

CURRICULUM VITAE

Mustafa Habib Chowdhury

Email: nanomustafa@gmail.com

Phone: (410)-900-8585

EDUCATION

- September 2000 – December 2005 **Ph.D. in Biomedical Engineering**
Texas A&M University, College Station, TX, USA
Doctoral Dissertation Title: *The use of Surface Enhanced Raman Spectroscopy (SERS) for biomedical applications.*
- August 1998 – August 2000 **M.Sc. in Electrical Engineering**
California State University, Long Beach, CA, USA
- August 1994 – May 1998 **B. Sc in Electrical Engineering**
Purdue University, West Lafayette, IN, USA

TRAINING AND PROFESSIONAL POSITIONS

- **Research Associate** November 2007 – present
Center for Fluorescence Spectroscopy
Department of Biochemistry and Molecular Biology
University of Maryland, School of Medicine, Baltimore, MD, USA.
- **Postdoctoral Research Fellow** September 2005 – October 2007
Center for Fluorescence Spectroscopy
Department of Biochemistry and Molecular Biology
University of Maryland, School of Medicine, Baltimore, MD, USA.
- **Graduate Research Assistant** May 2001 – August 2005
Optical Biosensing Laboratory
Department of Biomedical Engineering
Texas A&M University, College Station, TX, USA.
- **Graduate Teaching Assistant** September 2000 – May 2001
Department of Biomedical Engineering
Texas A&M University, College Station, TX, USA.

RESEARCH EXPERIENCE

- Configured a Renishaw Raman Spectrometer to a Leica microscope for using metal

colloidal nanoparticles as Surface Enhanced Raman Spectroscopy (SERS) substrates for detection of proteins and DNA. Developed SERS active substrates by thermal evaporation using a BOC Edwards Auto 306 Metal Evaporation Chamber, Nanosphere Lithography (NSL) and characterized gold nanoshell-based SERS substrates for use in a biosensor.

- Have experience in growing NIH/3T3 mouse fibroblast cells in cell culture, and incubating them gold nanoshells and colloidal gold nanoparticles for the detection of intracellular constituents using SERS.
- Configured a Roper Scientific spectrometer with a fiber optic to create a UV-Visible Absorption spectrometer to obtain extinction spectra of SERS substrates. Used JEOL 1200EX Transmission Electron Microscope (TEM), JEOL JSM-6400 Scanning Electron Microscope (SEM) and Digital Instruments Nanoscope IIIA Atomic Force Microscope (AFM) to view and characterize SERS substrates. All spectral analysis was done using GRAMS and MATLAB.
- Have experience in using the DDSCAT 6.0 simulation package which implements the Discrete Dipole Approximation algorithm (DDA) to solve Maxwell's equations in order to model extinction cross-section, scattering cross-section and absorption cross-section of SERS substrates.
- Have extensive experience in using the FDTD Solutions package (v. 5.0) from Lumerical, Inc. that uses the Finite Difference Time Domain (FDTD) algorithm to calculate the electromagnetic near field and far field energy distributions around plasmonic nanostructures as well their interactions with point dipole sources, which is used as an analogue for fluorophores.
- Experienced in using the WiTec α Near Field Scanning Optical Microscope (NSOM) for imaging the near field energy distributions around plasmonic nanostructures and their interactions with organic fluorophores.
- Was part of the research group to first experimentally demonstrate the existence of the metal enhanced chemiluminescence phenomena using silver island films (SIFs) and also to experimentally prove the coupling of chemically induced electronic excited states into surface plasmons on continuous silver films followed by their directional emission.
- Have wide experience in developing techniques for optimizing metal enhanced fluorescence (MEF) and surface plasmon-coupled emission (SPCE) applications, which involve enhancing both the signal strength and collection efficiency of the emission of optically excited luminescent probes that are used extensively in biotechnology.
- Have experience in the fabrication of thin films of molecules on top of metallic nanostructures using spin coating, dip coating and molecular self assembly techniques for applications involving MEF, SPCE and SERS.
- Configured a Spectra Physics Laser to a Photon Technologies Intl. Fluorescent Spectrometer and worked on developing a nanoparticle based surface modified fluorescence assay for the detection of prion proteins.
- Worked with a Beckmann DU 640 UV-Visible Spectrophotometer to develop an assay to monitor the differences in the ability of various oligonucleotides to influence the aggregation of colloidal gold nanoparticles.

