Our Faculty

Songon An
(san@umbc.edu)

Cellular biochemistry and enzymology investigating regulatory mechanisms of metabolic macromolecular complexes; transient protein-protein interactions and cellular enzyme kinetics, via fluorescence live-cell imaging and chemical biology techniques.

Bradley R. Arnold
(barnold@umbc.edu)

Ultra-fast laser techniques to study the dynamics of electron transfer reactions. Developing innovative spectroscopic techniques for remote sensing of pollutants and hazardous materials. Time-correlated single photon counting, transient absorption and laser induced fluorescence measurements are carried out in our state-of-the-art laser facility.

Joseph W. Bennett
(bennettj@umbc.edu)

Atomistic simulations of materials related to human health, energy, and the environment. Using first-principles calculations and data mining techniques we predict structure-property relationships of new functional materials to be used in energy generation and energy storage and the thermodynamics of surface transformations of minerals found in the natural and built environment.

Chengpeng Chen
(cpchen@umbc.edu)

Development of quantitative Organs-on-a-Chip models for physiological and pharmaceutical studies. 3D-printing, soft lithography, and electrospinning are used to fabricate microfluidic devices with 3D cell culture scaffolds. Spectroscopy, electrochemistry, and LC-MS are used to quantitate molecules of interest.

Brian M. Cullum
(cullum@umbc.edu)

Development of laser-based intracellular nanosensors for bio-medical and defense applications, as well as the development of non-invasive cancer imaging techniques.

Marie-Christine Daniel
(mdaniel@umbc.edu)

Preparation of targeted imaging contrast agents and multifunctional drug delivery systems based on gold nanoparticles and/or dendrons, for better monitoring of heart diseases and for optimization of drug efficiency in cancer therapy, respectively.

Chris D. Geddes
(geddes@umbc.edu)

Development and applications of fluorescence spectroscopy, including the discovery of metal-enhanced fluorescence and other plasmonic phenomenon for the ultrafast and sensitive detection of clinical and infectious targets, e.g. Anthrax, STDs, Salmonella, Listeria.

Lisa Kelly
(lkelly@umbc.edu)

Structure function relationships of fluorescent smart coatings and polymer sensors; optical spectroscopy of photoactivated compounds for elucidating macromolecular dynamics.

Deepak Koirala
(dkoirala@umbc.edu)

The research in Koirala laboratory focuses on understanding the structures and functions of RNA molecules associated with viral translation and human repeat expansion disorders using X-ray crystallography and other biochemical, biophysical and molecular biology methods towards exploring the opportunities for developing RNA-targeted therapeutics to treat both infectious and genetic diseases.

The Department of Chemistry and Biochemistry at UMBC

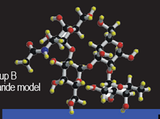
is a highly cross-disciplinary and interactive group of faculty, PhD and MS seeking graduate students and undergraduate majors engaged in cutting edge research at the molecular level. Programs that are supported by millions of dollars annually in federal, state and private funding focus on a diverse array of topics from Alzheimer's, cancer and HIV to laser initiated molecular processes, biophysics, nanotechnology and Homeland Security.

The University is strategically situated on a suburban campus in the intellectually and socially vibrant Baltimore-Washington corridor which enhances the dynamic educational and research opportunities afforded by its diversity, intermediate size and world-class infrastructure.

Faculty Research Areas

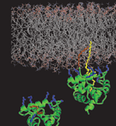
Fluorescent polymers and nano-particles as optical biosensors

Probe for brain tumor margining



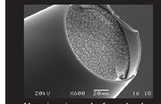
A blood group B oligosaccharide model

Crystal structure of the core domain of the T4 gene 32 protein complexed to a short oligonucleotide



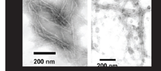
Structural basis for targeting HIV-1 proteins to virus assembly sites on the plasma membrane.

Hepatitis C virus RNA polymerase showing allosteric inhibitor (arrow) bound to the enzyme, ~30 Å from the active site (circled)

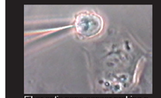


Nano-imaging probe for molecular scale chemical imaging

CHEM & BIOCHEM FACULTY	Analytical	Biochemistry	Computational/Theory	Drug Design/Synthesis	Forensics/Toxicology	Organic	Physical/Inorganic	Sensors/Imaging	Spectroscopy/Dynamics	Structural Biology	Nanomaterials
An, Songon		★		★				★	★		
Arnold, Bradley							★	★	★		
Bennett, Joseph			★				★				★
Chen, Chengpeng	★	★						★			
Cullum, Brian	★							★	★		★
Daniel, Marie-Christine	★					★	★	★			★
Geddes, Christopher	★		★				★	★	★		
Kelly, Lisa							★	★	★		
Koirala, Deepak		★								★	
Kyoung, Minjoung	★	★					★	★	★		
LaCourse, William	★				★			★			
Liebman, Joel			★			★	★				
Plaszek, Marcin					★			★	★		
Rosenzweig, Zeev	★				★		★			★	★
Seley-Radtke, Katherine		★		★		★					
Smith, Aaron		★					★			★	
Smith, Paul				★		★					
Summers, Michael										★	

