3118-Pos Board B810
Selective Nucleic Acid Capture with Shielded Covalent Probes
Jeffrey Vieregg[1], Niles A. Pierce[2].
[1]Institute for Molecular Engineering, University of Chicago, Chicago, IL, USA, [2]Dept of Bioengineering, California Institute of Technology, Pasadena, CA, USA.
Nucleic acid probes are used for diverse applications in vitro, in situ, and in vivo. In any setting, their power is limited by imperfect selectivity (binding of undesired targets) and incomplete affinity (binding is reversible, and not all desired targets are bound). These difficulties are fundamental, stemming from reliance on base pairing alone to provide both selectivity and affinity. Shielded covalent (SC) probes eliminate the longstanding trade-off between selectivity and durable target capture, achieving selectivity via programmable molecular conformation change and durable target capture via activatable covalent cross-linking (Vieregg et al, J. Am. Chem. Soc. 2013). In pure and mixed samples, SC probes covalently capture complementary DNA or RNA oligonucleotide targets and reject two-nucleotide mismatched targets with near-quantitative yields at room temperature, achieving discrimination ratios of 2−3 orders of magnitude. Semi-quantitative studies with full-length mRNA targets demonstrate selective covalent capture comparable to that for RNA oligo targets. Single-nucleotide DNA or RNA mismatches, including nearly isoenergetic RNA wobble pairs, can be efficiently rejected with discrimination ratios of 1−2 orders of magnitude. Covalent capture yields appear consistent with the thermodynamics of probe/target hybridization, facilitating rational probe design. If desired, cross-links can be reversed to release the target after capture. In contrast to existing probe chemistries, SC probes achieve the high sequence selectivity of a structured probe, yet durably retain their targets even under denaturing conditions. This previously incompatible combination of properties suggests diverse applications in vitro and in vivo; this talk will present our latest results on SC probe applications.

3119-Pos Board B811
Polyethylenimine: Experimental and Simulation Study of Polymer Biophysics During Ph Buffering
Bria J. Rice[1], Tasneem Abdus-Shakur[1], Kimberly A. Curtis[1], Jeffrey B. Klauda[2], Richard M. Venable[3], Richard W. Pastor[3], **Preethi L. Chandran**[1].
[1]Howard University, Washington, DC, USA, [2]University of Maryland, College Park, MD, USA, [3]National Institutes of Health, Bethesda, MD, USA.
Dynamic Light Scattering (DLS) and all atom molecular dynamics (MD) simulation were used in complementary ways to study the effect of protonation (simulation) and pH changes (experiment) on the polymer chain dynamics of a 2.4kDa linear PEI (~50mer). Simulations were performed with a modified CHARMM potential for a variety of charge states and ionic strengths to generate conformational statistics. DLS yielded a phase map of PEI aggregation to select for conditions in which PEI was in the dilute and free polymer state. Hydrodynamic radii from the experiments and simulations were within 3A agreement. The results indicate that PEI absorbs protons with minimal change in its elongation length, except at high protonation where the chain elongates and deviates from worm chain distributions. Salt screening introduced changes in the protonation/pH response. Our observations are consistent with PEI studies showing that intra-chain charge repulsion raised the free energy of subsequent protonation.

3120-Pos Board B812
Synthetic Membrane Curvature-Inducing DNA Origami Scaffolds
Henri G. Franquelim[1], Veikko Linko[2], Aleksander Czogalla[3], Hendrik Dietz[2], Petra Schwille[1].
[1]Max Planck Institute of Biochemistry, Martinsried, Germany, [2]Technical University of Munich, Garching, Germany, [3]Paul Langerhans Institute, Dresden, Germany.
Biological membranes are dynamic cellular barriers that suffer deformation and bending. Despite huge effort in identifying the general elements involved in membrane curvature, the physical-chemical basis of curvature induction is still poorly understood. In this work, we fill this gap by engineering a minimal curvature-inducing system. Due to its exclusive nanoengineering properties, DNA origami technology will be utilized to build minimal curvature-inducing scaffoldings. This state-of-the-art technology enables the folding of long strands of DNA into nano-objects with defined shapes by using sequence-specific short DNA staples. For instance, our group recently constructed membrane-interacting rod-like DNA origami structures, which were functionalized with hydrophobic anchors and fluorescently labeled at defined positions [1]. Here, synthetic nanostructures will be designed in order to have a) defined customized shapes and b) specific membrane binding elements. Hybrid origami scaffolds with specific functional membrane-attachment groups bound at defined positions on the scaffolds will be produced. The interaction of those hybrid scaffolds with lipid membrane model systems will be studied and their capability of inducing membrane curvature evaluated. Fluorescence microscopy and atomic force microscopy methods will be used in order to retrieve extent, localization and forces involved in the interactions. More precisely, the role of the scaffolding shapes, membrane-attachment moieties, oligomerization and conformational changes will be assessed. At the end, this quantitative characterization of minimal membrane-inducing scaffolds will help understand the role of cooperativity in membrane deformation and the rules that govern the induction of membrane curvature.
[1] A. Czogalla, E. P. Petrov, D. J. Kauert, V. Uzunova, Y. Zhang, R. Seidel, and P. Schwille, Faraday Discuss. 161 (2013) 31.

