X. Nancy Xu, Ph.D.

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Selected Research Accomplishments & Publication Highlights

I. **Pioneering Single-Molecule and Single Nanoparticle Optical Sensing and Imaging Platforms**

Dr. Xu has pioneered the development of new single-molecule and single nanoparticle optical sensing and imaging platforms, including photostable single-nanoparticle optical imaging probes, Single-Molecule Nanoparticle Optical Biosensors (SMNOBS), and Photostable Optical Nanoscopy (PHOTON). Her work aims to rationally design a new class of optical nanomaterials and develop photostable optical imaging probes and tools that overcome the intrinsic drawbacks of fluorescence-based imaging platforms, such as photobleaching and phototoxicity, for imaging live organisms (e.g., live cells and developing embryos) over extended periods.

She has demonstrated that these new optical nanomaterials and imaging tools can be used to study the signal transduction pathways of single live cells with nanometer localization spatial resolution and millisecond temporal resolution, achieving single-molecule sensitivity and quantification over long durations (hours to days).

Her discoveries include new dynamic and quantitative biological insights into the high heterogeneity of receptors on single live cells and their associated signaling dynamics and mechanisms. These highly innovative tools can be applied to investigate other cascade signaling pathways, advance our understanding of cellular functions, and support the design of more effective therapeutics. Applications include the identification of pre-disease biomarkers for early cancer detection, mapping drug-targeted sites, and characterizing vaccines.

Selected papers include:

1. T. Huang, P. D. Nallathamby, D. Gillet, and **X. Xu**[*], "Design and synthesis of single nanoparticle optical biosensors for imaging and characterization of single receptor molecules on single living cells", *Anal. Chem*. **79**, 7708-7718 (2007); https://pubs.acs.org/doi/pdf/10.1021/ac0709706

2. T. Huang, P. Nallathamby, **X. Xu**[*], "Photostable single-molecule nanoparticle optical biosensors for real-time sensing of single cytokine molecules and their binding reactions", *J. Am. Chem. Soc.* **130**, 17095-17105 (2008); https://pubs.acs.org/doi/pdf/10.1021/ja8068853

3. P. Nallathamby, **X. Xu**,[*] "Study of cytotoxic and therapeutic effects of stable and purified silver nanoparticles on tumor cells" *Nanoscale* **2**, 942-952 (2010); https://pubs.rsc.org/en/content/articlepdf/2010/nr/c0nr00080a

4. K. J. Lee, L. Browning, T. Huang, F. Ding, P. Nallathamby, **X. Xu**[*], "Probing multidrug ABC membrane transporters of single living cells using single nanoparticle plasmonic optical probes", *Anal. Bioanal. Chem*. **397**, 3317-3328 (2010); https://link.springer.com/content/pdf/10.1007%2Fs00216-010-3864-8.pdf

5. T. Huang, **X. Xu***, "Multicolored nanometre-resolution mapping of single protein–ligand binding complexes using far-field photostable optical nanoscopy (PHOTON)", *Nanoscale* 3, 3567-3572 (2011) (Journal front-cover highlight; Featured in *Chemical and Engineering News*, P. 32, June 20, 2011); https://pubs.rsc.org/en/content/articlepdf/2011/nr/c1nr10182j

6. T. Huang, L. M. Browning, **X. Xu***, "Far-field photostable optical nanoscopy (PHOTON) for real-time super-resolution single-molecular imaging of signaling pathways of single live cells" *Nanoscale* 4, 2797-2812 (2012); https://pubs.rsc.org/en/content/articlepdf/2012/nr/c2nr11739h

7. **X. Xu***, "Far-field photostable optical nanoscopy", in *Encyclopedia of Spectroscopy and Spectrometry*, 3rd Ed., J. C. Lindon, G. Tranter and D. W. Koppenaal, Eds. Elsevier, vol. 1, 566-570 (2017) https://doi.org/10.1016/B978-0-12-409547-2.12143-2

8. P. Songkiatisak, P. Cherukui, **X. Xu***, "PHOTON for sensing and imaging of rare subsets of single brain cancer stem cells", (in preparation)

II. Innovations in Plasmonic Nanoparticle Sensors for Probing Multidrug Resistance in Live Cells

Dr. Xu has pioneered the development and application of photostable, multicolored plasmonic nanoparticles as nanometer-sized sensors to image dynamic biological events, particularly the size-dependent efflux functions of multidrug membrane transporters in single live cells. Her group has demonstrated that the plasmonic optical properties (localized surface plasmon resonance, LSPR spectra) of individual nanoparticles can serve as nanometer-scale probes to monitor real-time conformational and functional changes of membrane transporters in single live cells, using single-nanoparticle dark-field optical microscopy and spectroscopy.

Dr. Xu has employed these highly innovative tools to investigate the molecular mechanisms of multidrug resistance (MDR) and has shown that engineered nanoparticles can act as drug carriers to enhance therapeutic efficacy and exert size-dependent inhibitory effects against highly infectious bacteria.

Key discoveries include the creation of super-bright and photostable (non-bleaching, non-blinking) single plasmonic nanoparticles; the characterization of size-dependent efflux functions of multidrug single membrane transporters of single live cells, the elucidation of dynamic and chemical sensing capabilities of membrane transporters; and the demonstration of how nanoparticle drug carriers can overcome MDR, offering more effective treatment options with reduced side effects.

Selected papers include:

1. **X. Xu***, J. Chen, R. Jeffers, S. Kyriacou, "Direct measurement of sizes and dynamics of single living membrane transporters using nano-optics", *Nano Letters*, **2**, 175-182 (2002). (To our knowledge, this is the first paper ever using single plasmonic nanoparticles to image single membrane transporters of single live cells at nm scale in real-time); https://pubs.acs.org/doi/pdf/10.1021/nl015682i
2. **X. Xu***, W. Brownlow, S. Kyriacou, Q. Wan, J. Viola, "Real-time probing of membrane transport in living microbial cells using single nanoparticle optics and living cell imaging", *Biochemistry* **43**, 10400-10413 (2004); https://pubs.acs.org/doi/pdf/10.1021/bi036231a
3. S. Kyriacou, W. Brownlow, **X. Xu***, "Nanoparticle optics for direct observation of functions of antimicrobial agents in single live bacterial cells", *Biochemistry* **43**, 140-147 (2004); https://pubs.acs.org/doi/pdf/10.1021/bi0351110
4. P. Nallathamby, K. Lee, T. Desai, **X. Xu***, "Study of multidrug membrane transporters of single living *Pseudomonas aeruginosa* cells using size-dependent plasmonic nanoparticle optical probes", *Biochemistry* **49**, 5942-5953 (2010); https://pubs.acs.org/doi/pdf/10.1021/bi100268k
5. F. Ding, K. Lee, A. Vahedi-Faridi, T. Huang, **X. Xu***, "Design and probing of efflux functions of EGFP fused ABC membrane transporters in live cells using fluorescence spectroscopy", *Anal. Bioanal. Chem.* **400**, 223-235 (2011).https://link.springer.com/content/pdf/10.1007%2Fs00216-011-4727-7.pdf
6. F. Ding, K. Lee, A. Vahedi-Faridi, H. Yoneyama, C. Osgood, **X. Xu***, "Design and study of efflux function of EGFP fused MexAB-OprM membrane transporter in *Pseudomonas aeruginosa* using fluorescence spectroscopy" *Analyst* **139**, 3068-3096 (2014). https://pubs.rsc.org/en/content/articlepdf/2014/an/c4an00108g

7. L. Browning, K. Lee, P. Nallathamby, P. Cherukui, T. Huang, S. Warren, **X. Xu***, "Single nanoparticle plasmonic spectroscopy for study of charge-dependent efflux function of multidrug ABC membrane transporters of single live *Bacillus subtilis* cells", *J. Phys. Chem. C.* **120**, 21007-21016 (2016); https://pubs.acs.org/doi/pdf/10.1021/acs.jpcc.6b03313

8. L. Browning, K. Lee, P. Cherukuri, T. Huang, S. Warren, **X. Xu***, "Single gold nanoparticle plasmonic spectroscopy for study of chemical-dependent efflux function of single ABC membrane transporters of single live *Bacillus subtilis* cells", *Analyst* **143**, 1599-1608 (2018); https://pubs.rsc.org/en/content/articlepdf/2018/an/c7an01787a

9. F. Ding, P. Cherukui, P. Songkiatisak, T. Huang, **X. Xu***, "Size-dependent inhibitory effects of antibiotics drug nanocarriers against *Pseudomonas aeruginosa*", *ACS Omega* **3**, 1231-1243 (2018); https://pubs.acs.org/doi/pdf/10.1021/acsomega.7b01956

10. P. Cherukui, P. Songkiatisak, F. Ding, JM Jault, **X. Xu***, "Antibiotic drug nanocarriers for probing of multidrug ABC membrane transporter of *Bacillus subtilis", ACS Omega* **5**, 1625-1633 (2020); https://pubs.acs.org/doi/pdf/10.1021/acsomega.9b03698

11. P. Songkiatisak, F. Ding, P. Cherukui, **X. Xu***, "Study of size-dependent inhibitory effects of antibiotics drug nanocarriers against *E. Coli*", *Nanoscale Advances* **2**, 2135-2145 (2020); https://pubs.rsc.org/no/content/articlehtml/2020/na/c9na00697d

III. Precision Engineering and Real-Time Imaging of Noble Metal Nanoparticles in Living Systems

Dr. Xu has synthesized, purified, and characterized noble metal nanoparticles with precisely controlled sizes, shapes, and surface chemistry. She has developed single nanoparticle optical microscopy and spectroscopy techniques to characterize the size and optical properties of individual nanoparticles using their localized surface plasmon resonance (LSPR) spectra. Additionally, she pioneered the development of single nanoparticle optical spectroscopy rulers to measure the size and shape of plasmonic nanoparticles in solution, in single live cells, and in developing embryos, *in situ* and in real time.

These innovative imaging and spectroscopic tools enable the rational design and application of noble metal nanoparticles for dynamic imaging of single live cells and developing embryos. Her team was the first to image embryonic development and map nano-environments and fluid dynamics *in vivo* with nanometer spatial resolution in real time.

