



Joseph Irudayaraj
Ph.D. Purdue University - 1990

Professor, Agricultural & Biological Engineering
Deputy Director, Bindley Bioscience Center

University Faculty Scholar Award, Purdue University, 2010
Excellence in Research Award, Office of the Vice President for Research, 2012
Fellow, American Institute of Medical and Biological Engineers, 2014
College of Engineering Research Excellence Award, Purdue University, 2015

Research Areas:

(i) Biosensors and nanomaterials for disease detection and food safety, (ii) Confocal raman spectroscopy for intracellular quantification of drugs/proteins, (iii) Single molecule studies of protein aggregation in/on living cells, DNA and receptor oligomerization dynamics in living cells.

Classes Taught:

ABE 450 – Finite Element Method in Design and Optimization
ABE 485 – Senior Engineering Design
ABE 560 – Biosensors
ABE 591T – Introduction to Biophysics

Selected Publications:

- Ren, W., Mura, S., and Irudayaraj, J. Modified graphene oxide sensors for ultrasensitive detection of nitrate ions in water. *Talanta*. 10.1016/j.talanta.2015.05.073.
- Zhou, Z., Cho, I., Shan, Z., and Irudayaraj, J. 2015. Cross-platform detection of epigenetic modifications from extracted chromatin in leucocytes from blood. *Analytical Chemistry Research*, doi:10.1016/j.ancr.2015.04.002.
- Cho, I., Bhunia, A., Irudayaraj, J. 2015. Rapid pathogen detection by lateral-flow immunochromatographic assay with gold nanoparticle-assisted enzyme signal amplification. *International Journal of Food Microbiology*. 206: 60-66.
- Cho, I., Das, M., Bhandari, P., and Irudayaraj, J. 2014. High performance immunochromatographic assay combined with surface enhanced Raman spectroscopy. *Sensors and Actuators: B. Chemical*. 213: 209-214.
- Liu, J., Hu, Y., Kumar, P., Cheng, G., and Irudayaraj, J. 2014. Enhanced Multi-Photon Emission from CdTe/ZnS Quantum Dots Decorated on Single Layer Graphene. *J. Phys Chem. C*. 119(1): 6331-6336.
- Cui, Y., Naz, A., Thompson, D., Irudayaraj, J. 2014. Decitabine Nano-conjugate Sensitizing Human Glioblastoma Cells to Temozolomide. *Molecular Pharmaceutics*. doi: 10.1021/mp500815b.
- Chowdhury, B., Chen, J., Liu, S., Lossie, A., and Irudayaraj, J. 2015. Effect of AZA on hydroxymethylation – exploring a novel effect. **Nature Scientific Reports**, doi: 10.1038/srep09281.
- Liu, J., Cho, I-H., Cui, Y., and Irudayaraj, J. 2014. Second harmonic super-resolution microscopy for quantification of mRNA at single copy resolution. *ACS Nano*, 8 (12): 12418–12427.
- Zhou, Z. and Irudayaraj, J. 2014. A native chromatin extraction method based on salicylic acid coated magnetic nanoparticles and characterization of chromatin. *Analyst*, 140(3): 938-44.
- Cui, Y. and Irudayaraj, J. 2014. Understanding cells: quantitative analysis with advanced optics and nanomaterials. *WIREs Nanomedicine and Nanobiotechnology*. DOI: 10.1002/wnan.1321
- Cui, Y. and Irudayaraj, J. 2014. Dissecting the behavior and function of MBD3 in DNA methylation homeostasis by single-molecule spectroscopy and microscopy. *Nucleic Acids Research*. doi: 10.1093/nar/gkv098.
- Vidi, P., Liu, J., Lelièvre, S., and Irudayaraj, J. 2014. Nanoscale localization microscopy reveals reduced chromatin mobility in response to DNA damage in single live cells. *Journal of Cell Science*. doi: 10.1242/jcs.161885.
- Shalaginov, M.Y., Vorobyov, V.V., Liu, J., Ferrera, M., Akimov, A., Lagutchev, A., Smolyaninov, A., Klimov, V., Irudayaraj, J., Kildishev, A., Boltasseva, A., and Shalaev, V. 2014. Enhancing the nanodiamond nitrogen-vacancy single-photon source with TiN/AlScN hyperbolic metamaterial superlattice. *Laser & Photonics Reviews*, 9(1): 120-127.
- Cho, I-H., Bhandari, P., Patil, P., and Irudayaraj, J. 2014. Membrane filter-assisted surface enhanced Raman spectroscopy for the rapid detection of E. coli O157:H7 in ground beef. *Biosensors and Bioelectronics*, 64: 171-176.
- Liu, J., Ishii, S., Shalaev, V. and Irudayaraj, J. 2014. Quantifying local density of optical states in single nanorods by fluorescence lifetime distribution. *New Journal of Physics*. 16, 063069.
- Craig, A., Franca, A., Oliveira, L., Irudayaraj, J., and Iileji, K. 2014. Fourier transform infrared spectroscopy and near infrared spectroscopy for the quantification of defects in roasted coffee. *Talanta*, 03/2015; 134:379–386. DOI: 10.1016/j.talanta.2014.11.038.
- Craig, A., Franca, A., Oliveira, L., Irudayaraj, J., and Iileji, K. 2014. Application of elastic net and infrared spectroscopy in the discrimination between defective and non-defective roasted coffees. *Talanta* 128, 393-400.
- Cui, Y., Choudhury, S., and Irudayaraj, J. 2014. Quantitative real-time kinetics of optogenetic proteins CRY2 and CIB1/N using single-molecule tools. *Analytical biochemistry* 458, 58-60.
- Cho, I-H., Mauer, L., and Irudayaraj, J. 2014. In-situ fluorescent immunomagnetic multiplex detection of foodborne pathogens in low numbers. *Biosensors & Bioelectronics*. 57, 143- 148.
- Narsireddy, A., Vijayashree, K., Irudayaraj, J., Manorama, S., and Rao M. Targeted in vivo photodynamic therapy with epidermal growth factor receptor-specific peptide linked nanoparticles. *International Journal of Pharmaceutics*. 471(1-2):421-9.
- Naik, G., Saha, B., Liu, J., Saber, S., Stach, E., Irudayaraj, J., Sands, T., Shalaev, V., and Boltasseva, A. 2014. Epitaxial superlattices with titanium nitride as a plasmonic component for optical hyperbolic metamaterials. **Proceedings of the National Academy of Sciences** 111 (21), 7546-7551.
- Chowdhury, B., Cho, I., Cui, Y., and Irudayaraj, J. 2014. Detection of 5mC, 5hmC, 5fC, and 5caC using a modified ELISA approach. *Analytica Chimica Acta*. DOI: 10.1016/j.aca.2014.09.020.
- Chen, H., Weng, T-W., Ticcitelli, M., Cui, Y., Irudayaraj, J., and Choi, J. 2014. Understanding the Mechanical Properties of DNA Origami Tiles and Controlling the Kinetics of Their Folding and Unfolding Reconfiguration. *JACS*. 136(19):6995-7005.