TEACHING EXPERIENCE

08/00-05/01: Graduate Teaching Assistant for the Biomedical Engineering Department at Texas A&M University. Laboratories taught were:

- “BMEN 308 - Bioinstrumentation” – The labs for this course covered topics such as the use of Operational Amplifiers for building Instrumentation Amplifiers, design of a Thermometer using the Wheatstone Bridge circuit, design of an Electrocardiogram (ECG) and Photoplethysmograph and introduction to Diodes, and Transistors.
- “BMEN 309- Biosignal Processing” – The labs for this course covered topics such as the use of Labview for data acquisition, signal generation and data processing for implementation in the design of an Electrocardiogram, heart rate monitoring system and digital thermometer.
- Gave short lectures on the theoretical principles on each topic in the beginning of each lab. Also gave substitute theory lectures in class when instructors were absent.

01/99 – 05/00: Graduate Tutor at the Minority Engineering Program (MEP) at California State University at Long Beach, CA. Tutored undergraduate courses in Linear Circuit Analysis (Time Domain and Frequency Domain) and Electricity and Magnetism.

NATIONAL AND LOCAL SERVICE

- 2007: Guest Editor for special issue of the peer-reviewed journal *Plasmonics*, “Advances in Metal-Molecular Interactions”, Mustafa H. Chowdhury and Chris D. Geddes - Editors of the special issue, *Plasmonics*, vol. 2, no. 3, (2007).
- 2007: Reviewer, of the peer-reviewed journal *Analytical Chemistry* from the American Chemical Society.
- 2008: Reviewer, of the peer-reviewed journal *Journal of Chemical Physics* from the American Institute of Physics.
- 2008: Reviewer, of the peer-reviewed journal *Journal of Physical Chemistry* from the American Chemical Society.
- 2008: Reviewer, of the peer-reviewed journal *Journal of American Chemical Society* from the American Chemical Society.

PUBLICATIONS

A. Peer Reviewed Journal Publications

1. **M. H. Chowdhury**, A. M. Julian, C. J. Coates, and G. L. Coté, “Detection of differences in oligonucleotide-influenced aggregation of colloidal gold nanoparticles using absorption spectroscopy”, *Journal of Biomedical Optics*, vol. 9(6), pp. 1347-1357 (2004).
2. **M. H. Chowdhury**, V. A. Gant, A. Trache, A. Baldwin, G. A. Meininger, and G. L. Coté, “The use of surface enhanced Raman spectroscopy for the detection of human integrins”, *Journal of Biomedical Optics*, vol. 11(2), pp. 024004, (2006).

