

Selected research topics in Biomedical Engineering: Novel Phenotyping and Diagnostic Tools

Location: Lecture room 14.03.002, Department of Biomedical Engineering, Allschwil,

Date and time: Thursday, 05.12.2019, 2019, 12:30-14:00

Pharmacokinetic Tomography

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Abstract

Coherent Raman scattering (CRS) imaging tools provide a label-free means to visualize specific molecules within tissue, making CRS methods well suited for solving challenges in drug development. We will present our efforts to leverage CRS tools to not only visualize the uptake of drugs within skin tissue, but also precisely quantify both pharmacokinetics and pharmacodynamics. We leverage deep learning methods, specifically the use of convoluted neural networks, for accurate feature extraction to measure pharmacokinetics across numerous different skin compartments. Using single and multicomponent compartment models, we can analyze the CRS-derived data to calculate traditional PK parameters such as T_{max} and C_{max} on both the micro- and macroscale. These approaches have been validated and now tested on multiple drugs in a range of formulations, demonstrating how CRS imaging tools can reveal new, previously-inaccessible PK and PD information. This research seeks to link the microscale information gained via CRS microscopy to the macroscale measurements made in traditional PK/PD labs to understand drug flow, the impact of structure and formulation on diffusion, and how these parameters relate to drug efficacy.

Curriculum:

Dr. is an Associate Professor at the Harvard Medical School, an Affiliated Faculty member of the Harvard University Biophysics Program, a Faculty member of the Laser Biomedical Research Center, and leads his lab at the Wellman Center for Photomedicine at Massachusetts General Hospital. Dr. Evans received his Bachelors of Science in Chemical Physics from Brown University and his PhD in Chemistry from Harvard University.

Dr. Evans lab's research is focused on the development and clinical translation of optical microscopy and spectroscopy tools, with specific interests in ultrasensitive detection of molecular markers, label-free imaging of drugs and tissues, and the imaging and quantification of tissue oxygenation. Dr. Evans has led the use of coherent Raman imaging technologies in biomedicine, and was the first to apply this imaging toolkit for the real-time visualization of lipids in skin in vivo. He has developed a number of imaging devices and methods in the fields of coherent Raman imaging, nanoscience, and "smart" wearable sensing technologies. A recipient of the NIH Director's New Innovator Award, his efforts in the synthesis of bright oxygen sensors has resulted in the

creation of new oxygen imaging technologies currently in clinical trials. He is a Royce Fellow of Brown University and has been honored with several awards, including the Goldwater Scholarship, NASA Space Grants, the National Science Foundation Graduate Fellowship, and the ASP New Investigator Award.

Dr. Evans is an academic editor for PLOS One and has written over 50 peer-reviewed publications. He holds more than 10 patents and patent applications and works to translate his technologies to the clinic. He serves the Wellman Center as Faculty Liaison to the Department of Defense, and focuses his efforts in the areas of Combat Casualty Care and Rehabilitative Medicine. Dr. Evans additionally serves as a faculty member of the Ludwig Center at Harvard.