Department of Chemistry & Biochemistry

About the Department

The Chemistry and Biochemistry Department, administratively situated within the College of Science, enrolls approximately 400 undergraduate majors and 25 graduate students. The department has 17 tenure-track faculty members, 16 part-time temporary instructors, and 7 staff members. Each year, between 30-50 majors graduate.

The Bachelor of Science degree in Chemistry has three program options that permit students to tailor their curriculum choices to fit their career goals. These three options are: American Chemical Society (ACS) option, Biochemistry option, and the General option. The ACS option leads to a degree certified by the American Chemical Society. The MS degree in Chemistry requires original research with a thesis.

The Chemistry and Biochemistry faculty embrace Cal Poly Pomona's inclusive polytechnic identity by providing our students with experiential learning and discovery opportunities through rigorous coursework and extensive laboratory study. Our faculty maintain active research programs that allow undergraduate and Master's students to gain independent research experience as part of a Senior Thesis Project. Independent research is supported through internal grants, extramural funding, and collaborations with local, national, and international groups.

Mission and Vision

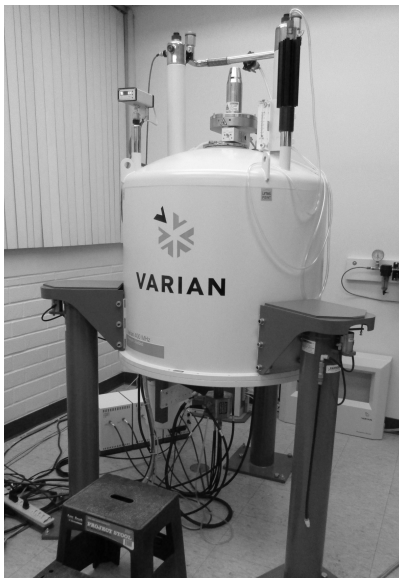
Our Vision: To catalyze intellectual growth through innovative, hands-on chemistry experiences that transform our students into science and industry leaders.

Our Mission: To educate by linking theory and practice and inspire Cal Poly Pomona students and the wider community through:

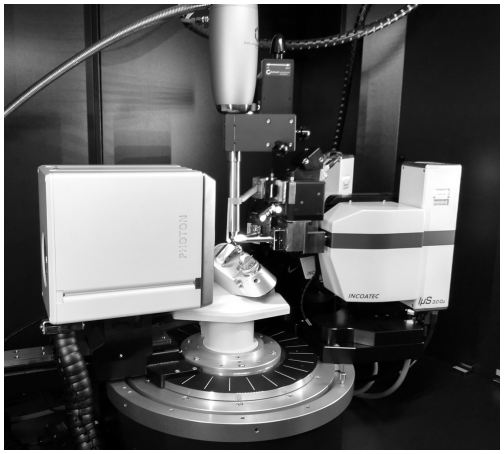
- Excellence in teaching
- A cohesive, rigorous, lab-intensive curriculum
- One-on-one advising and mentoring
- Participation in research and scholarly activities
- Collaboration with and outreach to local industries and educational institutions
- Support of extracurricular student activities

Featured Instrumentation with Research/Teaching Capabilities

- Dual source Cu/Mo single crystal κ X-ray diffractometer (Bruker D8 Venture)
- 400 MHz NMR spectrometer equipped with 12 sample autosampler and OneProbe (Varian 400 MR)
- Ion chromatography system (Thermo/Dionex ICS-1100)
- ATR FT-IR spectrometers (Bruker Tensor 27, Vector 22)
- FT-IR spectrometers (Nicolet Avatar 360 & 370)
- Smart single channel flash chromatography system (Yamazen "Smart Flash" EPCLC AKROS)
- Gas chromatograph/mass spectrometers (HP G1800A)
- Gas chromatograph/mass spectrometer with autosampler (Agilent 6850-5973N)
- High performance liquid chromatographs equipped with diode array detectors (Agilent 1260 Infinity II)
    - Evaporative light scattering detector (HPLC-DAD-ELSD)
    - Fluorescence detector (HPLC-DAD-FLD)



