technology to our advantage by using Raman systems on combines and grain elevators to perform mass scans to determine grain quality.

2309-Pos
Following Spatial Distribution of Photosynthetic Pigments Across the Development of a Leaf using Hyperspectral Fluorescence Microscopy
Sandeep Pallikkuth[1], Roxana Khoshravesh[2], David T. Hanson[2], Jerilyn A. Timlin[3], Keith A. Lidke[1].
[1]Physics and Astronomy, Univ New Mexico, Albuquerque, NM, USA, [2]Biology, Univ New Mexico, Albuquerque, NM, USA, [3]Sandia National Laboratories, Albuquerque, NM, USA.
Leaves on plants undergo a transition from a sink (a net carbon importer) to a source (a net carbon exporter) during their development. This conversion from sink to a photosynthetic source marks a fundamental transition in the physiology of the leaf, profoundly altering the carbohydrate metabolism and acting as one of the major determinants of plant performance. Hence a considerable amount of study is underway to understand its biochemical and structural characteristics. In plants, the process by which undifferentiated plastids differentiate into mature functional chloroplasts begins in the shoot apical meristem (SAM) and young leaf primordia (sink tissue), and continues along leaf development. In this work, we follow the spatial distribution of these plastids and their abundance of photosynthetic pigments in a gradient from sink to source by imaging laser induced fluorescence using a home-built laser scanning hyperspectral microscope. The line-scanning hyperspectral microscope combines fast scanning with optical sectioning to record 4-D datasets with spatial (*x, y, z*) and spectral (λ) information. We will present three dimensional observations of photosynthetic pigment carrying plastids in C_4 plants during the different phases of leaf cell development.

2310-Pos
Quantitative Fluorescence Quenching by Aromatic Amino Acids
Danielle R. Latham[1], Arturo R. Diaz[2], Jake Ribich[3], Nabanita Saikia[1], Emma Mulry[4], Leah Casabianca[4], Feng Ding[1], Hugo Sanabria[1].
[1]Physics and Astronomy, Clemson University, Clemson, SC, USA, [2]Georgia Southern University, Statesboro, GA, USA, [3]University of Illinois, Champaign, IL, USA, [4]Chemistry, Clemson University, Clemson, SC, USA.
Rhodamine dyes belong to one of the most common family of fluorophores. Even though they are broadly used across biological sciences and knowing that these dyes are susceptible to fluorescence quenching by aromatic amino residues such as those contained on Tryptophan, Histidine, Tyrosine and Phenylalanine, the molecular mechanism behind the quenching process is still unclear. We combine steady state, time-resolved, and single molecule fluorescence experiments with Nuclear Magnetic Resonance (NMR) and Discrete Molecular Dynamics (DMD) and Density Functional Theory (DFT) simulations to shed light into the molecular mechanisms of fluorescence quenching. We present the photo-physics of Rhodamine 110 in the presence of various amino acids in solution and diverse solvents (DMSO, water, buffers, various salts, and mixes between them). By understanding the interaction of amino acids with florescent aromatic rings, it becomes possible to optimize fluorescence experiments, leading to a clearer understanding of biological systems.

2311-Pos
21-Plex Microfluidic Flow Cytometer and its Potential Applications to Pediatric Malarial Immune Response Analysis
Gillian McMahon[1], Judith R. Mourant[1], Kristen WIlding[1], Douglas J. Perkins[2].
[1]Bioscience Division, Los Alamos National Laboratory, Los Alamos, NM, USA, [2]Center for Global Health, University of New Mexico, Albuquerque, NM, USA.
We are creating a new low-cost, microfluidic flow cytometry system that will measure up to 21 different parameters of individual cells from samples as small as a few hundred microliters. Unlike the conventional flow cytometers that measure 10's of parameters and use up to six lasers, this system will use only two lasers and any dye that is excited by either 488 or 532 nm laser. In contrast to current flow cytometers, the system measures the full wavelength range of the emission spectra at a resolution of 1-2 nm. Currently we have obtained a spectrum of BD FlowCheck fluorospheres in our device as well as the side scatter signal from flowing polystyrene spheres. After optimizing both our microfluidic design and our setup to improve the signal, we will test the system using various beads with multiple fluorescing dyes. We hope to use this device to assist in the understanding of pediatric immune response to malaria through analysis of fifteen years worth of longitudinal data from a hospital in Siaya, Kenya. Due to *Plasmodium falciparum* systematically varying its antigenic and phenotypic characteristics, analysis of the disease is difficult. The increased capability of this system is especially applicable to studying malaria because it will measure multiple cell markers from a single sample, it will be able to test on a small sample, such as those obtained from the anemic children, and it has the potential to be field-deployable.