Key discoveries include: (i) Tunable, rainbow-colored plasmonic optical properties of noble metal nanoparticles; (ii) Their size- and shape-dependent biological effects, and unique applications in biological imaging and medical diagnostics. Selected publications include:

Selected papers include:

1. K. Lee, P. Nallathamby, L. Browning, C. Osgood, **X. Xu***, "*In vivo* imaging of transport and biocompatibility of single nanoparticles in the early development of zebrafish embryos", *ACS Nano,* **1**, 133-143 (2007). (To our knowledge, this is the first time ever that zebrafish embryos were used to study toxicity and biocompatibility of nanomaterials, and the plasmonic nanoparticle optical imaging probes were used to study dynamics and transport of the developing embryos in real time at nanometer resolution; https://pubs.acs.org/doi/pdf/10.1021/nn700048y

2. P. Nallathamby, K. Lee, **X. Xu***, "Design of stable and uniform single nanoparticle photonics for *in vivo* dynamics imaging of nano environments of zebrafish embryonic fluids", *ACS Nano*, **2**, 1371-1380 (2008); https://pubs.acs.org/doi/pdf/10.1021/nn800048x

3. L. Browning, K. Lee, T. Huang, P. Nallathamby, J. Lowman, **X. Xu***, "Random walk of single gold nanoparticles in zebrafish embryos leading to stochastic toxic effects on embryonic developments", *Nanoscale* 1, 138-152 (2009); https://pubs.rsc.org/en/content/articlepdf/2009/nr/b9nr00053d

4. T. Huang, **X. Xu***, "Synthesis and characterization of tunable rainbow-colored silver nanoparticle solutions using single-nanoparticle plasmonic microscopy and spectroscopy", *J. Material Chemistry* **20**, 9867-9876 (2010) (Journal back-cover highlight); https://pubs.rsc.org/en/content/articlepdf/2010/jm/c0jm01990a

5. P. Nallathamby, T. Huang, **X. Xu***, "Design and characterization of optical nano rulers of single nanoparticles using optical microscopy and spectroscopy", *Nanoscale* 2, 1715-1722 (2010); https://pubs.rsc.org/en/content/articlepdf/2010/nr/c0nr00303d

IV. Advancing Nanotoxicology and Biocompatibility for Precision Medicine and Nano Manufacturing

Dr. Xu has designed, synthesized, and characterized a mini-library of purified, stable (non-aggregated) silver and gold nanoparticles with precisely controlled sizes and surface functional groups. She has employed these well-defined nanoparticles as a model system to investigate the biological effects of nanomaterials on living organisms.

Pioneering the development of *in vivo* assays using early-developing zebrafish embryos, her team has systematically studied how the biocompatibility and toxicity of nanomaterials are influenced by their physicochemical properties. Her research team rationally designed ultrasensitive *in vivo* assays for nanotoxicity assessment, aiming to develop biocompatible nanomaterials for applications in drug delivery, imaging, and implantable medical devices. Her work also provides critical insights for guiding the manufacturing of nanomaterials and evaluating their environmental impacts.

Dr. Xu published the first research article in this field and has since led a series of systematic studies examining how nanoparticle size, surface charge, and composition affect embryonic development (see Section III-1 above).

Her key discoveries include:

- The unique biological effects of engineered nanomaterials;
- The ability to tune nanomaterial toxicity and biocompatibility through precise control of their physical and chemical properties;
- The potential for rational design of nanomaterials for targeted biomedical applications, including imaging, drug delivery, and medical implants;
- The fundamental framework and experimental methods for establishment of specific guidelines for the safe manufacturing and environmental assessment of nanomaterials.

Selected papers include:

1. K. Lee, L. Browning, P. Nallathamby, T. Desai, P. Cherukuri, **X. Xu***, "*In vivo* quantitative study of size-dependent transport and toxicity of single silver nanoparticles using zebrafish embryos" *Chem. Res. Toxico.* **25**, 1029-1046 (2012); https://pubs.acs.org/doi/pdf/10.1021/tx300021u

2. K. Lee, P. Nallathamby, D. Tanvi, L. Browning, P. Cherukuri, **X. Xu***, "Single nanoparticle spectroscopy for real-time *in vivo* quantitative analysis of transport and toxicity of single nanoparticles in single embryos" *Analyst* **137**, 2973-2986 (2012); https://pubs.rsc.org/en/content/articlepdf/2012/an/c2an35293a

3. L. Browning, T. Huang, X. Xu*, "Real-Time *in vivo* imaging of size-dependent transport and toxicity of gold nanoparticles in zebrafish embryos using single nanoparticle plasmonic spectroscopy", *Interface Focus* 3, 20120098 (2013); http://rsfs.royalsocietypublishing.org/content/royfocus/3/3/20120098.full.pdf
4. K. Lee, L. Browning, P. Nallathamby, C. Osgood, **X. Xu***, "Silver nanoparticles induce developmental stage-specific embryonic phenotypes in zebrafish" *Nanoscale* **5**, 11625-11636 (2013). (Journal Front-cover highlight); https://pubs.rsc.org/en/content/articlepdf/2013/nr/c3nr03210h
5. L. Browning, K. Lee, P. Nallathamby, **X. Xu***, "Silver nanoparticles incite size and dose-dependent developmental phenotypes and nanotoxicity in zebrafish embryos" *Chem. Res. Toxico.* **26**, 1503-1513 (2013); https://pubs.acs.org/doi/pdf/10.1021/tx400228p
6. K. Lee, L. Browning, P. Nallathamby, **X. Xu***, "Study of charge-dependent transport and toxicity of peptide-functionalized silver nanoparticles using zebrafish embryos and single nanoparticle plasmonic spectroscopy" *Chem. Res. Toxico.* **26**, 904-917 (2013); https://pubs.acs.org/doi/pdf/10.1021/tx400087d
7. M. Johnson, P. Songkiatisak, P. Cherukui, **X. Xu***, "Toxic effects of silver ions on early-developing zebrafish embryos distinguish from silver nanoparticles", *ACS Omega* 7, 4046-4055 (2022); https://pubs.acs.org/doi/full/10.1021/acsomega.2c05504

V. High-Throughput Characterization of Individual Nanoparticles on Nanoparticle Arrays:

Dr. Xu has developed and applied high-throughput single-nanoparticle dark-field optical microscopy and spectroscopy (DFOMS) platforms to characterize the physicochemical property–dependent optical behaviors of single-nanoparticle (NP) arrays fabricated via electron-beam (E-beam) lithography, *in situ* and in real time.

Her work demonstrates the powerful high-throughput capabilities of DFOMS for single-nanoparticle analysis, including:

- Simultaneous *in situ*, real-time characterization of localized surface plasmon resonance (LSPR) spectra from individual nanoparticles across an entire array, enabling the study of interparticle interactions for diverse applications.
- Real-time monitoring of how LSPR properties of individual nanoparticles depend on their size, shape, and surface chemistry.
- Time-resolved tracking of physicochemical changes in single nanoparticles through their evolving LSPR spectra, allowing precise *in situ* monitoring of dynamics and kinetics of chemical reactions at the nanoscale.

Selected papers include:

1. T. Huang, W. Cao, H. Elsayled-Ali, **X. Xu***, "High-throughput ultrasensitive characterization of chemical, structural and plasmonic properties of EBL-fabricated single silver nanoparticles" *Nanoscale* 4, 380-385 (2012); (Journal Cover); https://pubs.rsc.org/en/content/articlepdf/2012/nr/c1nr11368b
2. Y. Song, P. Nallathamby, T. Huang, H. Elsayled-Ali, **X. Xu***, "Correlation and characterization of three-dimensional morphologically dependent localized surface plasmon resonance spectra of single silver nanoparticles using dark-field optical microscopy and spectroscopy and atomic force microscopy", *J. Phys. Chem. C.* 114, 74-81 (2010); https://pubs.acs.org/doi/pdf/10.1021/jp9083019
3. W. Cao, T. Huang, **X. Xu**, H. Elsayled-Ali, "Localized surface plasmon resonance of single silver nanoparticles studied by dark-field optical microscopy and Spectroscopy", *J. App. Phys.* **109**, 034310 (2011). https://aip.scitation.org/doi/pdf/10.1063/1.3544349?class=pdf

VI. Pioneering Bioelectric Methods for Stem Cell Research and Single-Cell Manipulation

Dr. Xu has pioneered the development of bioelectric methods using ultrashort (10-nanosecond) electric pulses to prepare feeder cells and to culture, study, and direct the differentiation of embryonic stem cells. She has designed and engineered single-cell micro-electric devices integrated with advanced single-cell imaging platforms, enabling real-time visualization of the effects of ultrashort electric pulses on live single cells.

For the first time, her work has made it possible to directly observe how ultrashort electric fields influence intracellular structures and functions in single live cells over time with high spatial and temporal resolution.

Her key discoveries and inventions include:

- Novel bioelectric approaches for preparing and culturing embryonic stem cells;
- Real-time, direct observation of the cellular and intracellular effects of ultrashort electric pulses;
- Precise manipulation of intracellular functions by tuning electric field parameters at the single-cell level.

Selected Publications:

1. L. Browning, T. Huang, **X. Xu***, "Electric pulses to prepare feeder cells for sustaining and culturing of undifferentiated embryonic stem cells", *Biotechnol. J.* **5**, 588-592 (2010); https://onlinelibrary.wiley.com/doi/epdf/10.1002/biot.201000040

2. H. Xu, P. D. Nallathamby, **X. Xu***, "Real-time imaging and tuning subcellular structures and membrane transport kinetics of single live cells at nanosecond regime", *J. Phys. Chem. B.* **113**, 14393-14404 (2009). https://pubs.acs.org/doi/pdf/10.1021/jp9021739

3. X. Xu*, L. Browning, "New Green Methods for Culture of Embryonic Stem Cells". Provision US Patent App. 61/293,526.

4. L. Browning, E. Perez V, F. Ding, T. Huang, **X. Xu***, "Pulsed electric fields for study of undifferentiated and differentiated embryonic stem cells into functional cardiomyocytes", (in preparation).

VII: Pioneering Contributions to Single-Molecule Detection Technologies

Dr. Xu has played a transformative role in advancing and popularizing single-molecule detection technologies in biology and medicine. She is among the early pioneers in the design and development of total internal reflection fluorescence microscopy (TIRFM) for single-molecule detection—a breakthrough that fundamentally reshaped the field of molecular analysis.

She was the first to demonstrate real-time, continuous imaging of single molecule photodecomposition reaction in free solution, successfully quantifying the photobleaching lifetimes and diffusion behaviors of individual fluorophores in water. She also discovered the long-range electrostatic trapping of single protein molecules at liquid–solid interfaces. These groundbreaking findings were published in two landmark *Science* papers.

Building on this foundational work, Dr. Xu was also among the first to extend single-molecule spectroscopy to living systems. She pioneered the use of TIRFM to probe the efflux rates of single membrane transporters in individual live cells—a landmark achievement that laid the groundwork for real-time functional studies of biomolecular machinery in complex biological environments.

Dr. Xu has continued to lead the field by developing photostable optical nanoparticle probes, single-molecule nanosensors, and advanced imaging platforms for studying single live cells and embryos at single-molecule resolution (see Sections I–V).

Before the invention and commercialization of TIRFM, single-molecule detection was confined to a handful of elite laboratories with highly specialized, custom-built instrumentation. The field was hampered by technical complexity, high-cost, and limited reproducibility. Dr. Xu's innovations helped dismantle these barriers, making the technology accessible, practical, and scalable.

Following its commercialization, TIRFM became widely available and user-friendly, offering a robust, affordable platform for single-molecule imaging. It transformed single-molecule detection from a niche technique into a routine analytical tool now used across a broad range of disciplines, including biology, medicine, nanoscience. It is now indispensable for probing biomolecular interactions, intracellular dynamics, cellular heterogeneity, and single-cell processes with molecular precision.

In addition to her scientific innovations, Dr. Xu has served as a leader and advocate in the research community. She has organized high-impact symposia at national and international conferences, shaped the direction of the field, and championed increased federal investment (NIH, NSF) to support the continued development and adoption of single-molecule technologies in biology and medicine.