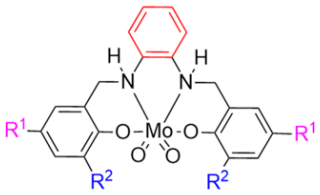
- Polarimeter (Rudolph Autopol I)
- Stopped flow spectrophotometer (Applied Photophysics)
- Thermogravimetric analyzer (TA Instruments Q50)
- Differential scanning calorimeter (TA Instruments NanoDSC)
- Circular dichroism spectrometer (Olis DSM 20)
- Atomic absorption spectrometer (PerkinElmer AAnalyst 400)
- Gas chromatograph with flame ionization detector (Agilent 6890)
- Raman spectrometer
- Dynamic light scattering spectrometer (Proterion DynaPro)
- Isothermal titration calorimeter (TA Instruments Nano ITC)
- Pressure reactor vessels (Asynt, 125 mL)
- Fluorescence spectrometers (Agilent Cary Eclipse)
- Inert atmosphere glovebox workstations (MBraun Unilab single and double port)
- Other standard research instrumentation, including:
    - Microscopes (light, fluorescence, stereo)
    - UV-Vis spectrophotometers
    - Centrifuges (floor, benchtop, and microcentrifuge capacities)
    - Schlenk lines, hood space
    - Freezers, refrigerators, ovens, incubators
    - Electrochemical setups, potentiostats



Department Research Interests

Organic Subdivision

The John Group: Sustainable Chemistry



- Explore reactions to support sustainable chemical enterprise
- Biomass-derived molecules
- Catalysis with molybdenum
- Synthesis, isolation, and characterization
- Current NSF RUI for the "Evaluation of Ligand Effects in Molybdenum Catalyzed Deoxydehydration Reactions"

The Klavetter Group: Polymer Chemistry

- Design and preparation of polymeric materials that conduct electricity
- Synthesis, characterization, and preparation of material into forms useful for semi-conductor devices
- Conducting polymers as light-emitting diodes

The Osberger Group: Synthesis—Catalysis—Function

- Development of synthetic organic methodology
- Pd-catalyzed C-H functionalizations
- Complexity generating reactions for natural product analogue synthesis
- Novel approaches to cyclobutane-containing compounds

The Page Group: Green Chemistry

- Plant seed oil triglycerides in biodiesel synthesis
- FAME use in synthesizing "green" plastics and urethanes
- Collaborates with Bio-copolymer division of USDA (Philadelphia, PA)

Related Research in the Department

The McCulloch Group: Biochemistry. Structure-function studies of enzymatic reactions using macromolecular crystallography to understand metabolic pathways and enzyme mechanisms.

The Schatschneider Group: Physical Chemistry. Computational studies using 1st principles and molecular mechanics methods to understand the physical and electronic properties of soft organic materials.

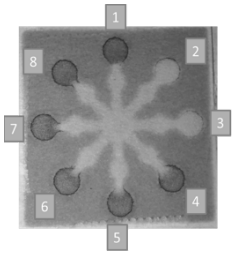
The Stieber Group: Inorganic Chemistry. Development and electronic structure determination of first-row transition metal catalysts and complexes. Secured DOD Grant for single crystal X-ray diffractometer and has a current NSF CAREER grant "Quantifying Nitrogen-Oxide (NO) Activation and Coordination Modes through Synthesis, Spectroscopy and Computations."

Analytical Subdivision

The Barding Group: Bioanalytical Chemistry

- Method development to explore unique biological questions
- Instrumental applications: NMR, HPLC, UV, FL, MS
- Investigation of physiological responses in response to organismal stressors

The Liu Group: Portable Analytical Chemistry



- Paper-based analytical devices for food and environmental applications
- Smartphone-assisted colorimetric analysis

The Sun Group: Electroanalytical Chemistry

- Electrochemical characterization of the single silver nanoparticle formation mechanism
- Mechanism and kinetics of ion transfer across the liquid/liquid interface
- Solid state ion-selective sensors
- Fabrication of portable potentiostat for very small current measurements

Related Research in the Deparment

The Corcoran Group: Physical Chemistry. Use of fluorescent labels to track and quantify small quantities of molecules. Raman spectroscopy and instrument development.

The Mogul Group: Biochemistry. Proteomics, microbiology, and biochemistry of microorganisms isolated from spacecraft assembly systems. Chemistry of lanthanide-bioanalyte complexes. Current NASA Astrobiology Institute MIRS funding for the study of Alaskan permafrost.

CalPolyPomona

Recent Publications (2017 – current)