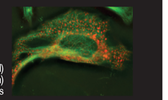


TEM images of amyloid fibers formed by peptide implicated in Alzheimer's disease

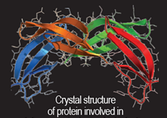


Fiber optic nano-sensor probing a single cell

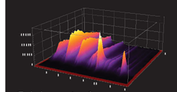
Multifunctional material binding peptides used to co-assemble conducting and electro-active materials for Li ion batteries



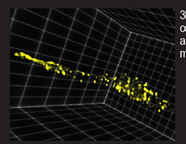
Purinosomes (red) and microtubule network (green) in live HeLa cells



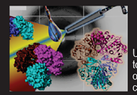
Crystal structure of protein involved in defense against microbial infection



Emission spectra of nitrogen excited states on the nanosecond timescale



3D distribution of macromolecular complexes in live cell imaged by a home-built super-resolution microscope



Use of x-ray crystallography to determine the 3D structure of proteins relevant to cardiovascular diseases

Centers and Institutes at UMBC

Core Shared Resource Facility at UMBC

- 400 and 500 MHz NMR
- 12 Tesla ICR ESI-MS, MALDI-TOF, UHPLC-ESI-TOF, HPLC-ESI-Triple Quad, Nano HPLC-ESI-Ion trap, GC-EI-MS
- FT-IR, UV-Vis spectrophotometers, Fluorescence Luminometer
- Phosphorimager / Densitometer (Molecular Dynamics Typhoon 9200)
- Electron paramagnetic resonance (EPR) spectrometer
- Ultrafast laser facilities (including femtosecond and picosecond lasers)

Howard Hughes Medical Institute at UMBC

- Center for the study of how retroviruses assemble and package their RNA genomes
- Facilities include 600 and 800 MHz NMR spectrometers

The Institute of Fluorescence at UMBC

- State-of-the-art facility for Fluorescence and Plasmonics disciplines and their applications (http://theinstituteoffluorescence.com/)
- Facilities include Single Molecule, TCSPC, FCS, FLIM, Confocal

Our Faculty

Minjoung Kyoung
(mjkyoung@umbc.edu)

Development and applications of biophysical and bioanalytical techniques to investigate real-time protein dynamics *in vivo* and *in vitro*. Mapping spatiotemporal coupling networks of metabolic pathways with signaling pathways to understand metabolism-associated human diseases via novel single molecule techniques.

William R. LaCourse
(lacourse@umbc.edu)

Development of novel electroanalytical techniques following advanced chromatographic separations to solve environmental, forensic, pharmaceutical, and toxicological problems.

Joel F. Liebman
(jliebman@umbc.edu)

My work is highly interdisciplinary, eclectic, conceptual and diverse. It is both qualitative and mathematical. Major areas of interest include exotic organic and inorganic structures; noble gas, fluorine and other main group species; strain, aromaticity and the estimation of energetics; rules and regularities for the explanation, understanding and prediction of chemical phenomena.

Marcin Ptaszek
(mptaszek@umbc.edu)

Chemistry of tetrapyrrolic macrocycles; fundamental studies on the optical properties of porphyrins, chlorins, bacteriochlorins and their arrays. Development of new fluorescent probes for in vivo imaging and their applications for cancer diagnosis.

Zeev Rosenzweig
(zrosenzw@umbc.edu)

Next generation nanomaterials with a focus on minimizing adverse impact of nanomaterials on human health and the environment. Studies involve the synthesis and characterization of semiconductor and metal nanoparticles; understanding their interactions with biological and environmental systems; and using them as non-invasive probes and imaging agents.

Katherine Seley-Radtke
(kseley@umbc.edu)

Design, synthesis and biological investigation of nucleoside and heterocyclic therapeutics to treat infectious diseases and cancer, as well as to develop strategies to fight emerging resistance to currently used drugs.

Aaron T. Smith
(smitha@umbc.edu)

The Smith laboratory uses structural, spectroscopic, and biophysical techniques to study the roles of transition metals in biology: the role of iron in translation and posttranslational modification of proteins implicated in cardiovascular and developmental diseases; the structure, mechanism, and selectivity of integral membrane and soluble proteins involved in pathogenic bacterial iron acquisition.

Paul J. Smith
(pjsmith@umbc.edu)

Design and synthesis of inhibitors of viral replication by hepatitis C, including analogs of the natural product UK-1 that inhibit the viral helicase enzyme.

Michael F. Summers
(summers@hhmi.umbc.edu)

The Summers laboratory uses nuclear magnetic resonance and other biophysical methods to study the structures and interactions of proteins and nucleic acids of HIV-1, the virus that causes AIDS.

Chemistry/Biology Interface Program

The UMBC Chemistry/Biology Interface (CBI) program is an NIH supported program designed for those graduate students interested in pursuing cross-disciplinary training in the chemical and biological sciences. The program will prepare the students for the challenges of the 21st century, where those who possess multi-disciplinary training will have significant advantages. As more and more scientists pursue boundary-crossing lines of investigation, those researchers possessing multi-disciplinary skills will be increasingly in high demand. CBI students obtain their Ph.D. degree in chemistry, biology, biochemistry, molecular biology or chemical and biological engineering, but with an additional focus in one of the other disciplines. Each course of study is individually tailored to take into account the students' strengths and interests, but all include coursework at an advanced level in both the biological sciences, chemistry and biochemistry.

Chemistry Biology Interface