Through her pioneering discoveries, sustained innovation, and visionary leadership, Dr. Xu has helped transform single-molecule detection from an elite experimental challenge into a widely adopted and powerful methodology—one that continues to revolutionize biology, medicine, and nanotechnology.

Selected Publications:

1. **X. Xu**, E. S. Yeung, "Long-range electrostatic trapping of single protein molecules at a liquid/solid interface", *Science*, **281**, 1650-1653 (1998); http://science.sciencemag.org/content/sci/281/5383/1650.full.pdf

2. **X. Xu**, E. S. Yeung, "Direct measurement of single-molecule diffusion and photodecomposition in free solution", *Science*, **275**, 1106-1109 (1997); http://science.sciencemag.org/content/sci/275/5303/1106.full.pdf

3. **X. Xu***, W. Brownlow, S. Huang, J. Chen, "Single-molecule detection of efflux pump machinery in *Pseudomonas aeruginosa*", *Biochem. Biophys. Res. Commun.*, **305**, 79-86 (2003). https://www.sciencedirect.com/science/article/pii/S0006291X03006922

VIII. Innovations in Ultrasensitive Bioanalysis and Electrochemiluminescence (ECL)

Dr. Xu has also made significant contributions to the field of ultrasensitive bioanalysis, particularly through her pioneering work in electrochemiluminescence (ECL). ECL assays have become the clinical gold standard for biomarker detection in diagnostics worldwide. [1]

She was the first to develop ECL-based DNA biosensors and holds a worldwide patent for her innovative platform. Her approach—developed before the advent of DNA microarrays—used surface chemistry and thin film techniques to immobilize single DNA strands, enabling detection of single gene mutations with high sensitivity and specificity and demonstrating the potential for disease diagnosis.

In addition, Dr. Xu designed and developed solution-phase ultrasensitive ECL protein assays to quantitatively detect cancer biomarkers and HIV neutralized antibodies and analyze protein–protein interactions and binding affinities. These tools have been instrumental in identifying and characterizing disease biomarkers and neutralizing antibodies , aiding the development of effective diagnostic and therapeutic strategies.

Selected Publications:

[1] https://www.mesoscale.com/en/technical_resources/our_technology/ecl

1. A. J. Bard and **X. Xu**, "Biosensor for and Method of Electrogenerated Chemiluminescent Detection of Nucleic Acid Adsorbed to a Solid Surface", Worldwide Patent. World Intellectual Property Organization No. WO9606946A1 (issued 03/07/1996); Australian Patent No. 703344 (sealed 08/07/1999).

2. **X. Xu**, A. J. Bard, "Immobilization and hybridization of ss-DNA on an aluminum (III) alkanebisphosphonate thin film with electrogenerated chemiluminescent detection", *J. Am. Chem. Soc.*, **117**, 2627-2631 (1995); https://pubs.acs.org/doi/pdf/10.1021/ja00114a027

3. **X. Xu**, H. Yang, T. Mallouk, A. J. Bard, "Immobilization of DNA on an aluminum (III) alkanebisphosphonate thin film with electrogenerated chemiluminescent detection", *J. Am. Chem. Soc.*, **116**, 8386-8387 (1994); https://pubs.acs.org/doi/pdf/10.1021/ja00097a064

4. **X. Xu***, J. Gao, R. Jeffers, B. Logan, Z. Wen, "Molecular analysis of biomarkers for the earlier cancer detection", in *Scanning and Force Microscopies for Biomedical Applications II*, S. Nie, E. Tamiya and E. S. Yeung, Eds., *Proceedings of the SPIE*, **3922**, 15 (2000); [Link]

5. **X. Xu***, R. Jeffers, J. Gao, "Novel solution-phase immunoassays for molecular analysis of tumor markers", *The Analyst*, **126**, 1285-1292 (2001) https://pubs.rsc.org/en/content/articlepdf/2001/an/b104180k

6. **X. Xu***, Z. Wen, W. Brownlow, "Ultrasensitive analysis of binding affinity of HIV receptor and neutralizing antibody using solution-phase electrochemiluminescence assay" *J. Electroanal. Chem.* **688**, 53-60 (2013); [Link]

IX. Advancing Electrochemistry and Metal Deposition in Ionic Liquids

Dr. Xu has made significant contributions to the field of electrochemistry through her groundbreaking work on metal deposition in room-temperature chloroaluminate molten salts (ionic liquids). She developed and applied novel electrochemical methods to study metal nucleation and growth processes in these chemically unique and industrially relevant systems.

Dr. Xu was the first to elucidate the nucleation mechanism of metal deposition in room-temperature chloroaluminate melts. Her work led to the first successful electrodeposition of two metals from both acidic and basic chloroaluminate ionic liquids—an achievement that provided critical insights into metal nucleation behavior under varying ionic and electrochemical conditions.

These discoveries laid a fundamental foundation for understanding electrochemical processes in ionic liquids and opened new avenues for controlled metal deposition. Her findings have far-reaching implications for a variety of applications, including advanced materials synthesis, nanofabrication, and electrochemical energy storage technologies.

Selected publications include:

1. **X. Xu**, C. L. Hussey, "The electrochemistry of tin from aluminum chloride-1-methyl-3-ethylimidazolium chloride molten salt", *J. Electrochem. Soc.*, **140**, 618-626 (1993). (ECS Journal: IF = 3.662; Citation = 98); http://jes.ecsdl.org/content/140/3/618.full.pdf+html

2. **X. Xu**, C. L. Hussey, "The electrochemistry of mercury at glassy carbon and tungsten electrodes in the aluminum chloride-1-methyl-3-ethylimidazolium chloride molten salt", *J. Electrochem. Soc.*, **140**, 1226-1233 (1993). (ECS Journal: IF = 3.662; Citation = 45); http://jes.ecsdl.org/content/140/5/1226.full.pdf+html

3. **X. Xu**, C. L. Hussey, "Electrodeposition of silver on metallic and nonmetallic electrodes from the acidic aluminum chloride-1-methyl-3-ethylimidazolium chloride molten salt", *J. Electrochem. Soc.* **139**, 1295-1300 (1992). (ECS Journal: IF = 3.662; Citation = 94);

http://jes.ecsdl.org/content/139/5/1295.full.pdf+html

4. **X. Xu**, C. L. Hussey, "The electrochemistry of gold at glassy carbon in the basic aluminum chloride-1-methyl-3-ethylimidazolium chloride molten salt", *J. Electrochem. Soc.*, **139**, 3103 (1992). (ECS Journal: IF = 3.662; Citation = 65); http://jes.ecsdl.org/content/139/11/3103.full.pdf+html

5. **X. Xu**, C. L. Hussey, "Electrodeposition of metals from room-temperature chloroaluminate molten salts", *Proc. of Electrochem. Soc.*, **16**, 445 (1992). (IF = 3.662; Citation = 11); http://ecst.ecsdl.org/content/ecstpv/1992-16/445.full.pdf+html

6. C. L. Hussey, **X. Xu**, "Electrodissolution and electrodeposition of lead in an acidic room temperature chloroaluminate molten salt", *J. Electrochem. Soc*., **138**, 1886-1890 (1991). (ECS Journal: IF = 3.662; Citation = 68); http://jes.ecsdl.org/content/138/7/1886.full.pdf+html

Selected Peer-Reviewed Publications:

(Original Research peer-reviewed publications: Total citations = 5993; h-index = 37; i10-index = 57; citation number on 8/2024 is listed below; See http://scholar.google.com/citations?user=4a4OTm0AAAAJ for updated citations; Top 5-6% citations in Nano & Anal. Chem. Fields; Top Scholar-Lifetime 0.5% in silver nanoparticle)

71. P. Songkiatisak, P. Cherukui, **X. Xu***, "PHOTON for sensing and imaging of rare subsets of single brain cancer stem cells", (in preparation)

70. T. Huang, **X. Xu***, "Design and characterization of photostable single CD133 molecule nanoparticle optical biosensors for imaging single live cancer stem cells" *J. Am. Chem. Soc.* (ACS Journal: IF = 16.383; to be submitted)

69. P. Songkiatisak, Cherukui, **X. Xu***, "Multicolored single plasmonics nanoparticles for real-time imaging efflux kinetics of single ABC multidrug membrane transporter in single live cells" *Anal. Bioanal. Chem.* (Springer Nature journal: IF = 4.478) (to be submitted)

68. L. Browning, E. Perez V, F. Ding, T. Huang, **X. Xu***, "New methods for study of differentiated embryonic stem cells into functional cardiomyocytes", (to be submitted).

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Selected Presentations

201. **X. Xu***, "Innovative nanobiotechnology for probing multidrug membrane transporters in single live cells", ACS National Meeting Fall 2025, Washington DC (**invited**).

200. **X. Xu***, "Innovative Nanobiotechnology for Biomedical Breakthrough", Global Conference on Biomedical Engineering 2025, (**Invited Plenary**)

199. **X. Xu***, "Innovative Nanobiotechnology for Biomarker Discovery", Pittcon 2025, Boston, MA. (**Invited**)

198. **X. Xu***, "Single Plasmonic Nanoparticles for Probing Multidrug Membrane Transporters in Single Live Cells", NanoBioTech, Norfolk, VA. (**Invited**)

197. **X. Xu***, "New nanobiotechnology for biomedical innovation", Nanotechnology 2024, Edinburgh, Scotland, Aug. 29-31, 2024 (**Invited Plenary Lecture**)

196. **X. Xu***, M. Johnson, P. Songkiatisak P. Cherukuri, "Real-time spectroscopic probing of surface-dependent biocompatibility and toxicity of nanoparticles", ACS National Meeting Fall 2024, Dever, CO (**invited**).

195. **X. Xu***, "Real-time probing of effects of single nanoparticles on single tumor cells", Unite Scientific Chemistry Conference, Munich, Germany, July 18-19, 2024 (**Invited Keynote**).

194. **X. Xu***, "Single nanoparticle molecular sensors for imaging of single live cells", Future of Biosensors and Bioelectronics, June 21, 2024 (**Invited Keynote**)

193. **X. Xu***, "Innovative NanoBiotechnology for Biomedical Breakthroughs", NanoBioTech, VA Beach, Virginia, April 25-26, 2024 (**Invited Plenary Lecture**)

192. **X. Xu***, "Single nanoparticle optics for real-time single molecule sensing and imaging of single live cells", 2023 International Conference on Nano Research and Development, Singapore (**Invited Plenary Lecture**)

191. **X. Xu***, "New nanobiotechnology for real-time imaging of single live cells", 2023 World Nanotechnology Conference, Orlando, FL (**Invited Keynote**)

190. **X. Xu***, P. Songkiatisak, P. K. Cherukui, M. Johnson, "Design of biocompatible nanoparticles for probing living cellular functions", 2022 NSF Nanoscale Science and Engineering Grantees, NSF, Washington, DC.

189. **X. Xu***, M. Johnson, P. Songkiatisak, "New sensing and imaging tools for dynamic probing of brain development *in vivo*", 8th Annual BRAIN Initiative Meeting 2022, NIH, Washington, DC.

188. **X. Xu***, P. Songkiatisak, P. Cherukuri, "Photostable nano probes for single molecule sensing and imaging of single live cells", 260th ACS National Meeting 2020, San Francisco, CA (**invited**).