3. **M. H. Chowdhury**, K. Aslan, S. N. Malyn, J. R. Lakowicz, and C. D. Geddes, “Metal-enhanced chemiluminescence”, **Cover Page Article**, *Journal of Fluorescence*, vol. 16(3), pp. 295-299, (2006).
4. **M. H. Chowdhury**, K. Aslan, S. N. Malyn, J. R. Lakowicz, and C. D. Geddes, “Metal-enhanced chemiluminescence: Radiating plasmons generated from chemically induced electronic excited states”, *Applied Physics Letters*, vol. 88, pp. 173104, (2006).
5. **M. H. Chowdhury**, S. N. Malyn, K. Aslan, J. R. Lakowicz, and C. D. Geddes, “Multicolor Directional Surface Plasmon-Coupled Chemiluminescence”, *Journal of Physical Chemistry B*, vol. 110, pp. 22644-22651, (2006).
6. **M. H. Chowdhury**, S. N. Malyn, K. Aslan, J. R. Lakowicz, and C. D. Geddes, “First observation of surface plasmon-coupled chemiluminescence (SPCC)”, *Chemical Physics Letters*, vol. 435, pp. 114-118, (2007).
7. **M. H. Chowdhury**, S. K. Gray, J. Pond, C. D. Geddes, K. Aslan, and J. R. Lakowicz, “Computational study of fluorescence scattering by silver nanoparticles”, *Journal of the Optical Society of America B*, vol. 24(9), pp. 2259-2267 (2007).
8. **M. H. Chowdhury**, Jeffrey M. Catchmark, and J. R. Lakowicz, “Imaging 3-Dimensional Light Propagation through Periodic Nanohole Arrays using Scanning Aperture Microscopy”, *Applied Physics Letters*, vol. 91, pp. 103118, (2007).
9. **M. H. Chowdhury**, K. Ray, K. Aslan, J. R. Lakowicz, and C. D. Geddes, “Metal enhanced fluorescence of phycobiliproteins from plasmonic nanostructures”, *Journal of Physical Chemistry C*, vol. 111, pp. 18856-18863, (2007).
10. **M. H. Chowdhury**, K. Ray, C. D. Geddes, and J. R. Lakowicz, “Use of Silver Colloidal Nanoparticles to Enhance Surface Plasmon-Coupled Emission (SPCE)”, *Chemical Physics Letters*, vol. 452, pp. 162-167, (2008).
11. **M. H. Chowdhury**, J. Pond, S. K. Gray, and J. R. Lakowicz, “Systematic computational study of the effect of silver nanoparticle dimers on the coupled emission from nearby fluorophores”, *Journal of Physical Chemistry C*, vol. 12, pp. 11236-11249, (2008).
12. **M. H. Chowdhury**, K. Ray, S. K. Gray, J. Pond, and J. R. Lakowicz, “Aluminum Nanoparticles as Substrates for Metal-Enhanced Fluorescence in the Ultraviolet for the Label-Free Detection of Biomolecules”, *Analytical Chemistry*, vol. 81, pp. 1397-1403 (2009).
13. K. Ray, **M. H. Chowdhury**, and J. R. Lakowicz, “Aluminum Nano-structured Films as Substrates for Enhanced Fluorescence in the Ultraviolet - Blue Spectral Region”, *Analytical Chemistry*, **Accelerated Article**, vol. 79(17), pp. 6480-6487, (2007).

