding answers to some of the most complex and pressing issues of our time.

Articles should focus on image and video acquisition and processing for clinical applications and may include the following topics:

- Image acquisition
  - Novel biomedical imaging systems
  - Optical imaging, synthetic-natural hybrid image systems; opto-acoustic imaging
- Image and video processing
  - Image and video filtering, restoration and optimization
  - Image and video enhancement, segmentation, morphological processing, interpolation and super-resolution
  - Feature extraction and analysis, object detection and classification
  - Motion detection, tracking and estimation
  - Color and multispectral processing, biometrics

At the discretion of the guest editors other articles on other relevant topics within the scope of the supplement may be included.

Advances in medical research are dependent on the development of new and emerging technologies. The field of medical and biomedical imaging has gained impetus due to vast strides made in both the clinical and research settings. Medical imaging aims to support and improve our understanding of human diseases, monitor the progression of pathophysiology, suggest therapeutic approaches for treatment and resolve any subsequent complications.

Traditionally, imaging techniques were primarily used for diagnostic purposes, treatment of diseases, and studying the anatomy and function of tissues and organs. Different imaging modalities now exist in the medical field to provide an assessment of a living tissue or organ at powerful functional resolutions. Among other capabilities, imaging provides (1) a beneficial approach for early detection or prevention of diseases, (2) capabilities to evaluate the body's response to a certain treatment, and (3) guidance during surgery. The conventional imaging modalities include magnetic resonance imaging (MRI), x-ray computed tomography, ultrasound and positron emission tomography among others. However, high-resolution, high-sensitivity and low cost imaging techniques are still needed in the biomedical field.

The field of medical imaging started with non-invasive x-ray images, which provided a two-dimensional (2D) representation of internal structures. However, as structure often relates to physiological functionality and pathophysiology, the 2D representation of organs was a limitation while attempting to study three-dimensional (3D) structure and function. 3D imaging techniques were then introduced and provided more robust capabilities for non-invasively evaluating internal anatomy. Several factors affect the quality of the images obtained using the different imaging modalities. The quality of images were primarily dictated by scanner instrumentation, image acquisition time, geometrical modeling of the tissues/organs, as well as image reconstruction techniques.

Apart from diagnostic purposes, imaging has gained special attention in the field of biomedical research. One area of growing interest is the development of imaging application at the cellular spatio-resolutions. Different techniques have been developed to image the cellular level of a living tissue. Those techniques, whether applied in vitro or in vivo in animal models provide a better understanding of cellular morphology and function, widely applied to cell motility, migration, integration within host tissues, etc. In regenerative medicine, imaging techniques play a major role in tissue regeneration and reconstruction, primarily as a tool to monitor tissue integration and interactions. Medical imaging is also being used to develop computer aided design (CAD) models of anatomical geometries for applications ranging from subject specific prosthetic design to computational human body models for injury prediction.

This current supplement is unique in providing different perspectives of imaging techniques for medical purposes. The articles include topics ranging from imaging at the organ level to imaging at the cellular level for medical applications. For example, one article describes an application of some of the most widely used imaging modalities to diagnose and localize prostate cancer. The article focuses on the selection of the imaging technique based on the biological properties of the tumor. In another article in this supplement, imaging is discussed at the level of 3D cell culture systems. Those imaging modalities are essential for studying cellular architecture and dynamics. Another article in this supplement focuses on non-invasive imaging techniques in tissue engineering applications. This becomes critical when neo-tissues are followed for maturation and remodeling. These topics also have implications for the role that imaging can play for the regeneration of a whole organ. Image processing and acquisition are used to generate a 3D model of the tissue that can be used for bioprinting.

In conclusion, the current supplement highlights important, upcoming uses of imaging modalities in biomedical research. The editorial team strongly believes that the articles within this supplement explore the future of imaging in the biomedical space.

Lead Guest Editor **Mr. Elie Zakhem**

Mr. Elie Zakhem, M.S., received his Bachelor's degree from the University of Balamand, Lebanon and his Master's degree from Wayne State University in Detroit, Michigan. Mr. Zakhem is currently a PhD student at Wake Forest School of Medicine—Institute for Regenerative Medicine (WFIRM) in the department of Molecular Medicine and Translational Sciences. His research interests focus on the basic science and translational aspect of regenerating the smooth muscle component of the gut along with its intrinsic innervation using gut-derived neural stem cells. He also works on developing gut replacements to treat patients with gut cancer or patients with short bowel syndrome using tissue engineering and regenerative medicine approaches. He previously worked on developing scaffolds using natural biomaterials and studying their biomechanical properties at the University of Michigan at Ann Arbor. Mr. Zakhem is the author or co-author of over 12 published peer-reviewed papers and 2 peer-reviewed book chapters and has presented at over 10 national conferences. Mr. Zakhem received a certificate of recognition from the American Gastroenterological Association for his scientific accomplishment as an early stage investigator in 2015 and 2016.

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Dr. Sean V. Murphy received his Bachelor's degree from the University of Western Australia and his Ph.D. from Monash University, Melbourne, Australia. He is currently an Assistant Professor of Regenerative Medicine at the Wake Forest Institute for Regenerative Medicine in North Carolina, USA. His research focuses on developing regenerative medicine and tissue engineering strategies to establish and improve clinical treatments for lung disease. These strategies include cell therapies to restore normal function to lung tissue and minimize inflammation and scarring associated with disease, use of 3D bioprinting to fabricate new airway tissues for transplantation, and lung-on-a-chip technologies for disease modeling and drug discovery. Dr. Murphy is currently the Associate Editor of the journal *Bioprinting*, on the Editorial Board of multiple journals, including *Stem Cells Translational Medicine* and is Director, Secretary and Founder of the Perinatal Stem Cell Society. Dr. Murphy has published over 30 peer reviewed journal articles, multiple book chapters and reviews, and numerous awards and fellowships, most notably from the American Lung Association Senior Research Training and the American Australian Association.

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