187. **X. Xu***, "Spectroscopic tracking of single plasmonic nanoparticles for probing nano-environments of developing embryos", 260th ACS National Meeting 2020, San Francisco, CA (**invited**).

186. **X. Xu***, P. Songkiatisak, P. Cherukuri, K. Raut, R. Richardson, "Single nanoparticle plasmonic spectroscopy for biomedical applications: from diagnosis to therapy", 258th ACS National Meeting 2019, San Diego, CA (**invited**).

185. **X. Xu**[*], "New nano tools for real-time single molecule imaging of single live cells: from fundamental discoveries to biomedical applications", 258th ACS National Meeting 2019, San Diego, CA (**invited Award Address**).

184. R. Richardson, K. Raut, T. Zvonareva, P. Songkiatisak, P. Cherukuri, **X. Xu**[*], "Study of cytotoxic and therapeutic effects of silver nanoparticles against colon tumor cells", 258th ACS National Meeting 2019, San Diego, CA. (My student, RR, presented this paper)

183. **X. Xu**[*], R. Richardson, K. Raut, P. Songkiatisak, P. Cherukuri, "Real-time probing of cytotoxic and therapeutic effects of single nanoparticles on single tumor cells", 257th ACS National Meeting 2019, Orlando, FL (**invited**).

182. **X. Xu**[*], P. Songkiatisak, P. Cherukuri, F. Ding, "Single nanoparticle spectroscopic imaging for probing of multidrug membrane transporters of single live cells", Pittcon 2019, Philadelphia, PA.

181. **X. Xu**[*], P. Songkiatisak, P. Cherukuri, K. Raut, "Single nanoparticle optical biosensors for real-time, single-molecule and super-resolution imaging of single live cells", Pittcon 2019, Philadelphia, PA.

180. **X. Xu**[*], P. Songkiatisak, P. Cherukuri, "Photostable optical nanoscopy (PHOTON) for cancer research", 256th ACS National Meeting 2018, Boston, MA (**invited**).

179. **X. Xu**[*], P. Songkiatisak, P. Cherukuri, F. Ding, T. Huang, "Multifunctional size-dependent drug nanocarriers for probing multidrug membrane transporters of single live cells", 256th ACS National Meeting 2018, Boston, MA (**invited**).

178. **X. Xu***, M Johnson, P. Cherukuri, P. Songkiatisak, K. Raut, "BRAIN-EAGER: New tools for real-time *in vivo* imaging of single neuron-neuron communication during embryonic development", 4th BRAIN Initiative Investigators Meeting 2018, Baltimore, MD (**invited**).

177. **X. Xu***, M. Johnson, P. Cherukuri, P. Songkiatisak, "Photostable nanosensors for real-time and single molecular imaging and tracking of neurotransmitters *in situ*", Neuroscience 2017, Washington DC.

176. **X. Xu***, "New nano tools for real-time single-molecular sensing and imaging of single live cells", 3rd Annual Next Generation Sequencing & Clinical Diagnostics Congress & Single Cell Analysis USA Congress, 2017, Boston (**invited**).

175. **X. Xu***, P. Songkiatisak, P. Cherukuri, "Photostable optical nanoscopy (PHOTON) for following single live cells: From fundamental discoveries to biomedical applications", 254th ACS National Meeting 2017, Washington DC (**invited**).

174. P. Songkiatisak, P. Cherukuri, S. Phan, **X. Xu***, "Probing of effects of silver nanoparticles on single liver tumor cells", 254th ACS National Meeting 2017, Washington DC.

173. P. Songkiatisak, P. Cherukuri, **X. Xu***, "Real-time imaging and sensing of single cancer stem cells", 254th ACS National Meeting 2017, Washington DC.

172. M. Johnson, **X. Xu***, "Real-time *in vivo* monitoring of single neuron-neuron communication", 254th ACS National Meeting 2017, Washington DC (**invited**).

171. **X. Xu***, "Photostable multiplexing nanoassays for real-time molecular imaging of single live cells", 4th Annual Single Cell Analysis Investigator Meeting, NIH Campus, Bethesda, MD, 2017 (**invited**).

170. **X. Xu***, P. Cherukuri, P. Songkiatisak, S. Phan, "New nano tools for real-time imaging of single cancer stem cells", Pittcon'2017, Chicago, IL (**invited**).

169. **X. Xu***, "BRAIN EAGER: New tools for real-time imaging of synapses", 3rd BRAIN Initiative Investigators Meeting, Baltimore, MD (2016) (**invited**).

168. **X. Xu***, K. Lee, T. Huang, F. Ding, P. Cherukuri, "Single nanoparticle plasmonic spectroscopy for single-molecule sensing and super-resolution imaging of single live cells", FACSS & SCIX 2016, Minneapolis, MN (**invited**).

167. **X. Xu***, P. Cherukuri, P. Songkiatisak, T. Huang "Photostable optical nanoscopy (PHOTON) for dynamic and single molecule imaging of single live cells: from diagnosis to therapy", 252nd ACS National Meeting 2016, Philadelphia, PA (**invited**).

166. **X. Xu***, Cherukuri, P. Songkiatisak, T. Huang, "New photostable nano tools for following that single live cells", 4th Annual Single Cell Analysis Investigator Meeting, NIH Campus, Bethesda, MD, 2016 (**invited**).

165. **X. Xu***, P. Cherukuri, P. Songkiatisak, "New nano tools for molecular sensing and imaging of single neuron-neuron communication", Pittcon'2016, Atlanta, GA (**invited**).

164. **X. Xu***, K. Lee, T. Huang, P. Songkiatisak, F. Ding, "Single nanoparticle plasmonic spectroscopy and biosensors for imaging of efflux functions of single live cells", Pittcon'2016, Atlanta, GA.

163. **X. Xu***, "BRAIN EAGER: New tools for real-time and molecular imaging of synapses", Joint NSF/NIH BRAIN Initiative Investigators Meeting, Baltimore, MD (2015) (**invited**).

162. **X. Xu***, "New nano tools for real-time and single molecular imaging of single live cells", NSF Nanoscale Science and Engineering Grantees Conference: Progress in Nanotechnology, Arlington, VA (2015) (**invited**).

161. **X. Xu***, T. Huang, P. Cherukuri, P. Songkiatisak, "New nano tools for "follow-that-molecule" in single live cells", Eastern Analytical Symposium, NJ (2015) (**invited**).

160. **X. Xu***, "New tools for real-time imaging of single live cells", Mayo Brain Initiative Symposium (2015) (**invited**). (The presentation webcasts throughout all Mayo clinic locations.)

159. **X. Xu***, "Photostable multiplexing nanoassays for real-time molecular imaging of single live cells", 3rd Annual Single Cell Analysis Investigator Meeting, NIH Campus, Bethesda, MD, 2015 (**invited**).

158. **X. Xu***, T. Huang, K. Lee, P. Nallathamby, "Super-resolution optical imaging of real-time membrane transport of single live cells", Pittcon'2015, New Orleans (**invited**).

157. **X. Xu***, P. Cherukuri, P. Songkiatisak, S. Warren, T. Huang, "PHOTON for real-time sensing and imaging of rare-subsets of single cancer stem cells in heterogeneous tumor cells", 250th ACS Meeting 2015, Boston.

156. **X. Xu***, F. Ding, P. Songkiatisak, P. Cherukuri, T. Huang, "Study of size and dose dependent therapeutic effects of nano drug carriers", Pittcon'2015, New Orleans, LA.

155. P. Songkiatisak, M. Johnson, L. Browning, P. Cherukuri, S. Warren, N. Gonda, **X. Xu***, "Acute nano toxicity study of effect of nanoparticles on embryonic development", Pittcon'2015, New Orleans, LA.

154. M. Johnson, P. Songkiatisak, P. Cherukuri, S. Warren, N. Gonda, L. Browning, **X. Xu***, "*In vivo* study of nanoparticles on embryonic neurological development", Pittcon'2015, New Orleans, LA.

153. **X. Xu***, "BRAIN EAGER: New tools for real-time imaging of molecular-resolution connectomics of synapses", Joint NSF/NIH BRAIN Initiative Investigators Kick-Off Meeting (2014) (**invited**).

152. T. Huang, P. Nallathamby, L. Browning, K. Lee, **X. Xu***, "New nanophotonics tools for real-time and single molecule imaging of single live cells", NeuroConnections 2014, ODU, Norfolk, VA

151. **X. Xu***, K. Lee, L. Browning, P. Nallathamby, "Making silver nanoparticles biocompatible", Pittcon'2014, Chicago.

150. L. Browning, K. Lee, P. Nallathamby, P. Cherukuri, E. Perez, **X. Xu***, "Study of charge-dependent efflux function of multidrug membrane transporters in single live cells", Pittcon'2014, Chicago.

149. **X. Xu***, K. Lee, T. Huang, F. Ding, and P. Nallathamby, "PHOTON for super-resolution imaging of efflux functions of single membrane transporters in single live cells", Pittcon'2014, Chicago.

148. **X. Xu***, L. Browning, K. Lee, P. Nallathamby, "Ultrasensitive assays for study of nanotoxicity and nanomedicine", Pittcon'2014, Chicago.

147. L. Browning, F. Ding, T. Huang, **X. Xu***, "Design of new methods for study of embryonic stem cells", Pittcon'2014, Chicago.

146. M. Johnson, P. Songkiatisak, L. Browning, **X. Xu***, "*In vivo* toxicology study of ions on embryonic development", Pittcon'2014, Chicago.

145. P. Songkiatisak, M. Johnson, L. Browning, **X. Xu*** "Design of *in vivo* assays for the study of toxicity of silver cations", Pittcon'2014, Chicago.

144. **X. Xu***, K. Lee, L. Browning, P. Nallathamby, "Single nanoparticle spectroscopy and ultrasensitive *in-vivo* assays for real-time study of nanotoxicity", The 15th Beijing Conference and Exhibition on Instrumental Analysis (BCEIA) (Beijing, China, 2013) (**Invited keynote**).

143. **X. Xu***, "Single plasmonic nanoparticle biosensors for single-molecule and super-resolution imaging of single live cells", Biosensing and Nanomedicine-III (2013 Optics + Photonics, SPIE, San Diego, 08/2013) (**invited**).

142. **X. Xu***, "Single nanoparticle optical biosensors", Symposium on Frontiers of Nano & Bioanalytical Chemistry (St. John's University, NYC, 03/2013) (**invited keynote**).

141. **X. Xu***, "Nanoparticle biosensors for mapping single-molecule functions in single live cells", American Association for the Advancement of Science (AAAS) Annual Meeting (Boston, 02/2013) (**invited**).

140. **X. Xu***, T. Huang and L. Browning. "Far-field photostable optical nanoscopy (PHOTON) for super-resolution imaging of single protein-ligand binding complexes", Far-field Super Resolution Microscopy I (2013 Optics + Photonics, SPIE, San Diego, 08/2013).

139. **X. Xu***, T. Huang, L. M. Browning, **"**Far-field photostable optical nanoscopy (PHOTON) for super-resolution and single-molecule imaging of single live cells", Pittcon'2013, Philadelphia, PA.

