ESCRT machinery with respect to HIV bud sites using iPALM to gain critical insight. We find ESCRT-III proteins assemble within the head of the budding virion, not the base as previously proposed. This later finding prompts a reevaluation of current models for ESCRT-III scaffolding, and suggests that ESCRT abscission initiates from within the head of the budding virion.

34-Subg
Nanoplasmonics Meets BIO
Jochen Feldmann.
Ludwig Maximilians Universitaet, Munich, Germany.
I will report on our recent efforts to utilize some of the unique plasmonic properties of noble metal nanoparticles for sensing and controlling nano- and microscale processes in aqueous solution. The use of optical forces and of local optothermal heating is in the focus of our investigations. Examples range from controlled laser printing with nanoscale precision via the study of DNA-binding events to the purely optical detection of a single rotating bacterium.

35-Subg
Single Molecule Fluorescence Studies of Protein Aggregates and their role in Neurodegenerative Disease
David Klenerman.
Cambridge University, Cambridge, United Kingdom.
Small soluble protein aggregates are thought to play a key role in the initial development of neurodegenerative diseases, such as Alzheimer's and Parkinson's disease, but are difficult to study using conventional methods due to their low concentration and dynamic and heterogeneous nature. We have developed single molecule fluorescence based methods to detect and analyse the protein oligomers formed during an aggregation reaction, with time, and to study how these oligomers interact with the membrane of live neuronal cells. I will present recent work from our laboratory on beta amyloid, tau and alpha synuclein oligomers to show how such quantitative studies can provide new insights into both the aggregation pathway and also the molecular mechanism of cellular damage, allowing us to put forward a model for the disease onset.

36-Subg
Engineering Electron Nanoconduits to Electronically Interface Cells with Materials
Caroline M. Ajo-Franklin.
Materials Sciences Division, Lawrence Berkeley National Lab, Berkeley, CA, USA.
My laboratory is particularly interested in manipulating processes at the nano-interface between living cells and inorganic materials. In my talk, I will discuss our efforts to engineer bi-directional electronic communication between living cells and non-living systems by introducing protein-based electron nanoconduits into cell membranes. We have recently demonstrated that by transplanting synthetic genes into the model organism Escherichia coli we can express these electron nanoconduits and confer upon these cells the ability to reduce metal ions, solid metal oxides, and electrodes. Additionally, these engineered E. coli cells are able to respire using these extracellular materials instead of its native respiratory pathways. This work provides the first example of a predetermined, molecularly-defined route for electronic communication between living cells to inorganic materials. Ultimately we seek to exert such control over processes at the cellular-inorganic nanointerface that our engineered cells become a new generation of self-replicating, programmable 'living materials'.

37-Subg
Advances in Live Cell Nanoscopy
Joerg Bewersdorf.
Cell Biology, Yale School of Medicine, New Haven, CT, USA.
Optical nanoscopy, or super-resolution microscopy, overcomes the diffraction limit of light and enables fluorescence microscopy at ~25 nm resolution - about 10-fold better than conventional fluorescence microscopy [1]. Over the last years, the field has seen a number of conceptual and technological advances which have expanded the range of biomedical applications significantly. In my presentation, I will focus on progress in live-cell STED and single-molecule switching (FPALM/PALM/STORM) nanoscopy and will present new developments and applications in this area [2].
[1] T.J. Gould, S.T. Hess, and J. Bewersdorf (2012). ''Optical Nanoscopy: from Acquisition to Analysis'', Annual Review of Biomedical Engineering 14:231-254.
[2] F. Huang, T.M.P. Hartwich, F.E. Rivera-Molina, Y. Lin, W.C. Duim, J.J. Long, P.D. Uchil, J.R. Myers, M.A. Baird, W. Mothes, M.W. Davidson, D. Toomre, J. Bewersdorf (2013). ''Video-rate nanoscopy using sCMOS camera-specific single-molecule localization algorithms'', Nature Methods 10(7): 653-658.

38-Subg
Single-Molecule Observation in the DNA Origami Nanostructures
Hiroshi Sugiyama.
Kyoto University, Graduate School of Science & WPI-iCeMS, Japan.
Direct observation of the movement of biomolecules including enzymes and DNAs should be one of the ultimate goals for investigating the detailed mechanical behavior of the molecules during the reactions. We designed various DNA nanostructures using DNA origami method for the preparation of single-molecule observation scaffolds. Using the designed DNA scaffold and high-speed atomic force microscopy (AFM), the single-molecule behaviors of the DNA modifying enzymes, repair enzymes, and recombinases were observed in the target double-stranded DNAs (dsDNAs) placed in the DNA frame structure. DNA structural changes including G-quadruplex formation and B-Z DNA conformational change were also visualized. Using this system, we observed the photo-induced DNA hybridization and dissociation by detecting the global structural changes of the incorporated two dsDNAs in the DNA frame structure. A pair of azobenzene-modified oligonucleotides (ODNs) was employed, which forms duplex in the trans-form and dissociates in the cis-form. During UV-irradiation, hybridized azobenzene-modified ODNs at the center dissociated, and the subsequent visible-light irradiation induced the hybridization of the photoresponsive ODNs, meaning that the reversed switching behavior such as the hybridization and dissociation was directly visualized at the single-molecule level. These photoresponsive ODNs were also used for controlling assembly and disassembly of the hexagonal DNA origami structures with photo-irradiation. The combination of the designed DNA scaffold modified with target DNA strands and high-speed AFM is valuable for visualizing and analyzing the single enzymatic and chemical reactions.

39-Subg
Single Cell Genome Analysis
Stephen Quake.
Stanford Univ, Stanford, CA, USA.
No abstract.

Subgroup: Biopolymers in vivo

40-Subg
The Machines that Fold Proteins in the Eukaryotic Cytosol
Judith Frydman.
Stanford University, Stanford, CA, USA.
No abstract.

41-Subg
Unexpected Functions of the CLP AAA+ Unfoldases
Tania Baker.
MIT, Cambridge, MA, USA.
No abstract.

42-Subg
Coil-Coil Under Load: Stability of Essential Machine Component
Ron Elber.
Computer Sci Dept, University of Texas at Austin, Austin, TX, USA.
A molecular machine like myosin needs to work in cycles and resists the possibility of an overload. A critical component of myosin is the coiled-coli structure of two amphipathic alpha helices that helps transmit load and are found in a wide range of motor and structural proteins. What are the mechanical benefits of the coiled-coil structure and the specific sequence design found in the myosin protein? In this talk I will discuss a ''load release valve'' that is naturally designed into the coiled-coil sequence and structure. The valve responds to external load and undergoes significant conformational transition to reduce load levels and strain ensuring that a recovery path (and closure of the valve when appropriate) is simple, reliable and remarkably fast.

43-Subg
Starling's Law at Small Scale: Surprising Sub-Cellular Adaptation of Cargo Transport to Opposition to Motion
Steven P. Gross, PhD, J.N. Babu Reddy.
Developmnetal and Cell Biology, University of California, Irvine, Irvine, CA, USA.
Most sub-cellular cargos are transported along microtubules by a combination of kinesin and dynein, and how this transport is regulated is not well