

## Dr Colin Campbell EaStCHEM Research Fellow

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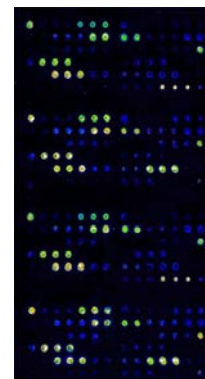
Research Interests: Biosensor research, electrochemistry, SERS, nanotechnology.



My research group is interested in understanding the fundamental interactions between biomolecules and physical systems. This involves both electrochemical and photochemical research, the ultimate goal of which is the integration of physical sciences and life sciences for the benefit of applications and understanding in medicine. Our research focuses on arrays of biosensors, new imaging modalities or combinations thereof. Devices resulting from these studies find early applications in biosensors but also have enormous potential for the study of dynamics within cells.

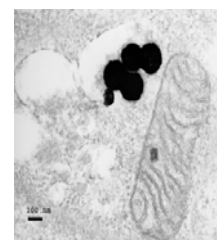
### SERS nanosensors

SERS nanosensors are engineered nanoparticles which can be used to monitor or image physiological processes inside cells. We have recently demonstrated that our nanosensors can be delivered to cells without impairing cell growth or causing cell death – this is a prerequisite of any intracellular sensing mechanism. We have also demonstrated that our sensors can be made sensitive to concentrations of specific proteins by coating them with aptamers, or to factors such as pH or redox potential by coating them with engineered small molecules. Our ongoing work, in collaboration with colleagues in the College of Medicine and Veterinary Medicine, will investigate the importance of redox potential in the regulation of a variety of important physiological processes.



### Microarrays

Microarray is a format that allows the creation of orderly patterns of small features. Features can be molecules such as proteins or DNA and such microarrays can thus be used to screen biological samples for multiple biomarkers. We work with both protein and DNA microarrays in a variety of formats and our research interests include new amplification methods, arrays of nanoswitches, new microarray imaging modalities and protein microarrays for label-free cell phenotyping.



## SELECTED RECENT PUBLICATIONS

Alessandro Ceroni, Sahar Sibani, Josh Labaer, Juergen Haas, **Colin J. Campbell**  
Self assembled protein microarray for genome wide studies of host-VZV interactions. Published online Mol. Biosyst., 2010, DOI: 10.1039/C003798B Emerging Investigators Special Issue (*Front cover*)  
**First whole proteome screen of viral immune response.**

Michael A. Ochsenkühn, **Colin J. Campbell**  
Probing biomolecular interactions using surface enhanced Raman spectroscopy: label-free protein detection using a G-quadruplex DNA aptamer. *Chemical Communications*, 2010, 46, 2799. *Featured in MIT Technology Review, The Metro and The Caledonian Mercury.*  
**First demonstration of the measurement of biomolecular conformational changes as a result of protein-DNA binding using SERS.**

Robinson, I.; Ochsenkühn, M.A.; **Campbell, C.J.**; Giraud, G.; Hossack, W.J.; Arlt, J.; Crain, J.  
Intracellular imaging of host-pathogen interactions using combined CARS and two-photon fluorescence microscopies  
*Journal of Biophotonics* 2010, 3, 138-146 (*Front cover*)  
**First demonstration of combined two-photon/CARS imaging for studying lipid trafficking and reorganization over the course of a viral infection.**

Michael A. Ochsenkühn, Philip R.T. Jess; Helene Stoquert; Kishan Dholakia; **Colin J. Campbell**, Nanoshells for Surface enhanced Raman Spectroscopy in eucaryotic cells: cellular response and sensor development.  
*ACS Nano* 2009, 3 (11), 3613–3621 (*Featured in a AC today, Analytical Chemistry news piece*)  
**First demonstration of the use of nanoshells for intracellular SERS imaging without inducing toxic effects on the cell.**