138. **X. Xu***, K. Lee, L. Browning, P. Nallathamby, P. Cherukuri, **"**Single nanoparticle spectroscopy for quantitative analysis of nanotoxicity", Pittcon'2013, Philadelphia, PA.

137. **X. Xu***, T. Huang, L. Browning, **"**Multiplexing analysis of single protein molecules using single-molecule nanoparticle optical biosensors (SMNOBS)", Pittcon'2013, Philadelphia, PA.

136. **X. Xu***, Z. Wen, W. Brownlow, **"**Electrochemiluminescence assay for ultrasensitive analysis of HIV receptor and neutralizing antibody", Pittcon'2013, Philadelphia, PA.

135. **X. Xu***, "Single molecule nanoparticle optical biosensors (SMNOBS) for super-resolution imaging of single live cells", Gordon Research Conference on Analytical Biosensors (Newport, RI, 06/2012) (**invited**).

134. T. Huang, L. Browning, **X. Xu***, **"**Design of far-field photostable optical nanoscopy for real-time super-resolution single-molecule imaging of single live cells", Pittcon'2012, Orlando, FL.

133. T. Huang, L. Browning, **X. Xu***, **"**Single-molecule nanoparticle optical biosensors for super-resolution imaging of single protein-ligand binding complexes", Pittcon'2012, Orlando, FL.

132. **X. Xu***, T. Huang, L. Browning, P. Nallathamby, "Plasmonic nanoparticle probes for study of single ABC multidrug membrane transporters of single live cells", 242nd ACS National Meeting 2011, Denver (**invited**).

131. **X. Xu***, T. Huang, L. Browning, P. Nallathamby, "Photostable single molecule nanoparticle biosensors for real-time imaging of single living cells", 242nd ACS National Meeting 2011, Denver, CO (**invited**).

130. **X. Xu***, "Nanoassay for real-time molecular probing of multidrug membrane transporters", Gordon Research Conference on Multidrug Efflux Systems 2011 (*Les Diablerets*, Switzerland, June 2011) (**invited**).

129. **X. Xu***, "Photostable plasmonic nano rulers and single-molecule biosensors: from single cells to single embryos", 2011 International Workshop in Chemical Biology, Xiamen, 2011 (**invited**).

128. **X. Xu***, T. Huang, "Super-resolution and single molecule imaging of SERS hot spots", The 242nd ACS National Meeting 2011, Denver, CO.

127. **X. Xu***, K. Lee, L. Browning, P. Nallathamby, "Design of *in vivo* assays for probing of physicochemical dependent biocompatibility and toxicity of nanomaterials", The 242nd ACS National Meeting 2011, Denver, CO.

126. **X. Xu***, P. Nallathamby, T. Huang, **"**Design of optical nano rulers for sizing of single nanoparticles using optical microscopy and spectroscopy", Pittcon/ACS 2011, Atlanta, GA.

125. **X. Xu***, P. Nallathamby, **"**Cytotoxic and therapeutic effects of stable and purified silver nanoparticles on tumor cells", Pittcon'2011, Atlanta, GA.

124. **X. Xu***, K. Lee, P. Nallathamby, **"**Design of size-dependent plasmonic nanoparticles for probing of multidrug membrane transporter of single live cells in real time", Pittcon/ACS 2011, Atlanta, GA.

123. K. Lee, P. Nallathamby, L. Browning, **X. Xu***, **"***In-vivo* study of size-dependent transport and biocompatibility of single silver nanoparticles", Pittcon'2011, Atlanta, GA.

122. K. Lee, L. Browning, T. Huang, P. Nallathamby, **X. Xu***, **"**Design of single plasmonic nanoparticle optical probes for study of multidrug ABC membrane transporter in single living cells", Pittcon'2011, Atlanta, GA.

121. **X. Xu***, P. Nallathamby, T. Huang, K. Lee, L. Browning, "Design of multifunctional nanoparticle probes for molecular imaging and sensing in single living organisms", The Federation of Analytical Chemistry and Spectroscopy Societies (FACSS) 2010 (Raleigh, NC, Oct. 2010) (**invited**).

120. **X. Xu***, T. Huang, M. Browning, P. Nallathamby, "Design of photostable single molecule nanoparticle biosensors for real time probing of single live cells", 204th ACS National Meeting (Boston, 08/2010) (**invited**).

119. **X. Xu***, T. Huang, P. Nallathamby, "Photostable single molecule nanoparticle optical biosensors for sensing and imaging of single protein molecules and their binding kinetics", The 204th ACS National Meeting 2010 (Boston).

118. L. Browning, K. Lee, T. Huang, P. Nallathamby, J. Lowman, **X. Xu***, "Real-time imaging of transport and diffusion of single gold nanoparticles *in vivo*", Pittcon'2010, Orlando, FL.

117. L. Browning, K. Lee, T. Huang, P. Nallathamby, J. Lowman, **X. Xu***, "Developing *in vivo* assays for probing biocompatibility of single gold nanoparticles", Pittcon'2010, Orlando, FL.

116. K. Lee, L. Browning, T. Huang, P. Nallathamby, **X. Xu***, **"**Real-time probing of efflux mechanisms of single living cells using photostable single nanoparticle optics", Pittcon'2010, Orlando, FL.

115. K. Lee, T. Desai, P. Nallathamby, L. Browning, **X. Xu*, "***In vivo* study of size dependent transport and biocompatibility of single silver nanoparticles in zebrafish embryos in real-time", Pittcon'2010, Orlando, FL.

114. T. Huang, P. Nallathamby, **X. Xu***, "Single molecule detection and sensing of individual receptor molecules on single living cells using single nanoparticle plasmonic optical biosensors", Pittcon'2010, Orlando, FL.

113. T. Huang, P. Nallathamby, **X. Xu***, "Real-time sensing and detection of single cytokine molecules using photostable single-molecule nanoparticle optical biosensors", Pittcon'2010, Orlando, FL

112. **X. Xu***, P. Nallathamby, T. Huang, K. Lee, L. Browning, "Photostable nanophotonics probes for real-time molecular imaging: from single living cells to single embryos", FACSS 2009 (Louisville, KY, 10/2009) (**invited**).

111. **X. Xu***, T. Huang, P. Nallathamby, "Photostable single molecule nanoparticle optical biosensors for real-time sensing and imaging of single protein molecules and their binding kinetics", 237th ACS National Meeting (Salt Lake City, 03/2009) (**invited**).

110. P. Nallathamby, T. Huang, K. Lee, L. Browning, **X. Xu***, "Photostable nanophotonic probes and biosensors for molecular imaging and diagnosis", NIH-Workshop-SPIE'2009, Bethesda, MD (Oct. 1-2, 2009)

109. P. Nallathamby, K. Lee, **X. Xu***, "Using single nanoparticle optics for real-time imaging of *in vivo* transport kinetics", Pittcon'2009, Chicago.

108. P. Nallathamby, T. Huang, **X. Xu***, "Development of single nanoparticle biosensors for imaging of single protein molecules on single living cells", Pittcon'2009, Chicago.

107. P. Nallathamby, K. Lee, **X. Xu***, "Design of stable single nanoparticle photonics for *in vivo* imaging", Pittcon'2009, Chicago.

106. **X. Xu*, "**Photostable single nanoparticle biosensors for molecular imaging of single living cells**"**, National Nano Engineering Conference (Boston, Nov. 12-13, 2008) **(invited).**

105. K. Lee, P. Nallathamby, L. Browning, **X. Xu***, "Developing single nanoparticle optics and *in vivo* assays for real-time characterization of transport and biocompatibility of nanomaterials", The 236th ACS National Meeting, Philadelphia, 2008.

104. L. Browning, K. Lee, T. Huang, P. Nallathamby, J. Lowman, **X. Xu***, "Developing photostable and biocompatible single nanoparticle probes for *in vivo* imaging of early development of zebrafish embryos", The 236th ACS National Meeting, Philadelphia, 2008.

103. **X. Xu***, "Design of biocompatible single nanoparticle optics for biomedical imaging", National Nano Engineering Conference (Boston, Nov. 14-15, 2007) (**invited**).

102. **X. Xu***, P. Nallathamby, T. Huang, K. Lee, "*In vivo* imaging using single nanoparticle photonics", SERMACS 2007 (SC, Oct. 24-27, 2007) (**invited**).

101. **X. Xu***, T. Huang, P. Nallathamby, D. Gillet "Design of single nanoparticle optical sensors for imaging and characterization of single receptor molecules on single living cells", 234th ACS National Meeting (Boston, Aug. 19-23, 2007) (**invited**).

100. **X. Xu***, P. Nallathamby, T. Huang, Y. Song, J. Lowman, "Design of biocompatible nanoparticles for probing living cellular functions", 2007 NNIN Annual Meeting (U. of Michigan, May 2007) (**invited**).

99. **X. Xu***, P. Nallathamby, T. Huang, Y. Song, J. Lowman, V. Pravodelov, "Single nanoparticle assay for real-time molecular study of cellular function of single living cells", Pittcon 2007, Chicago, IL (**invited**).

98. P. Nallathamby, T. Huang, **X. Xu***, "Design of stable and biocompatible nanoparticle probes for single molecule study of single living cells", Pittcon'2007, Chicago, IL.

97. K. Lee, P. Nallathamby, L. Browning, C. Osgood, **X. Xu***, "Study of biocompatible of nanomaterials *in vivo*", Pittcon'2007, Chicago, IL.

96. **X. Xu***, D. Gillet, H. Elsayed-Ali, C. Osgood, R. Van Duyne, "NIRT (II): Design of biocompatible nanoparticles for probing living cellular functions and their potential environmental impacts", NSF-NIRT Grantee Conference (NSF, Dec. 4-6, 2006) (**invited**).

95. **X. Xu***, P. Nallathamby, T. Huang, V. Pravodelov, H. Xu, W. Brownlow, "Design of single nanoparticle optics for molecular imaging single living cells", 232th ACS National Meeting, (Physical Chemistry Division, San Francisco, Sept. 10-14, 2006) (**invited**).

94. W. Brownlow, S. Kyriacou, P. Nallathamby, V. Pravodelov, J. Viola, Y. Song, T. Huang, **X. Xu***, "Design of single nanoparticle optics for probing living cellular function: efflux pump machinery", Virginia Nanotech 2006 meeting (July 11-13, 2006, Newport News, VA) (**invited**)

93. **X. Xu***, P. Nallathamby, V. Pravodelov, W. Brownlow, H. Xu, "Development of single nanoparticle optics for single living cell imaging", Pittcon'2006, Orlando, FL.

92. **X. Xu***, P. Nallathamby, H. Xu, "Molecular analysis of cellular pathways and functions using single nanoparticle assay," Pittcon'2006, Orlando, FL.

91. **X. Xu***, H. Xu, P. Nallathamby, W. Brownlow, "Real-time tuning membrane transport and subcellular structures of single living cell using electric fields", Pittcon'2006, Orlando, FL.

90. **X. Xu***, D. Gillet, H. Elsayed-Ali, C. Osgood, R. Van Duyne, "NIRT (I): Design of biocompatible nanoparticles for probing living cellular functions and their potential environmental impacts", NSF NIRT Grantee Conference (NSF, Dec. 11-15, 2005) (**invited**).