3121-Pos Board B813
On-Chip Fast Plasmonic Detection of Single Molecule Mirna for Cancer Diagnosis
Julian A. Diaz, Inhee Choi, Chi-Cheng Fu, Sang Hun Lee, Luke P. Lee.
Berkeley Sensor and Actuator Center, Department of Bioengineering, Department of Electrical Engineering and Computer Science, University of California at Berkeley, Berkeley, California 94720, USA.
Simple methods that enable early stage cancer diagnosis are indispensable to increase the chances of a successful treatment. Detecting changes on the concentrations of specific miRNAs is a promising strategy for cancer premature identification. However, miRNAs detection can be challenging due to their low concentrations in physiological fluids, and sequence similarities that make slightly different miRNA species difficult to discriminate. Here, we present an integrated plasmonic detection method that allows the specific detection of multiple miRNAs types, at a very low concentration, in a fast and user-friendly essay. By using gold-nanoparticles, controlling the surface chemistry, and improving the hybridization strategy, we are able to selectively detect miRNAs concentrations of less than 1fM at the single molecule level in a multiplexed (> 2 species) and fast (< 20 min) essay. Moreover, our approach avoids the typical enzymatic/chemical target modification, which makes it ideal for point of care applications. We believe this technology can be used not only on the early detection of cancer but also, to monitor its progression and to study its drug resistance changes.

3122-Pos Board B814
Enhancing Portable Ultrasound Machine for Detecting Breast Masses in Ultrasound Breast Images
Farzan Khatib, Firouzeh Ghafourian Nasab.
Islamic azad University, Mashhad, Iran, Islamic Republic of.
The aim of this research is enhancing Breast masses extraction from Ultrasound Breast images of a portable Ultrasound machine and improving the interpretation of Medical Officers using Computer-Assisted Detection techniques.
Breast Cancer is the second leading cause of death in women and mothers all around the world. Detecting Breast Cancer in early stage may increase survival chance of patients. Among different methods of breast screening Ultrasound is one of the safest and the most cost effective way. A portable Ultrasound machine can be used to distribute the benefits of early stage breast screening with lower cost and higher number of patients specifically in country sides and far away centers around countries with wide people distributions. Modes of operation, transducer, frequency and contrast were the main parameters in this work. Ultrasound images were acquired considering an applicable range of setting for these parameters in B-Mode Ultrasound.
Using MATLAB Image Processing Tool Box and an enhancement and detection algorithm could produce a set of results that were reviewed and marked by two experienced radiologists. A sensitivity of 99% and accuracy of 98% for proposed framework were come from statistical analysis of results.
Applicability, predicting chance of Breast Cancer, safety, cost effective and reliability are some of the key point for this work. It has high implementation possibilities and can simply realize and add to any portable Ultrasound machine.

3123-Pos Board B815
Integrating Synthetic Cells and Flexible Electronics for the Control of Bio-Opto-Fluidic Materials
Kyle Justus[1], Saumya Saurabh[2], Marcel Bruchez[2], Carmel Majidi[1], Philip LeDuc[1], Cheemeng Tan[3].
[1]Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA, USA, [2]Carnegie Mellon University, Pittsburgh, PA, USA, [3]Biomedical Engineering, University of California, Davis, Davis, CA, USA.
The integration of optofluidics and soft materials has ushered in a new generation of flexible devices for drug delivery, biosensors, and tissue engineering. These devices are biocompatible and allow complex control of device dynamics using fluidic and pneumatic controls. Importantly, these devices could be combined with synthetic biological systems to increase sensory and control capabilities of the devices through exploitation of complex genetic controls in