14. X. Wu, **M. H. Chowdhury**, C. D. Geddes, K. Aslan, R. Domszy, J. R. Lakowicz, and A. J-M. Yang, "Use of surface plasmon-coupled emission (SPCE) for enhancing light transmission through top-emitting organic light emitting diodes (OLEDs)", *Thin Solid Films*, vol. 516(8), pp. 1977-1983, (2008).
15. K. Ray, **M. H. Chowdhury**, and J. R. Lakowicz, "A Single Molecule Spectroscopic Study of Enhanced Intrinsic Phycoerythrin Fluorescence on Silver Nanostructured Surfaces", *Analytical Chemistry*, **Cover Page Article**, vol. 80, pp. 6942-6948 (2008).
16. K. Ray, **M. H. Chowdhury**, H. Szmazinski, and J. R. Lakowicz, "Metal-enhanced Intrinsic Fluorescence of Proteins on Silver Nanostructured Surfaces towards Label-Free Detection", *Journal of Physical Chemistry C*, vol. 112, pp. 17957-17963, (2008).
17. K. Ray, **M. H. Chowdhury**, and J. R. Lakowicz, "Observation of Surface Plasmon Coupled Emission using Thin Platinum Films", *Chemical Physics Letters*, vol. 465, pp. 92-95, (2008).
18. J. Henry, A. Anand, **M. Chowdhury**, G. Coté, R. Moreira and T. Good, "Development of a nanoparticle based surface-modified fluorescence assay for the detection of prion proteins", *Analytical Biochemistry*, vol. 334, pp. 1-8 (2004).
19. J. Zhang, Y. Fu, **M. H. Chowdhury**, and J. R. Lakowicz, "Metal-Enhanced Single-Molecule Fluorescence on Silver Particle Monomer and Dimer: Coupling Effect between Metal Particles", *Nano Letters*, vol. 7(7), pp. 2101-2107, (2007).
20. J. Zhang, Y. Fu, **M. H. Chowdhury**, and J. R. Lakowicz, "Enhanced Forster Resonance Energy Transfer (FRET) on Single Metal Particle 2: Dependence on Donor-Acceptor Separation Distance, Particle Size, and Distance from Metal Surface", *Journal of Physical Chemistry C*, vol. 111, pp. 11784-11792, (2007).
21. J. Zhang, Y. Fu, **M. H. Chowdhury**, and J. R. Lakowicz, "Single Molecule Studies on Fluorescently Labeled Silver Particles: Effects of Particle Size", *Journal of Physical Chemistry C*, vol. 112, pp. 18-26, (2008).
22. J. Zhang, Y. Fu, **M. H. Chowdhury**, and J. R. Lakowicz, "Plasmon-Coupled Fluorescence Probes: Effect of Emission Wavelength on Fluorophore-Labeled Silver Particles", *Journal of Physical Chemistry C*, vol. 112, pp. 9172-9180, (2008).
23. J. R. Lakowicz, K. Ray, **M. Chowdhury**, H. Szmazinski, Y. Fu, J. Zhang, K. Nowaczyk, "Plasmon-Controlled Fluorescence: A New Paradigm in Fluorescence Spectroscopy", *The Analyst*, vol. 133, pp. 1308-1346 (2008).
24. A. Anand, R. Moriera, J. Henry, **M. Chowdhury**, G. Coté and T. Good, "A biodetection strategy for the detection of prions in foods", *LWT – Food Science and Technology*, vol. 38, pp. 849-858, (2005).

B. Conference Papers and Proceedings

1. **M. H. Chowdhury**, B. Atkinson, T. Good and G. L. Coté, “Surface Enhanced Raman Spectroscopy for the detection of pathogenic protein and DNA in foods”, *Proceedings of SPIE on Optical Diagnostics and Sensing in Biomedicine III*, San Jose, CA, vol. 4965, pp. 111-115, (2003).
2. V. A. Gant, **M. H. Chowdhury**, G. A. Meininger, and G. L. Coté, “Detection of integrins using surface-enhanced Raman spectroscopy”, *Proceedings of SPIE on Optical Diagnostics and Sensing in Biomedicine IV*, San Jose, CA, vol. 5325, pp. 174-178, (2004).
3. **M. H. Chowdhury**, A. J. Marian, C. J. Coates and G. L. Coté, “UV-Visible Absorption Spectroscopy for the detection of differences in oligonucleotide influenced aggregation of colloidal gold nanoparticles”, *Proceedings of SPIE on Nanobiophotonics and Biomedical Application II*, San Jose, CA, vol. 5705, pp. 108-113, (2005).
4. **M. H. Chowdhury**, A. Anand, J. E. Henry, R. Moreira, T. A. Good, and G. L. Coté, “The use of Surface Enhanced Raman Spectroscopy (SERS) in a Competitive Affinity Binding Assay for the Detection of Prions”, *Proceedings of the 25th Annual International Conference of the IEEE EMBS*, pp. 3049-3051, Cancun, Mexico, September 17-21, (2003).
5. **M. H. Chowdhury**, A. Anand, J. E. Henry, R. Moreira, T. A. Good, and G. L. Coté, “Implementation and optimization of a surface enhanced Raman spectroscopy (SERS) based competitive binding assay for the detection of prions”, *Annual Fall Biomedical Engineering Society (BMES) Meeting*, Nashville, TN, October 2-4, (2003).
6. **M. H. Chowdhury**, V. A. Gant, A. Trache, A. Baldwin, G. A. Meininger and G. L. Coté, “Detection of two forms of human integrins using Surface Enhanced Raman Spectroscopy (SERS)”, *Annual Fall Biomedical Engineering Society (BMES) Meeting*, Baltimore, MD, September 28 – October 1, (2005).
7. **M. H. Chowdhury**, C. J. Campbell, E. Theofanidou, S. J. Lee, A. Baldwin, G. Sing, A. T. Yeh, J. Crain, P. Ghazal and G. L. Coté, “Surface enhanced Raman spectroscopy (SERS) for the detection of intracellular constituents using gold nanoshells”, *Proceedings of SPIE on Plasmonics in Biology and Medicine III*, San Jose, CA, vol. 6099, 609905, (2006).
8. J. R. Lakowicz, **M. H. Chowdhury**, K. Ray, J. Zhang, Y. Fu, R. Badugu, C. R. Sabanayagam, K. Nowaczyk, H. Szmajcinski, K. Aslan and C. D. Geddes, “Plasmon-controlled fluorescence: A new detection technology”, *Proceedings of SPIE on Plasmonics in Biology and Medicine III*, San Jose, CA, vol. 6099, 609909, (2006).
9. **M. H. Chowdhury**, C. R. Sabanayagam, J. Catchmark, and J. R. Lakowicz, “Plasmonic Properties of Ordered Metallic Nanostructures”, *National Institute of Health (NIH)*