89. **X. Xu***, "Development of single nanoparticle optics for single living cell imaging", 13th NSF Workshop On Materials Chemistry & Nanoscience (Oct 28-31, 2005) (**invited**).

88. **X. Xu***, P. Nallathamby, R. Jeffers, "Single nanoparticle optics assay for sensing single protein molecules on single living cells", 230th ACS National Meeting (DC, Aug. 28-Sept. 1, 2005) (**invited**).

87. **X. Xu***, P. Nallathamby, W. Brownlow, S. Kyriacou, "Single nanoparticle optics for real-time imaging membrane transport of single living cells", 230th ACS National Meeting (DC, 2005) (**invited**).

86. P. Nallathamby, M. Natarajan, **X. Xu***, "Real-time study of signal transduction pathways involving in bystander effects using single nanoparticle optics and single living cell imaging", DOE Investigators Meeting (Bethesda, April 25-27, 2005) (**invited**).

85. **X. Xu***, P. Nallathamby, "Timing intracellular function of single living cells using nanosecond electric pulses", Symposium Record Abstracts, ElectroMed2005, Portland, OR, May 2005, p. 25.

84. M. Khalid, C. Zhou*, A. Bassi, H. Gerber, C. Tseng, **X. Xu***, "Heat transfer analysis of cell culture in a microchannel-based nsPEF system", Symposium Record Abstracts, ElectroMed2005, Portland, OR, May 2005, p 4.

83. **X. Xu***, W. Brownlow, S. Kyriacou, "Real-time probing of membrane transport in living microbial cells using single nanoparticle optics and living cell imaging", Pittcon'2005.

82. **X. Xu***, W. Brownlow, S. Kyriacou, "Single-molecule study of subcellular function in single living cells", Pittcon'2005**.**

81. P. Nallathamby, **X. Xu***, "Study of single ligand-receptor interactions on single live cell using single nanoparticle optics assay", Pittcon'2005.

80. **X. Xu***, Q. Wan, J. Kolb, K. Schoenbach, "Real-time monitoring of effects of electric fields on kinetics of membrane transport in single living cells", 2004 Bioelectromagnetics Society (BEMS) Annual Meeting (**invited**).

79. Q. Wan, **X. Xu***, J. Kolb, K. Schoenbach, "Real-time study of accumulation effects of electric fields upon membrane transport in single living cells", 2004 Bioelectromagnetics Society (BEMS) Annual Meeting (**invited**).

78. C. Steel, **X. Xu***, "Study of biocompatibility of silver nanoparticles at the single-cell resolution", Pittcon 2004.

77. C. Steel, **X. Xu***, "Real-Time probing of bacterial communication and growth: single cells versus clusters", Pittcon 2004.

76. Q. Wan, **X. Xu***, "Real-time probing of the effect of high electric field on subcellular functions", Pittcon 2004.

75. **X. Xu**[*], W. Brownlow, C. Steel, "Single molecule detection of subcellular events in single live cells", SERMACS 2003 (**invited**).

74. **X. Xu**[*], W. Brownlow, Q. Wan, "Real-time imaging of effects of electric fields on subcellular structures using nanoparticle optics and single live cell microscopy", 3rd ElectroMed Conference in San Antonio, TX. (06/2003) (**Platform speaker**).

73. **X. Xu**[*], Q. Wan, C. Steel, R. Jeffers, "Real-time study of effects of electric fields on binding of single ligand-receptor interaction on living cell surfaces", 3rd ElectroMed Conference in San Antonio, TX

72. **X. Xu**[*], S. Kyriacou, W. Brownlow, "Real-time single-molecule study of efflux pump machinery of single living bacterial cells", Gordon Research Conferences in Multi-drug Efflux Systems, (March 7-12, 2003).

71. **X. Xu**[*], Q. Wan, C. Steel, "Single live cell imaging of growth and division of *Pseudomonas aeruginosa*", Gordon Research Conferences in Multi-drug Efflux Systems, March 7-12, 2003.

70. C. Steel, **X. Xu**[*], **"**Study of hyper-elongation of *Pseudomonas aeruginosa* in antibiotics using single live-cell imaging**",** Pittcon 2003**.**

69. Q. Wan, C. Steel, **X. Xu**[*]**,** "Single live cell imaging of chromosome replication of *Pseudomonas aeruginosa*", Pittcon 2003.

68. C. Steel, **X. Xu**[*], "Study of multidrug resistance in cancer cells using live cell imaging and nanoprobes"**,** Pittcon 2003.

67. Q. Wan, **X. Xu**[*], "*In vivo* study of the function of apoptotic peptide tBid and nBid using fluorescence resonance energy transfer (FRET)", Pittcon 2003.

66. **X. Xu**[*], R. Jeffers, W. Brownlow, J. Viola, "Electrochemilumiescence study of HIV receptors and tumor markers" 224th ACS National Meeting, Boston (08/2002) **(invited)**.

65. **X. Xu**[*], W. Brownlow, Q. Wan, S. Kyriacou, J. Viola, C. Steel, "Real-time single molecule chemical microscopy for monitoring of single biomolecules", New Instrumentation for Space at JPL-Caltech, (06/2002) **(invited)**.

64. **X. Xu**[*], R. Jeffers, J. Chen, W. Brownlow, S. Kyriacou, "Exploring living interfaces using single-molecule detection", FACSS 2002 **(invited)**.

63. **X. Xu**[*], R. Jeffers, S. Huang, J. Chen, "Single-molecule studies of single living cells", 222nd ACS National Meeting, Chicago (08/2001) **(invited)**.

62. **X. Xu**[*], S. Huang, J. Chen, S. Kyriacou, R. Jeffers, "Single-molecule studies of membrane pump machinery", International Society for Optical Engineering (Photonics West-SPIE)/BiOS 2002, (San Jose, CA) **(invited)**.

61. **X. Xu**[*], R. Jeffers, "Single molecule probes of single ligand-receptor interaction on living cell surfaces", International Society for Optical Engineering (Photonics West-SPIE)/BiOS 2002, (San Jose, CA) **(invited)**.

60. E. S. Yeung, **X. Xu**, S. Kang, J. Zheng, "Alignment at a solid-liquid interface and its implications on the double layer", The 222nd ACS National Meeting, Chicago, 2001. **(invited)**

59. **X. Xu**[*], J. Chen, R. Jeffers, S. Huang, M. Nowak, "Single-molecule dynamics and interactions at living interface", 221st ACS National Meeting, San Diego, 2001.

58. **X. Xu***, R. Jeffers, S. Huang, M. Nowak, H. Yoneyama, "Single-molecule analysis in biomedical sciences", International Society for Optical Engineering (Photonics West-SPIE)/BiOS 2001, (San Jose, CA) (**invited**).

57. **X. Xu***, S. Huang, "Single-molecule biosensing and chemical microscopy", Pittcon 2001.

56. **X. Xu***, K. Salaita, S. Huang, R. Jeffers, "Study of gold nanoparticles", Pittcon 2001.

55. **X. Xu***, M. Nowak, S. Huang, H. Yoneyama, "Probing of multi-antibiotic efflux pump machinery using fluorescence spectroscopy and electrochemiluminescence", Pittcon 2001.

54. R. Jeffers, **X. Xu***, "Novel ultrasensitive solution-phase immunoassay of tumor markers in serum samples using electrochemiluminescence", Pittcon 2001.

53. R. Jeffers, **X. Xu*****,** "Biomedical applications of nanoparticle probes", Pittcon 2001**.**

52. **X. Xu***, S. Huang, M. Nowak, R. Jeffers, "Single-molecule probing of biomechanics", Pittcon 2001

51. **X. Xu***, Z. Wen, R. Jeffers, J. Gao, "Single-molecule induction of single-cell immune response", Pittcon 2000 (**invited**).

50. **X. Xu***, Z. Wen, "Molecular analysis of HIV receptors and neutralizing antibody using electro-chemiluminescence", Pittcon 2000.

49. R. Jeffers, **X. Xu***, "A novel solution phase immunoassay of prostate specific antigen using electrochemiluminescence", Pittcon 2000.

48. R. Jeffers, **X. Xu***, "Nanoparticle probes for biomolecular sensing", Pittcon 2000.

47. J. Gao, **X. Xu***, "Real-time monitoring of single biomolecules using total internal reflection fluorescence microscopy", Pittcon 2000.

46. **X. Xu***, R. Jeffers, H. Yoneyama, "Ultrasensitive analysis of protein-protein interactions", FACSS 2000, (**invited**).

45. **X. Xu***, R. Jeffers, J. Gao, H. Yoneyama, "Single-molecule dynamics and interactions", FACSS 2000, (**invited**).

44. **X. Xu***, J. Gao, R. Jeffers, B. Logan, Z. Wen, "Molecular analysis of biomarkers for the earlier cancer detection", International Society for Optical Engineering (Photonics West-SPIE)/BiOS 2000, (**invited**).

43. **X. Xu***, R. Jeffers, M. Nowak, J. Gao, H. Yoneyama, "Single-molecule analysis in biomedical sciences", Nanoscience and Nanotechnology: Shaping Biomedical Research, (NIH campus, 06/2000).

42. **X. Xu***, Z. Wen, J. Gao, "Single-molecule assay of tumor markers in T-cell apoptosis", The First NASA/NCI Workshop, JPL-Caltech (06/99) (**invited**).

41. **X. Xu***, J. Gao, Z. Wen, R. Jeffers, "Single-molecule analysis of ligand-receptor interactions", After the Genome-V, Jackson Hole, Wyoming (10/99) (**invited**).

40. **X. Xu***, J. Gao, Z. Wen, R. Jeffers, "Emerging applications of single-molecule analysis in biomedical sciences", Single-Molecule Analysis & Applications, Boston (08/99) (**invited**).

39. **X. Xu***, Z. Wen, "Electrochemiluminescence study of HIV receptors", FACSS 1999 (**invited**).

38. **X. Xu***, J. Gao, "Dynamics of single neurotransmitter molecules", FACSS 1999 (**invited**).

37. E. S. Yeung, **X. Xu**, M. Shortreed, "Single-molecule spectroscopy", Pittcon 1999 (**invited**).

36. Z. Wen, **X. Xu***, "Real-time sensing HIV biomarkers using electrochemiluminescence detection", Pittcon 1999.

35. **X. Xu***, Z. Wen, "Single-molecule monitoring of HIV proteins in T cell immune response", Pittcon 1999.

34. **X. Xu***, Z. Wen, "Single-molecule immunoassay of tumor markers", Pittcon 1999.

33. Z. Wen, **X. Xu***, "Ultrasensitive analysis of HIV receptors and neutralizing antibodies using electrochemiluminescence", 1999 Virginia Academy of Science.

32. Z. Wen, B. Logan, R. Jeffers, **X. Xu***, "Electrochemiluminescence study of the interaction of biomolecules", 1999 Virginia Academy of Science.

31. R. Jeffers, B. Logan, Z. Wen, **X. Xu***, "Determination of prostate specific antigen using nanoparticle probes", 1999 Virginia Academy of Science.

30. **X. Xu***, J. Gao, Z. Wen, "Real-time monitoring of single biomolecules using laser-induced native fluorescence microscopy", 1999 Virginia Academy of Science.

