What is Chemical Biology?

Any definition of “chemical biology” is inherently imprecise, due to the immense breadth of this relatively new scientific discipline. Many chemists working in chemical biology use chemical tools and approaches to understand and control biological systems, whereas others apply biology in service of chemistry. Our program has many research groups that are investigating all facets of modern chemical biology, with close connections to analytical, inorganic, materials, organic, and physical chemistry.

Martin D. Burke
Synthesis and study of small molecules with protein-like functions; molecular prosthetics; synthesis of complex natural products; iterative cross-coupling; MIDA boronates
chemistry.illinois.edu/mdburke

Jefferson Chan
Development of chemical probes for sensing and biological imaging of disease states; synthesis of small molecules and nanomaterials to modulate biology with light
chemistry.illinois.edu/jeffchan

Martin Gruebele
Protein and RNA folding and interactions in vitro, in cells and in vivo
chemistry.illinois.edu/mgruebel

Hee-Sun Han
Developing new bioimaging and sequencing platforms to unveil the molecular mechanisms driving the ensemble behavior of biological systems; imaging-based spatial transcriptomics, microfluidic-based single virus genomics, lab-on-a-chip platforms for disease diagnostics
chemistry.illinois.edu/hshan

Paul J. Hergenrother
Use of small molecules to identify and define novel targets for the treatment of cancer, neurodegeneration, and drug-resistant bacteria
chemistry.illinois.edu/hergenro

Yi Lu
Metalloprotein design based on proteomics and computational biology; nucleic acid sensors and therapeutics; DNA nanomaterials
chemistry.illinois.edu/yi-lu

Zaida Luthey-Schulten
Stochastic simulations of biological processes in minimal cells; physics of metabolism and ribosome biogenesis; dynamical networks of protein-RNA and protein-DNA interactions; statistical mechanics of the genome and DNA replication
chemistry.illinois.edu/zan
Other faculty with interests in Chemical Biology

Raven Huang (affiliate faculty)
Structural biology

Mary L. Kraft (affiliate faculty)
Biomembrane surface science

Deborah E. Leckband
Biological adhesion

Susan A. Martinis (affiliate faculty)
RNA-protein structure/function

Catherine J. Murphy
Biophysical chemistry

Satish K. Nair (affiliate faculty)
Structural biology

Eric Oldfield
Drug discovery and NMR/X-ray

Elena V. Romanova (research faculty)
Mass spectrometry of peptides

Stanislav Rubakhin (research faculty)
Microbioanalytical chemistry & Imaging

Stephen G. Sligar (emeritus faculty)
Nanobiotechnology and drug discovery

Huimin Zhao (affiliate faculty)
Biocatalysis and synthetic biology

Angad Mehta
Synthetic biology to develop: (i) vaccine platforms for bacterial and viral vaccines (ii) experimental models to study eukaryotic cell evolution and (iii) photosynthetic bioproduction platforms
chemistry.illinois.edu/apm8

Liviu M. Mirica
Development of bifunctional therapeutic and diagnostic agents for amyloid peptide disorders such as Alzheimer’s disease; study of the role of transition metal ions in neurodegenerative diseases
chemistry.illinois.edu/mirica

Douglas A. Mitchell
Natural product chemical biology; mechanistic enzymology; structure-function studies of complex small molecules; bioinformatic and bioorganic methodology to accelerate biomedical discovery
chemistry.illinois.edu/douglasm

Lisa Olshansky
Engineering conformationally gated artificial metalloproteins for the investigation of enzyme mechanism, energy conversion, switchable catalysis, and biomedical imaging
chemistry.illinois.edu/lolshans

Scott K. Silverman
DNA as an enzyme
chemistry.illinois.edu/sks

Jonathan V. Sweedler
Neurochemistry: the characterization of unusual neurotransmitters and neuromodulators and the determination of their function
chemistry.illinois.edu/jsweedle

Wilfred A. van der Donk
Antibiotic biosynthesis; combinatorial chemistry of cyclic peptides; enzymology
chemistry.illinois.edu/vddonk

Steven C. Zimmerman
Small-molecule therapeutic agents that target DNA and RNA; development of chemical catalysts for chemical biology; drug and cellular delivery agents; biomaterials; nanomedicine
chemistry.illinois.edu/sczimmer