# X. Nancy Xu, Ph.D.

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## Selected Research Accomplishments & Publication Highlights

**I.** Dr. Xu has pioneered the development of novel single-molecule sensing and imaging platforms, including photostable single-molecule nanoparticle optical imaging probes**,** single-molecule nanoparticle optical biosensors (SMNOBS), and photostable optical nanoscopy (PHOTON)**.** Her work focuses on the rational design of a new class of optical nanomaterials and the development of highly photostable super-bright imaging probes and tools. These advances aim to overcome the intrinsic limitations of conventional fluorescence-based imaging—such as photobleaching and phototoxicity—particularly in the context of long-term imaging of live cells and developing embryos.

Dr. Xu has demonstrated that these cutting-edge nanomaterials and imaging tools enable the study of signal transduction pathways in single live cells with nanometer-scale spatial resolution, millisecond temporal resolution, single-molecule sensitivity and quantification over extended periods (hours to days).

Her discoveries have revealed new, dynamic, and quantitative biological insights into the high heterogeneity of receptors on individual live cells and the associated signaling dynamics and mechanisms. These innovative platforms have broad applications, including the investigation of other cascade signaling pathways, a deeper understanding of cellular functions, and the development of more effective therapeutics. Applications also include the identification of pre-disease biomarkers for early cancer detection, drug-target interaction sites, and vaccine characterization. Selected publications 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. P. Songkiatisak, P. Cherukui, **X. Xu***, "PHOTON for sensing and imaging of rare subsets of single brain cancer stem cells", (in preparation)

**II.** Dr. Xu has pioneered the development and application of photostable multicolored plasmonic nanoparticles as nanometer-scale sensors to image dynamic cellular events—particularly the size-dependent efflux function of multidrug membrane transporters in single live cells. Her team developed dark-field optical microscopy and spectroscopy and demonstrated that the localized surface plasmon resonance (LSPR) spectra of single nanoparticles can serve as precise nanometer-sized probes to monitor the real-time structural transformations of membrane transporters in single living cells.

Using these innovative tools, Dr. Xu has elucidated key molecular mechanisms underlying multidrug resistance (MDR) and shown that nanoparticles can act as drug carriers to enhance therapeutic efficacy. Her research revealed size-dependent inhibitory effects of nanoparticles against highly infectious bacteria, offering new strategies to combat MDR pathogens.

Key discoveries include the development of: (i) Super-bright, photostable (non-bleaching, non-blinking) single plasmonic nanoparticles; (ii) Size-dependent efflux functions of membrane transporters; (iii) Dynamic chemical sensing capabilities of individual transporters, (iv) The therapeutic potential of nanoparticle-based drug delivery to overcome drug resistance while minimizing side effects.

Selected publications 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.** Dr. Xu has synthesized, purified, and systematically characterized noble metal nanoparticles with precisely controlled sizes, shapes, and surface chemistries. She has developed single-nanoparticle optical microscopy and spectroscopy methods to measure the sizes and optical properties of individual nanoparticles by analyzing their localized surface plasmon resonance (LSPR) spectra. Her team further advanced this approach by creating single-nanoparticle optical rulers, enabling precise measurements of nanoparticle size and shape in solution, within single live cells, and in developing embryos *in situ* and in real time. These innovative imaging and spectroscopic tools allow for the rational design of noble metal nanoparticles for high-resolution imaging applications in complex biological environments. Dr. Xu's team was the first to achieve real-time imaging of developing embryos, mapping their nano-environments and embryonic fluid dynamics *in vivo* at nanometer spatial resolution using single nanoparticle optics.

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:

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.** 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. Her team has

used this well-defined model system to investigate the biological effects of nanomaterials on living organisms. Dr. Xu pioneered the development of *in vivo* assays using zebrafish embryos to explore how the biocompatibility and toxicity of nanomaterials depend on their physical and chemical properties.

Her goal is twofold: to rationally design ultrasensitive in vivo assays for nanotoxicity studies, and to enable the rational design of biocompatible nanomaterials for applications in drug delivery, imaging, and implantable devices. She published the first research paper in this field, and her group has systematically studied the physicochemical property-dependent effects of nanoparticles on embryonic development (see Section III-1).

Key discoveries include: (i) Unique biological effects of engineered nanomaterials; (ii) Tunable toxicity and biocompatibility based on nanoparticle design; (iii) The potential for rational development of biocompatible nanomaterials for a wide range of biomedical applications, including imaging, targeted drug delivery, and implantable medical devices. Selected publications 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.** Dr. Xu has pioneered the development of bioelectric methods using ultrashort (10 nanosecond, ns) 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 microelectric devices that can be seamlessly integrated with single-cell imaging platforms, enabling real-time visualization of the effects of ultrashort electric pulses on single live cells. These tools have made it possible to directly observe and manipulate the intracellular structures and functions of single live cells in response to precisely controlled electric fields.

Key discoveries and innovations include: (i) Novel bioelectric techniques for the preparation and culture of embryonic stem cells; (ii) Real-time visualization of cellular responses to ultrashort electric pulses; (iii) Manipulation of intracellular processes at the single-cell level by tuning electric field parameters.
Selected publications include: those listed in Section I and the following:

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).

**VI.** Dr. Xu has played a transformative role in advancing and popularizing single-molecule detection and ultrasensitive bioanalytical methods in biology and medicine. She is one of the early pioneers in the design and invention of total internal reflection fluorescence microscopy (TIRFM) for single-molecule detection. Dr. Xu was the first to demonstrate real-time, continuous imaging of single molecules in free solution, successfully measuring the photobleaching lifetime and diffusion behavior of individual fluorophores. She also discovered the long-range electrostatic trapping of single protein molecules at liquid-solid interfaces. Her groundbreaking findings were published in two papers in *Science*.
TIRFM has since been commercialized and is now widely accessible, offering researchers around the world an inexpensive, simple, and user-friendly tool to probe single molecules in solution, in living systems, and at liquid/solid interfaces in individual laboratories.