2312-Pos
Investigations of Protein and Biomolecules using a 280 nm or 295 nm Picosecond Laser for High Speed Measurements and High Time Resolution
Christian Oelsner, Eugeny Ermilov, Thomas Schönau, Dietmar Klemme, Guillaume Delpont, Kristian Lauritsen, Rainer Erdmann.
PicoQuant, Berlin, Germany.
Next to steady-state fluorescence investigations, time-resolved photoluminescence measurements with pulsed light sources are a powerful tool to get more information about the nature, characteristics and environment of molecules, e.g., proteins and small biomolecules. Their emission lifetime can affected by various processes such as Förster Resonance Energy Transfer (FRET), charge transfer, solvation dynamics, or molecular rotation.
The spectral region between 280 and 300 nm is significant for biology, life and materials science. Many important organic molecules such as tryptophan or tyrosine can be excited in this wavelength range. Whereas the fluorescence and lifetime of these amino acids is very sensitive to changes in protein's secondary or tertiary structure.
Here we present the results of steady state and time-resolved fluorescence measurements of Human Serum Albumin (HSA), an important protein for many pharmaceutical and biomedical applications, with a FluoTime 300 photoluminescence spectrometer in combination with two different pulsed excitation sources, a pulsed LED (PLS-280) and a new picosecond pulsed laser module (VisUV-280). In comparison to a pulsed LED, the properties of the VisUV-280 are much better suited for photophysical investigations with a spectral bandwidth of < 0.1 nm and temporal pulse width <80 ps compared to $\sim$16 nm and 750 ps of the LED.
Without doubt, using the VisUV-280 laser for excitation of proteins and biomolecules allows investigations in terms of fast kinetics e.g., energy / electron transfer processes and fast measurements with short acquisition times both in steady-state as well as time-resolved measurements in complex molecular systems or building blocks.

Posters: Biosensors II

2313-Pos
Nanoimpact Based Single-Entity Detection of Proteins using a Nanopore-Nanoelectrode Nanopipette
Popular Pandey, Jin He.
Physics, Florida International Universi, Miami, FL, USA.
Nanopores and nanoelectrodes are two promising electrochemical methods for single entities analysis. Combining these two methods in one nanopipette apex allows us to simultaneously monitor the signal changes at nanopore and nanoelectrode when a biomolecule enters the nanopore or collides at the nanoelectrode. Here, I present a facile electrical method of detecting proteins at the single-molecule level in the solution based on the nanoimpact events at the nanoelectrode. Proteins such as Horse Spleen Ferritin, Bovine Hemoglobin, and Lysozyme are used to test the method. Open circuit potential (OCP) changes are detected from the nanoimpact events due to the collision of individual proteins at or near the vicinity of the floating nanoelectrode. Compared to the commonly used amperometric method, the detected OCP changes are more sensitive showing a bigger detection range and a higher time resolution. The new nanopipette based potentiometric method provides new opportunities to study various biological entities at a single-entity level with close to physiological conditions.

2314-Pos
Microscopic Imaging of Engineered Biological Nanopores Aiming for High Throughput Nanopore Sensing and Sequencing
Shuo Huang.
Chemistry and Chemical Engineering, Nanjing University, Nanjing, China.
A specially engineered biological nanopore directly resolves a variety of analytes such as inorganic ions, small molecules, nucleic acids or even proteins. This high resolution enables the biological nanopore as an ideal platform to dynamically monitor chemical biology targets in single molecule, which include but not limited to the probing of carcinogenic DNA damages, cisplatin modifications to DNA and small molecule interactions with ion channels, as to be presented in our talk. Particularly, O6-carboxymethyl guanine, which is a highly carcinogenic base damage related to the development of rectum cancer, were identified by a nanopore sequencing assay with a $\sim$98% accuracy. However, it can't be detected by any other sequencing means. Routinely, the