29. **X. Xu***, Z. Wen, B. Logan, "Real-time sensing of HIV biomarkers at molecule level ", The Gordon Research Conferences on Bioanalytical Sensors, Ventura, CA (01/1999).

28. **X. Xu***, Z. Wen, R. Jeffers, B. Logan, J. Gao, "Ultrasensitive analysis of biomolecules: from HIV/tumor biomarkers to single protein molecules", The Gordon Research Conferences on Analytical Chemistry, New England College, NH (Summer 1999).

27. **X. Xu**, E. S. Yeung, "Chemical monitoring of single neurotransmitter molecules using laser-induced native fluorescence microscopy", FACSS 1998, Austin, TX (**invited**).

26. E. S. Yeung, **X. Xu**, "Microscale separations: from single cells to single molecules", Pittcon 1998, New Orleans, LA (**invited**).

25. **X. Xu**, E. S. Yeung, "Real-time monitoring of single-protein retention and partition at the liquid/solid interfaces", Pittcon 1998, New Orleans, LA.

24. E. S. Yeung, **X. Xu**, "Single-molecule dynamics in solution: from chromatography to medical diagnostics", Pittcon 1998, New Orleans, LA (**invited**).

23. **X. Xu**, E. S. Yeung, "Real-time monitoring of single membrane protein molecules using laser-induced native fluorescence microscopy", The Gordon Research Conferences on Membrane Transporters, Tilton School, NH (Summer 1998).

22. **X. Xu**, E. S. Yeung, "Single-molecule imaging of chromatographic interactions and interfacial structures", 1998 EAS Conference, Somerset, NJ.

21. **X. Xu**, E. S. Yeung, "Real-time monitoring of single-molecule reactions in free solution", FACSS 1997, Providence, RI (**invited**).

20. **X. Xu**, E. S. Yeung, "Real-time monitoring of single-molecule reactions in aqueous solution", The 213rd ACS National Meeting, San Francisco, CA (1997) (**invited**).

19. E. S. Yeung, **X. Xu**, "Direct measurement of single-molecule dynamics in free solution", The 213rd ACS National Meeting, San Francisco, CA (1997) (**invited**).

18. **X, Xu**, E. S. Yeung, "Direct observation of single-molecule events", Pittcon 1997, Atlanta, GA.

17. **X. Xu**, E. S. Yeung, "Chemical movies of single ion-exchange", The Gordon Research Conferences on Analytical Chemistry, New England College, NH (Summer 1997).

16. E. S. Yeung, **X. Xu**, "Following the reaction of single molecules: implications on molecular conformations and microenvironments", 1996 Eastern Analytical Symposium, Somerset, NJ (**invited**).

15. **X. Xu**, E. S. Yeung, "Watching single-molecule behavior in aqueous solution by total internal reflection fluorescence microscopy", FACSS 1996.

14. E. S. Yeung, W. Tan, **X. Xu**, S. J. Lillard, "Chemical movies of single cells and single molecules", FACSS 1996, Kansas City, MO (**invited**).

13. E. S. Yeung, S. J. Lillard, W. Tong, **X. Xu**, "Analytical instrumentation in the fourth dimension", The 212nd ACS National Meeting, Orlando, FL (1996) (**invited**).

12. **X. Xu**, A. J. Bard, "Immobilization and hybridization of ss-DNA on electronically conductive surfaces", The Gordon Research Conferences: Biomolecular Recognition & Immobilization, Colby-Sawyer College, NH (Summer 1996).

11. **X. Xu**, A. J. Bard, "Electrochemiluminescent investigation of molecular recognition of monoclonal antibody with Ruthenium (II) chelates", The Gordon Research Conferences: Biomolecular Recognition & Immobilization, Colby-Sawyer College, NH (1996).

10. **X. Xu,** A. J. Bard, "Electrochemiluminescent investigation of DNA biosensor and antibody affinity", Pittcon 1996, Chicago, IL.

9. **X. Xu**, A. J. Bard, "Immobilization and hybridization of DNA on an aluminum (III) alkanebisphosphonate film with electrochemiluminescent detection", The 210th ACS National Meeting, (1995).

8. **X. Xu**, A. J. Bard, "DNA biosensors with electrochemiluminescent detection", The First Conference for Worldwide Young Chinese Chemists, Peking University, China (1995) (**invited**).

7. **X. Xu**, A. J. Bard, "Electrochemiluminescent investigation of antibody affinity", The First Conference for Worldwide Young Chinese Chemists, Peking University, China (1995).

6. **X. Xu**, K. Shreder, B. Iverson, A. J. Bard, "Electrochemiluminescent investigation of antibody affinity", The 46th International Society of Electrochemistry, Xiamen, China (1995) (**invited**).

5. **X. Xu**, A. J. Bard, "Sensing DNA using electrochemiluminescence", The 46th International Society of Electrochemistry, Xiamen, China (1995) (**invited**).

4. **X. Xu**, A. J. Bard, "Electrogenerated chemiluminescent emission from adsorbed layers of $Ru(bpy)_3^{2+}$ and $Ru(dp\text{-}bpy)_3^{2+}$ on a highly order pyrolytic graphite (HOPG)", Southwest Regional Meeting of the ACS, Austin, TX (1993).

3. **X. Xu**, C. L. Hussey, "The electrochemistry of mercury at glassy carbon and tungsten electrodes in the aluminum chloride-1-methyl-3-ethylimidazolium chloride molten salt", International Symposium on Molten Salt Chemistry & Technology, (1993) (**invited**)

2. **X. Xu**, C. L. Hussey, "Electrodeposition of metals from room-temperature chloroaluminate molten salts", The Eighth International Symposium on Molten Salts, (1992) (**invited**).

1. P. A. Barnard, **X. Xu**, C. L. Hussey, "Electrochemistry and spectroelectrochemistry of hexanuclear transition metal clusters in room temperature chloroaluminate molten salts", Proc. of the 42nd Southeast/46th Southwest Combined Regional Meeting of the ACS, New Orleans, LA (1990).

Selected Invited Seminars:

88. **X. Xu***, "Advanced Quantum/Nanomaterials and Innovative NanoBiotechnology for Biomedical Breakthroughs", Case Western Reserve University (2024) (**invited**).

87. **X. Xu***, "Innovative NanoBiotechnology for Biomedical Breakthroughs" Indiana University (2024) (**invited**)

86. **X. Xu***, "Innovative NanoBiotechnology for Biomedical Applications", University of Nevada, Reno (2024) (**invited**).

85. **X. Xu***, "New NanoBiotechnology for Biomedical Innovations", Texas A&M University (2023) (**invited**).

84. **X. Xu***, "New NanoBiotechnology for Biomedical Innovations", University of Arizona (2023) (**invited**).

83. **X. Xu***, "New NanoBiotechnology for Biomedical Innovations", Tufts University (2023) (**invited**).

82. **X. Xu***, "New NanoBiotechnology for Real-time Imaging of Single Live Cells", University of Kentucky (2023) (**invited**).

81. **X. Xu***, "New NanoBiotechnology for Biomedical Innovations", Center of Bioelectronics, ODU (2023) (**invited**).

80. **X. Xu***, "Innovative Sensing and Imaging Tools for Biomedical Applications", Texas A&M University (2022) (**invited**).

79. **X. Xu***, "New NanoBiotechnology for Sensing and Imaging of Single Live Cells: From Fundamental Discoveries to Biomedical Innovations", Purdue University (2022) (**invited**).

78. **X. Xu***, "New NanoBioPhotonics for Biomedical Engineering Innovations", Arizona State University (2022) (**invited**).

77. **X. Xu***, "New NanoBioPhotonics for Innovative Biomedical Applications", Northeastern University (2021) (**invited**).

76. **X. Xu***, "New Tools for Biomedical Innovations and Applications", University of Alabama (2021) (**invited**).

75. **X. Xu***, "NanoBioPhotonics: Innovations & Applications", University of Louisville (2021) (**invited**).

74. **X. Xu***, "NanoBiotechnology for Biomedical Innovations and Applications", Howard University (2021) (**invited**).

73. **X. Xu***, "New Nano Tools for Real-Time Imaging of Single Live Cells: From Fundamental Discoveries to Biomedical Engineering Applications", UMass Amherst (2020) (**invited**).

72. **X. Xu***, "New Nano Tools for Following Single Live Cells: From Fundamental Discoveries to Transformative Engineering Applications", Washington University (2020) (**invited**).

71. **X. Xu***, "New Nano Tools for Real-time Single Molecule Imaging of Single Live Cells: From Fundamental Discoveries to Transformative Engineering", University of Illinois (2020) (**invited**).

70. **X. Xu***, "New Nano Tools for Following Single Live Cells: From Fundamental Discoveries to Biomedical Applications", Texas Tech University (2020) (**invited**).

69. **X. Xu***, "Following Single Live Cells: From Fundamental Discoveries to Biomedical Applications", Temple University (2019) (**invited**).

68. **X. Xu***, "New Nano Tools for Following Single Live Cells", University of Connecticut (2019) (**invited**).

67. **X. Xu***, "New Nano Tools for Following Single Live Cells: From Fundamental Discoveries to Biomedical Applications", University of Virginia (2018) (**invited**).

66. **X. Xu***, "Real-time Imaging of Single Live Cells for Biomedical Applications", Bioelectric Center, Old Dominion University (2018) (**invited**).

65. **X. Xu***, "New Imaging Tools for Following Single Live Cells: From Fundamental Discoveries to Biomedical Applications", Old Dominion University (2017) (**invited**).

64. **X. Xu***, "New Tools for Real-time and Molecular Imaging of Single Live Cells", University of Maryland, College Park (2016) (**invited**).

63. **X. Xu***, "New Tools for Real-time Imaging of Single Live Cells", Integrative Neuroscience Lecture Series, Center for Biomedical Research Excellence, University of Nevada, Reno (2015) (**invited**).

62. **X. Xu***, "New Nanochemistry Tools for Real-time and Single-Molecular Imaging of Single Live Cells", Old Dominion University (2015) (**invited**).

61. **X. Xu***, "New Tools for Real-time Study of Nanotoxicity", Chinese Academy of Sciences, Beijing (2014) (**invited**).

60. **X. Xu***, "Single-molecule Nanoparticle Biosensors for Deciphering of Cellular Functions", Chinese Academy of Sciences, Beijing (2013) (**invited**).

59. **X. Xu***, "Nanophotonics Biosensors for Probing of Life Sciences", CUNY Advanced Science Seminar Series (2013) (**invited**).

58. **X. Xu***, "Deciphering Functions of Single Live Cells One-Molecule-at-a-Time", ODU-Department of Biology (2013) (**invited**).

57. **X. Xu***, "Single-molecule Nanoparticle Biosensors for Super-Resolution Imaging of Single Live Cells", University of California, Riverside (2013) (**invited**).

56. **X. Xu***, "Nanoparticle Biosensors for Super-Resolution and Single-Molecule Imaging of Single Cells", ODU-BME Innovation Seminar Series (2012) (**invited**).

55. **X. Xu***, "Showcase Powers of Chemical and Nano Sciences", Old Dominion University (2012) (**invited**).