Biomedical Technology Resource Centers Principal Investigators Meeting – Creating Biotechnology for Tomorrow’s Clinic, Poster Session, Bethesda, MD, June 19, (2006).

10. **M. H. Chowdhury**, K. Aslan, S. N. Malyn, J. R. Lakowicz, and C. D. Geddes, “Metal Enhanced Chemiluminescence (MEC)”, *National Institute of Health (NIH) Biomedical Technology Resource Centers Principal Investigators Meeting – Creating Biotechnology for Tomorrow’s Clinic*, Poster Session, Bethesda, MD, June 19, (2006).
11. **M. H. Chowdhury**, K. Ray, and J. R. Lakowicz, “Use of aluminum films as substrates for enhanced fluorescence in the ultraviolet-blue spectral region”, *Proceedings of SPIE on Plasmonics in Biology and Medicine V*, San Jose, CA, vol. 6869, pp. 68690E1-12, (2008).
12. J. Zhang, Y. Fu, K. Ray, **M. H. Chowdhury**, H. Szmecinski, K. Nowaczyk, J. R. Lakowicz, “Single molecule photophysics near metallic nanostructures”, *Proceedings of SPIE on Single Molecule Spectroscopy and Imaging*, San Jose, CA, vol. 6862, (2008).
13. **M. H. Chowdhury**, S. K. Gray, J. Pond, and J. R. Lakowicz, “Computational study of the interaction of fluorophores with various metallic nanoparticle systems”, in press, *Proceedings of SPIE on Plasmonics in Biology and Medicine VI*, San Jose, CA, vol. 7192, pp. 7192F1-12, (2009).

C. Books and Chapters

1. K. Ray, **M. H. Chowdhury**, J. Zhang, Y. Fu, H. Szmecinski, K. Nowaczyk, and J. R. Lakowicz, “Plasmon-Controlled Fluorescence towards High-sensitivity Optical Sensing” in *Advances in Biochemical Engg/Biotechnology Special Volume : Optical Sensors*, Ed. G. Rao, in press, Springer (New York), **2008**.
2. **M. H. Chowdhury**, K. Ray, and J. R. Lakowicz, “The Use of Aluminum Nanostructures in Plasmon-Controlled Fluorescence Applications in the Ultra-Violet Towards the Label Free Detection of Biomolecules” in *Comprehensive Nanoscience and Technology Vol. 6 - Nanofabrication and devices/Nano-photonic devices*, Eds. D. Andrews, Greg Scholes and G. Wiederrecht, in press, Elsevier (Amsterdam), **2009**.

