

Industrial Physics Forum (IPF) on Fabrication, imaging, and sensing in biological systems.

The IPFs, scientific gatherings sponsored by the American Institute of Physics and hosted by its member societies, are unique, topic-specific conferences addressing application-focused research in the physical sciences emerging from academia and the private sector. They consist solely of invited talks grouped around several subtopics. The present Forum, the seventh at AVS since 2006, focuses for the first time exclusively on the biophysical/medical sciences and is co-hosted by the Biomaterials Interfaces Division (BID). The program was designed to broaden the interest and perspective of the BID community through talks partially overlapping research areas of their interest, yet not routinely covered at prior AVS Symposia.

The program focuses on innovations in three sub-topics of the biosciences: imaging and structural determination, bioanalytic sensing and diagnostics, and biomaterial assembly. Each topic is covered by five invited speakers in three consecutive morning sessions starting Monday October 22. The afternoons are set aside for contributed talks on topics related to the respective morning sessions. The event is preceded by the traditional BID Plenary session on Sunday afternoon October 21, with topics complementary to those of the IPF.

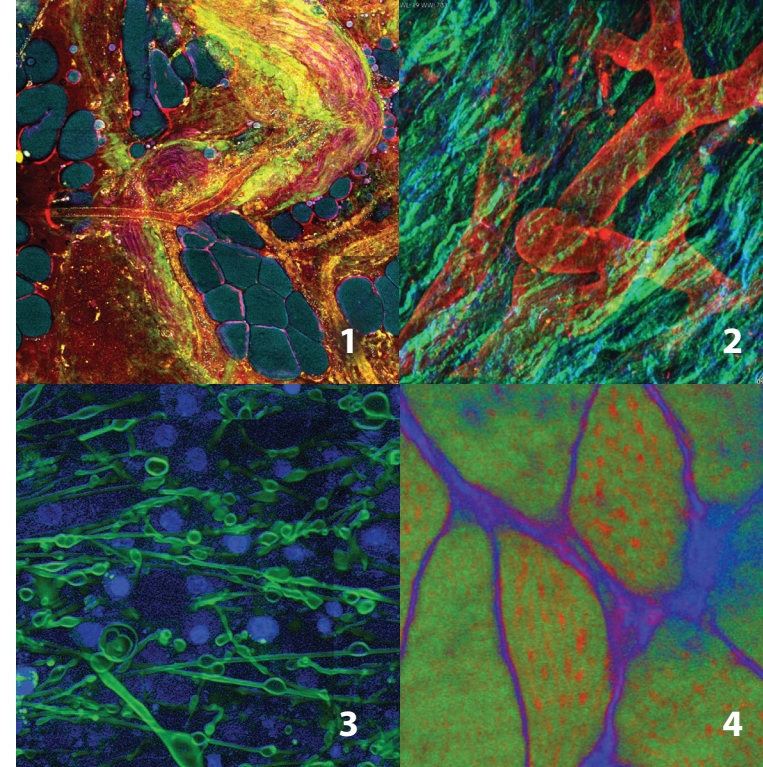
The session on imaging and structural determination highlights diverse experimental approaches based on infrared,

visible, X-ray and mass spectrometric technologies, and encompasses advanced nonlinear optical, fluorescence and Raman spectroscopy, as well as synchrotron and X-ray free electron laser (XFEL) studies for dynamic and 3D imaging of biomolecules and sub-cellular structures at nanoscale resolution.

The bioanalytic, biosensor, and diagnostic session covers diverse sensing approaches from activated surfaces to discreet nano-sized biomolecular and patterned structures. Topics include advances in in-vitro and in-vivo approaches to disease detection, nanoparticles for monitoring biomolecular functions in their biological environment, subcellular sensors to probe biological processes in live cells, and sensitized surfaces acting as pressure and tunable photo-responsive sensors.

The biofabrication session encompasses a structured build-up from basic tissue assembly to the prospects of full organ fabrication. The intermediary steps of vascular co-assembly and its accompanying challenges of supplying life sustaining nutrients and oxygen to the living cells will be amply covered. In addition, the scaffolding required to maintain the integrity of the assembling organ will be discussed, as well as the different approaches and challenges in 3D printing.