54. **X. Xu***, "Super-Resolution Single Molecule Imaging of Single Ligand-Receptor Interactions on Single Live Cells", CEA-Saclay, France (2011) (**invited**).

53. **X. Xu***, "Design of Photostable Plasmonic Nanoparticle Probes and Biosensors for Molecular Imaging of Single Living Cells", University of Cincinnati (2011) (**invited**).

52. **X. Xu***, "Design of Photostable Plasmonic Nanoparticle Probes and Biosensors for Molecular Imaging of Single Living Cells", University of Chinese Academy of Sciences, Beijing, China (2011) (**invited**).

51. **X. Xu***, "Single Molecule Imaging of Single Live Cells", Xiamen University (2011) (**invited**).

50. **X. Xu***, "Design of Photostable Nanoparticle Probes for Molecular Imaging of Single Living Cells", Hampton University (2011) (**invited**).

49. **X. Xu***, "New Frontiers in Nanobiotechnology: Probing of Multidrug Membrane Transporters in Single Living Cells Using Single Nanoparticle Optics", Davidson College (2010) (**invited**).

48. **X. Xu***, "Design of Photostable Plasmonic Nanoparticle Probes and Biosensors for Molecular Imaging of Single Living Cells", Clemson University (2009) (**invited**)

47. **X. Xu***, "Design of Biocompatible Nanoparticles for Molecular Imaging of Single Living Cells and Embryos", Brown University (2009) (**invited**)

46. **X. Xu***, "Design of Photostable Nanoparticle Optics and Biosensors for Molecular Imaging of Single Living Cells", Virginia Commonwealth University (2009) (**invited**)

45. **X. Xu***, "New Frontiers in Nanoscience and Nanotechnology: Design of Biocompatible Single Nanoparticle Optics for Imaging Single Living Cells", Xiamen University, (2008) (**invited**)

44. **X. Xu***, "Design of Single Nanoparticle Biosensors for Real-time Imaging of Single Living Cells", University of Maryland at College Park (2007) (**invited**)

43. **X. Xu***, "Design of Single Nanoparticle Photonics and Sensors for Real-time Probing of Single Living Cells and Embryos", University of Washington, Seattle (2007) (**invited**)

42. **X. Xu***, "Design of Single Nanoparticle Optics for Molecular Imaging of Single Living Cells**",** Rensselaer Polytechnic Institute (2007) (**invited**)

41. **X. Xu***, "Design of Biocompatible Single Nanoparticle Optics for Imaging Single Living Cells", Rice University (2007) (**invited**)

40. **X. Xu***, "Design of Single Nanoparticle Photonics and Biosensors for Real-time Molecular Analysis of Single Living Cells", Iowa State University (2007) (**invited**)

39. **X. Xu***, "New Frontiers in Nanobiotechnology: Design of Biocompatible Nanoparticles for Real-Time Molecular Imaging of Single Living Cells", Hampton University (2007) (**invited**)

38. **X. Xu***, "Design of Biocompatible Single Nanoparticle Optics for Real-Time Molecular Imaging of Membrane Transport in Single Living Cells", University of Illinois at Urbana-Champaign (2006) (**invited**)

37. **X. Xu***, "Design of Biocompatible Single Nanoparticle Optics for Real-time Molecular Imaging of Living Cellular Function", Northeastern University (2006) (**invited**)

36. **X. Xu***, "Design of Single Nanoparticle Optics for Probing Living Cellular Function", National Institute of Aerospace (2006) (**invited**)

35. **X. Xu*,** "Design of Single Nanoparticle Optics for Probing Living Cellular Membrane Transport" Student-Selected Speaker, University of Illinois at Urbana-Champaign (2005) (**invited**)

34. **X. Xu***, "Frontiers in Nanoscience and Nanotechnology, NIRT Lecture Series-2005: Design of Single Nanoparticle Optics for Probing Living Cellular Membrane Transport", 1st Annual Public Lecture of NIRT Program at ODU (2005)

33. **X. Xu**[*], "Novel NanoBiotechnology", Nanoscience and Nanotechnology Meeting, Sigma Xi (2004) (**invited**)

32. **X. Xu**[*], "Real-Time Study of Accumulation Effects of Electric Fields Upon Membrane Transport in Single Living Cells", Center for Bioelectrics, College of Engineering and Technology, ODU (2004) **(invited)**.

31. **X. Xu**[*], "Molecular Study of Multidrug Resistance Using Nanoparticle Optics and Live Cell Imaging", Inst. for Struct. Bio. & Drug Discovery, Virginia Commonwealth University (2003) (**invited**)

30. **X. Xu**[*], "Real-time Single Molecule Monitoring of Multidrug Extrusion Pump of Single Living Cells", Eastern Virginia Medical School (2002) **(invited)**.

29. **X. Xu**[*], "Real-time Molecular Study of Subcellular Response to RF", 1st MURI Meeting at Purdue University, (2002) **(invited)**

28. **X. Xu**[*], "Single-molecule Study of Single Living Cells", ODU Physics Colloquium, (2001) (**invited**)

27. **X. Xu**[*], "Single-molecule Detection in Single Live Cells", University of Pittsburgh, (2001) (**invited**)

26. **X. Xu**[*], "Single-molecule Dynamics at Living Interfaces", Univ. of Wisconsin at Madison, (1999) (**invited**)

25. **X. Xu**[*], "Real-time Imaging of Single Live Cells", Eastern Virginia Medical School (1999) (**invited**)

24. **X. Xu**[*], "Real-time Monitoring of Single Protein Molecules Using Laser-Induced Native Fluorescence", Distinguished Lecture Series at Tennessee State University, (1999) (**invited**).

23. **X. Xu**[*], "Real-time Monitoring of Biomolecules Using Ultrasensitive Detection Means", Old Dominion University, Norfolk, VA (1999) (**invited**).

22. **X. Xu**, "Real-time Monitoring of Single Molecule Dynamics in Free Solution", Duke University, Durham, NC (1998) (**invited**).

21. **X. Xu**, "Single Molecule Detection in Free Solution and Novel DNA Biosensing", Montana State University, Bozeman, MT (1998) (**invited**).

20. **X. Xu**, "Chemical Monitoring of Single-Molecule Dynamics in Free Solution and at Liquid/Solid Interfaces", Louisiana State University, Baton Rouge, LA (1998) (**invited**).

19. **X. Xu**, "Single Molecule Dynamics of DNA and Proteins in Free Solution", Ohio University, Athens, OH (1998) (**invited**).

18. **X. Xu**, "Real-time Monitoring of Single Molecules Dynamics in Free Solution", Florida International University, Miami, FL (1998) (**invited**).

17. **X. Xu**, "DNA Biosensors with Electrochemiluminescence Detection", Oklahoma State University, Stillwater, OK (1998) (**invited**).

16. **X. Xu**, "Real-time Monitoring of Single Molecules in Free Solution", Old Dominion University, Norfolk, VA (1998) (**invited**).

15. **X. Xu**, "Real-time Single Molecule Detection in Free Solution", SUNY, NY (1997) (**invited**).

14. **X. Xu**, "Chemical Movies of Single Molecules", Drexel University, Philadelphia (1997) (**invited**).

13. **X. Xu**, "Real-Time Monitoring of Single-Molecule Events in Free Solution", Iowa State University, Ames, IA (1997) (**invited**).

12. **X. Xu**, "Direct Observation of Distinctive Single-Molecule Motion and Lifetime in Aqueous Solution", The Midwestern University Analytical Chemistry Conference, Urbana-Champaign, IL (1996) (**invited**).

11. **X. Xu**, "Advanced in Electrogenerated Chemiluminescence", The City University of New York, (1996) (**invited**).

10. **X. Xu**, "Novel DNA Biosensors with Electrogenerated Chemiluminescence Detection", Iowa State University, (1996) (**invited**).

9. **X. Xu**, "Ultrasensitive Sensing of DNA and Antibody Affinity Using Electrochemiluminescent Detection", Harvard Medical School, Genetic Department, (1996) (**invited**).

8. **X. Xu**, "Electrochemiluminescent Detection for DNA Biosensor and Antibody Affinity", The Johnson & Johnson Family of Companies, CA (1995) (**invited**).

7. **X. Xu**, "Novel DNA Biosensor with Electrochemiluminescent Detection", Ortho Diagnostic Systems, Inc., Johnson & Johnson, NJ (1995) (**invited**).

6. **X. Xu**, "Electrochemiluminescent Investigation of DNA Biosensors and Antibody Affinity", Boehringer Mannheim, CA (1995) (**invited**).

5. **X. Xu**, "Advanced in Electrogenerated Chemiluminescence", International Electrochemiluminescence Advisory Board Meeting, UT-Austin, TX (1995) (**invited**).

4. **X. Xu**, "Immobilization of DNA on an Aluminum (III) Alkanebisphosphonate Thin Film with Electrogenerated Chemiluminescent Detection", The University of Texas at Austin, (1994)

3. **X. Xu**, "Electrochemical and Electrogenerated Chemiluminescent Investigation of the Interaction of Metal Chelates with Antibodies", The University of Texas at Austin, (1994).

2. **X. Xu**, "Immobilization and Hybridization of ss-DNA on an Aluminum (III) Alkanebisphosphonate Thin Film with Electrogenerated Chemiluminescent Detection", The University of Texas at Austin, (1994).

1. **X. Xu**, "Frontier Research on the Development of LCEC System for the Determination of Biological Molecules", The University of Mississippi, (1990).

Student Thesis and Dissertation Directed

9. Martha Johnson (mentor: **X. Xu**), "Study of Effects of Silver Ions and Nanoparticles on embryonic Development". Dissertation. Old Dominion University, Norfolk, VA (May 2019).

8. Preeyaporn Songkiatisak (mentor: **X. Xu**), "Study of ABC membrane transporter in single live cells". Dissertation. Old Dominion University, Norfolk, VA (May 2018).

7. Pavan K. Cherukuri (mentor: **X. Xu**), "Design of drug nanocarriers for study of multidrug resistance in single live cells". Dissertation. Old Dominion University, Norfolk, VA (2016).

6. Lauren M. Browning (mentor: **X. Xu**), "New tools for real-time study of embryonic development". Dissertation. Old Dominion University, Norfolk, VA (2013). (COS Distinguished Dissertation Award)
5. Feng Ding (mentor: **X. Xu**), "Structural and functional study of multidrug membrane transporters". Dissertation. Old Dominion University, Norfolk, VA (2013).
4. Kerry J. Lee (mentor: X. Xu), "Design of *in vivo* assay for study of transport, biocompatibility and toxicity of nanoparticles". Dissertation. Old Dominion University, Norfolk, VA (2012).
3. Prakash D. Nallathamby (mentor: **X. Xu**), "Design and synthesis of photostable nanoparticle probes for molecular imaging and sensing in life science". Dissertation. Old Dominion University, Norfolk, VA (2010).
2. William J. Brownlow (mentor: **X. Xu**), "Development of single nanoparticle optical assays for imaging single living cells". Thesis. Old Dominion University, Norfolk, VA (2006).
1. S. V. Kyriacou (mentor: **X. Xu**), "Real-time study of multidrug resistance mechanism in *Pseudomonas aeruginosa* using nanoparticle optics and single live cell imaging". Thesis. Old Dominion University (2003).