ORAL AND POSTER PRESENTATIONS AT CONFERENCES

1. **M. H. Chowdhury**, B. Atkinson, T. Good and G. L. Coté, “Surface Enhanced Raman Spectroscopy for the detection of pathogenic protein and DNA in foods”, Oral Presentation at the *Photonics West BiOS Conference*, San Jose, CA, Jan. (2003).
2. V. A. Gant, **M. H. Chowdhury**, G. A. Meininger, and G. L. Coté, “Detection of integrins using surface-enhanced Raman spectroscopy”, Poster Presentation at the

Photonics West BiOS Conference, San Jose, CA, Jan. (2004).

3. **M. H. Chowdhury**, A. J. Marian, C. J. Coates and G. L. Coté, “UV-Visible Absorption Spectroscopy for the detection of differences in oligonucleotide influenced aggregation of colloidal gold nanoparticles”, Oral Presentation at the *Photonics West BiOS Conference*, San Jose, CA, Jan. 22-27 (2005).
4. **M. H. Chowdhury**, V. A. Gant, A. Trache, A. Baldwin, G. A. Meininger and G. L. Coté, “Detection of two forms of human integrins using Surface Enhanced Raman Spectroscopy (SERS)”, Oral Presentation at the *Annual Fall BMES Meeting*, Baltimore, MD, September 28 – October 1 (2005).
5. **M. H. Chowdhury**, C. R. Sabanayagam, J. Catchmark, and J. R. Lakowicz, “Plasmonic Properties of Ordered Metallic Nanostructures”, *National Institute of Health (NIH) Biomedical Technology Resource Centers Principal Investigators Meeting – Creating Biotechnology for Tomorrow’s Clinic*, Poster Presentation at the Poster Session, Bethesda, MD, June 19 (2006).
6. **M. H. Chowdhury**, K. Aslan, S. N. Malyn, J. R. Lakowicz, and C. D. Geddes, “Metal Enhanced Chemiluminescence (MEC)”, *National Institute of Health (NIH) Biomedical Technology Resource Centers Principal Investigators Meeting – Creating Biotechnology for Tomorrow’s Clinic*, Poster Presentation at the Poster Session, Bethesda, MD, June 19 (2006).
7. **M. H. Chowdhury**, K. Ray, and J. R. Lakowicz, “Use of aluminum films as substrates for enhanced fluorescence in the ultraviolet-blue spectral region”, Oral Presentation at the *Photonics West BiOS Conference*, San Jose, CA, Jan. 18-24 (2008).
8. **M. H. Chowdhury**, S. K. Gray, J. Pond, and J. R. Lakowicz, “Computational study of the interaction of fluorophores with various metallic nanoparticle systems”, Oral Presentation at the *Photonics West BiOS Conference*, San Jose, CA, Jan. 23-29 (2009).
9. **M. H. Chowdhury**, K. Ray, J. Zhang, and J. R. Lakowicz, “Fluorophore Conjugated Silver Nanoparticles: A Time-resolved Fluorescence Correlation Spectroscopic Study”, Oral Presentation at the *Photonics West BiOS Conference*, San Jose, CA, Jan. 23-29 (2009).

US PATENTS

1. US Provisional Application No. 60/923,577. J. R. Lakowicz, **M. H. Chowdhury**, and C. R. Sabanayagam, “Subwavelength Resolution Optical Microscopy”, filed April 16, 2007. UMB Ref: JL-2007-088.

US Non-Provisional patent application filed with the U.S. Patent and Trademark Office on April 15, 2008. Title: "Subwavelength Resolution Optical Microscopy", UMB Ref:

JL-2007-088, Docket No: D6821.

2. US Provisional Application No. 61/087,585. J. R. Lakowicz, H. Szmecinski, K. Ray, **M. H. Chowdhury**, K. Nowaczyk, "Metal-Enhanced Fluorescence for the Label-Free Detection of Interacting Biomolecules", filed August 8, 2008. UMB Ref: JL-2009-007.