All IPF panels are in Room 101B



1) Fine-tuned five wavelengths of light display five distinct cancer processes, and combine them in images like this to see how they dynamically relate to one another. Courtesy Stephen Boppart. **2)** Two photon excited fluorescence (TPEF) of blood vessels (red) and second harmonic generation (SHG) of collagen (blue and green) within a decellularized heart image volume. Courtesy Lauren Black, Irene Georgakoudi, Kyle Quinn, and Kelly Sullivan. **3)** Quantitative analysis of an infiltrative tumor margin imaged with SRS microscopy. Courtesy Xiaoliang Sunney Xie. **4)** Hyperspectral SRL imaging of mouse muscle tissue. RGB image representation of the dataset based on the three largest components from a vertex component analysis. Courtesy Alba Alfonso-Garcia.

INDUSTRIAL PHYSICS FORUM

on fabrication,
imaging, and
sensing in
biological
systems

The IPF is part of the AVS International Symposium & Exhibition and sponsored by the American Institute of Physics.



SUNDAY, OCTOBER 21, 2018

The Biomaterials Plenary Session

The Biomaterials Interfaces Division and AIP's Industrial Physics Forum program kicks off with the now traditional Biomaterials Plenary Session. This year's plenary session features presentations from two eminent scientists who have made significant contributions to the fields of biofabrication and high resolution cryo-electron-microscopy.

3:00pm *Integrating Single Molecule Devices with Conventional Microfabrication using DNA Origami*, Paul Rothmund, California Institute of Technology

3:40pm *High Resolution Cryo-EM Structures of Macromolecular Complexes*, Wah Chiu, Stanford University

MONDAY, OCTOBER 22, 2018

Biofabrication: From Tissue to Organ

8:20am *Strategic Thinking on the Architecture and Design of Scaffolds for Regenerative Medicine*, Buddy D. Ratner, University of Washington, Seattle

9:00am *Sequential Bottom-up Assembly of Synthetic Cells*, Joachim Spatz, Max Planck Institute for Medical Research, Germany

9:40am *Activation of Inkjet Printed Cells Enhances Microvasculature Formation in Host Tissues*, Thomas Boland, B. Oropeza, L.H. Solis, University of Texas at El Paso; M. Yanez, University of South Carolina

10:40am *Challenges in Organ-specific Vascular Engineering and Tissue Assembly*, Ying Zheng, University of Washington

11:20am *Bioprinting for Translational Applications: The Quest for Whole Organ Fabrication*, James J. Yoo, Wake Forest School of Medicine

Lunch break

1:20pm *Relaxometry as a Medical Diagnostic*, Michael J. Cima, Massachusetts Institute of Technology

2:00pm Contributed paper session: *Advanced Image and Structure Determination of Biomaterials*

TUESDAY, OCTOBER 23, 2018

Advanced Imaging and Structure Determination of Biomaterials

8:00am *Chemical Imaging as a Tool to asses Molecular and Morphologic Content in Natural Tissues and Fabricated Models*, Rohit Bhargava, T. Comi, M. Gryka, University of Illinois at Urbana-Champaign

8:40am *Fluorescence Dynamics and Nonlinear Optical Imaging Methods for Biomedical Applications*, Alba Alfonso Garcia, L. Marcu, University of California at Davis

9:20am *Single Molecule Imaging of Receptor Signalling*, Katharina Gaus, University of New South Wales, Australia

11:00am *Developing a Google-earth View of Tumour Metabolism through Multiscale Molecular Imaging*, Rory Steven and Josephine Bunch, National Physical Laboratory, United Kingdom

11:40am *X-ray Diffraction and Coherent Imaging with Nano-focused Radiation: A Multi-scale Approach from Biomolecular Assembly to Cell, Tissue and Organ*, Jan-David Nicolas, T. Salditt, University of Göttingen, Germany

WEDNESDAY, OCTOBER 24, 2018

Bioanalytics, Biosensors, and Diagnostics

8:40am *Harnessing Bacteria for Fabrication of Photoelectrodes and Pressure Sensors*, Y. Feng, K.E. Marusak, Y. Cao, E. Ngaboyamahina, J. Glass, L. You, Stefan Zauscher, Duke University

9:20am *Surface Chemistry and Surface Analysis: Their Importance and Application in Industrial Genomics*, Fiona Black, Illumina Inc.

11:00am *Design and Evaluation of Organosilica Nanosensors for Continuous Molecular Monitoring in Complex Biological Environments*, Simon Corrie, Monash Univ., Melbourne AU

11:40am *Optoregulated Biointerfaces*, Aránzazu del Campo, INM-Leibniz Institute for New Materials, Germany