Over the decades, Dr. Xu has continued to pioneer photostable optical nanoparticle probes, single-molecule nanosensors, and advanced imaging platforms to study single live cells and embryos at single-molecule resolution (see publications in Sections I–V). She has organized high-profile symposia at leading national and international conferences and advocated for increased funding from the NIH and NSF to accelerate the development and application of single-molecule technologies in biomedical research. As a result of these collective efforts, single-molecule detection is now a widely adopted and powerful tool in modern biology and medicine.

In addition, Dr. Xu has made significant advances in electrochemiluminescence (ECL)-based bioanalysis. ECL assays are now a gold standard for the analysis of biomarkers in clinical diagnostics. Dr. Xu pioneered the development of ECL-based DNA biosensors, holding a worldwide patent for her invention. Her approach, which predated the development of DNA microarrays, utilized surface chemistry and thin-film techniques to immobilize single DNA strands, enabling detection of single gene mutations using ECL.

Furthermore, Dr. Xu developed ECL solution-phase ultrasensitive protein assays to quantitatively study protein–protein interactions and affinities. These tools have been instrumental in identifying and characterizing biomarkers and neutralizing antibodies for the development of effective diagnostics and therapeutics. Selected publications include:

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. 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).

4. **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

5. **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

6. **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

7. **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]

**VII.** Dr. Xu has made significant contributions to the advancement of electrochemistry and metal deposition in room-temperature chloroaluminate molten salts (ionic liquids). She developed and demonstrated novel electrochemical methods to investigate metal deposition processes in these unique environments and was the first to describe the nucleation mechanism of metal deposition in room-temperature chloroaluminate melts. Her pioneering work led to the first successful deposition of two metals from both acidic and basic chloroaluminate melts, providing foundational insights into metal nucleation and growth in ionic liquid systems. These discoveries have broad implications for applications in materials science, nanofabrication, and electrochemical energy storage. 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 = 5983; h-index = 37; i10-index = 57; citation number on 6/2024 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).

67. 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). (ACS Interdisciplinary Journal; IF = 5.2); https://pubs.acs.org/doi/full/10.1021/acsomega.2c05504

66. P. Songkiatisak, F. Ding, P. Cherukui, **X. Xu***, "Size-dependent inhibitory effects of antibiotics drug nanocarriers on filamentation of *E. coli*" *Nanoscale Advances* **2**, 2135-2145 (2020) (RSC Journal; ; IF = 5.11); https://pubs.rsc.org/no/content/articlehtml/2020/na/c9na00697d

65. 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); (ACS Interdisciplinary Journal; IF = 5.2; Citation = 11)
https://pubs.acs.org/doi/pdf/10.1021/acsomega.9b03698

64. K. Mathieu, W. Javed, S. Vallet, C. Lesterlin, M.-P. Candusso, F. Ding, **X. Xu**, C. Ebel, JM Jault, C. Orelle, "Functionality of membrane proteins overexpressed and purified from *E. coli* is highly dependent upon the strain", *Scientific Report* **9**, 2654 (2019) (Nature Publishing: IF = 4.996; Citation = 41); https://www.nature.com/articles/s41598-019-39382-0.pdf

63. L. Browning, K. Lee, P. Cherukuri, T. Huang, S. Warren, **X. Xu***, "Single plasmonic gold nanoparticles for study of chemical-dependent efflux function of single ABC membrane transporters of single live *Bacillus subtilis* cells", *Analyst* **143**, 1599-1608 (2018) (Royal Society of Chemistry (RSC, UK) journal: Impact Factor (IF) = 5.227; Citation = 14);
https://pubs.rsc.org/en/content/articlepdf/2018/an/c7an01787a

62. 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) (ACS Interdisciplinary Journal; IF = 5.2; Citation = 27);
https://pubs.acs.org/doi/abs/10.1021/acsomega.7b01956

61. **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) (Elsevier publication: **invited & peer-reviewed Chapter**);
https://doi.org/10.1016/B978-0-12-409547-2.12143-2

60. 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) (Richard P. Van Duyne Festschrift, **invited & peer-reviewed**) (ACS Journal, IF = 4.177; Citation = 10); https://pubs.acs.org/doi/pdf/10.1021/acs.jpcc.6b03313

59. L. Browning, K. Lee, P. Cherukuri, P. Nallathamby, S. Warren, JM Jault, **X. Xu***, "Single nanoparticle plasmonic spectroscopy for study of efflux function of multidrug ABC membrane transporters of single live cells", *RSC Advances* **6**, 36794-36802 (2016). (RSC Journal: IF = 4.036 in 2016; Citation = 12); https://pubs.rsc.org/en/content/articlepdf/2016/ra/c6ra05895g

58. K. Lee, T. Huang, P. Nallathamby, **X. Xu***, "Wavelength dependent specific plasmon resonance coupling of single silver nanoparticles with EGFP", *Nanoscale* **7**, 17623-17630 (2015). (RSC Journal: IF = 8.307); https://pubs.rsc.org/en/content/articlepdf/2015/nr/c5nr05234c

57. 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). (RSC Journal: IF = 5.227; Citation = 11); https://pubs.rsc.org/en/content/articlepdf/2014/an/c4an00108g

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55. 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) (ACS Journal: IF = 3.973; Citation = 51); https://pubs.acs.org/doi/pdf/10.1021/tx400228p

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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 Lecture**)

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 Plenary Lecture**)

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, Deven, 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 Annaul 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:

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).