CPP Chemistry faculty underlined

- Anz, S.J., Margolese, D.I., Sando, S.F., Gillis, H.P., Goddard III, W.A. (2019) Damage-free atomic-scale etching and surface enhancements by electron-enhanced reactions: results and simulations, in *Computational Materials, Chemistry, and Biochemistry: from Bold Initiatives to the Last Mile*, Springer Publishing.
- Kundu, S., Phu, P.N., Ghosh, P., Kozimor, S.A., Bertke, J.A., Stieber, S.C.E., Warren, T. H. (2019) Nitrosyl linkage isomers: NO coupling to N_2O at a mononuclear site, *J. Am. Chem. Soc. 141*, 1415-1419.
- Hummel, E.D., Stieber, S.C.E. (2019) Student-led computational inorganic chemistry research in a classroom setting, *J. Comput. Sci. Educ. 10*, 12-15.
- Mogul, R. (2019) Protecting planets beyond Earth, *Physics Today 17*, 66-67.
- Yu, M., Wang, X., Du, X-F., Kunkel, C., Garcia, T.M., Monaco, S., Schatschneider, B., Oberhofer, H., Marom, N. (2019) Anomalous pressure dependence of the electronic properties of molecular crystals explained by changes in intermolecular electronic coupling, *Synth. Metals 253*, 9-19.
- Wang, X., Liu, X., Tom, R., Cook, C., Schatschneider, B., Marom, N. (2019) Phenylated acene derivatives as candidates for intermolecular singlet fission, *J. Phys. Chem. C 123*, 5890-5899.
- McCulloch, K.M., Yamakawa, I., Shifrin, D.A., McConnell, R.E., Foegeding, N.J., Singh, P.K., Mao, S., Tyska, M.J., Iverson, T.M. (2019) An alternative N-terminal fold of the intestine-specific annexin A13a induces dimerization and regulates membrane binding, *J. Biol. Chem. 294*, 3454-3463.
- Navarro, C.N., John, A. (2019) Deoxyhydration using a commercial catalyst and readily available reductant, *Inorg. Chem. Commun. 99*, 145-148.
- Limaye, S.S., Mogul, R., Smith, D.J., Ansari, A.H., Slowik, G.P., Vaishampayan, P. (2018) Venus' spectral signatures and the potential for life in the clouds, *Astrobiol. 18*, 1181-1198.
- You, R., Dai, J., Zhang, P., Barding, G.A. Jr., Raftery, D. (2018) Dynamic metabolic response to adriamycin-induced senescence in breast cancer cells, *Metabolites 8*, 95/1-95/13.
- Zheng, H., Zheng, P., Zheng, L., Jiang, Z., Wu, Z., Wu, F., Shao, L., Liu, Y., Zhang, Y. (2018) Nitrogen-doped graphene quantum dots synthesized by C60/Nitrogen plasma with excitation-independent blue photoluminescence emission for sensing of ferric ions, *J. Phys. Chem. C 122*, 29613-29619.
- Hammouri, M., Garcia, T.M., Cook, C., Monaco, S., Jezowski, S., Marom, N., Schatschneider, B. (2018) High-throughput pressure-dependent density functional theory investigation of herringbone polycyclic aromatic hydrocarbons: Part 2. Pressure-dependent electronic properties, *J. Phys. Chem. C 122*, 23828-23844.
- Hammouri, M., Garcia, T.M., Cook, C., Monaco, S., Jezowski, S., Marom, N., Schatschneider, B. (2018) High-throughput pressure-dependent density functional theory investigation of herringbone polycyclic aromatic hydrocarbons: Part 1. Pressure-dependent structure trends, *J. Phys. Chem. C 122*, 23815-23827.
- Brannon, J.P., Stretch, B.E., Stieber, S.C.E. (2018) Crystal structure of 1-(2,4,6-trimethylphenyl)-1H-imidazole, *CSD Comm.*
- Yamamoto, C.D., Zhang, Z., Stieber, S.C.E. (2018) Crystal structure of (η^4-cyclooctadiene) (3,3´- dimesityl-1,1´- methylenediimidazoline-2,2´ -diylidene) nickel(0) tetrahydrofuran monosolvate, *Acta. Crystallogr. E74*, 1396-1399.
- Jiang, Y., Zheng, L., Zheng, H., Wu, F., Shao, L., Zheng, P., Liu, Y., Zhang, Y. (2018) Ultra-highly fluorescent N-doped carbon dots-CdTe QDs nanohybrids with excitation-independent emission in the blue-violet region, *RSC Advances 8*, 35700-35705.
- Starbird, C.A., Perry, N.A., Chen, Q., Berndt, S., Yamakawa, I., Loukachevitch, L.V., Limbrick, E.M., Bachmann, B.O., Iverson, T.M., McCulloch, K.M. (2018) The structure of the bifunctional everninomicin biosynthetic enzyme EvdMO1 suggests independent activity of the fused methyltransferase-oxidase domains, *Biochemistry 57*, 6827-6837.

- Wu, S., Nguyen, L., Dang, J., Liang, K., Dail, C., Henriquez, B., Huynh, Q., Dinh, U., Liang, Y., Anz, S., Sun, P. (2018) Evaluation of the stoichiometry between $PtCl_6^{2-}$ and TOA+ ions during the liquid/liquid extraction, *Electroanalysis 30*, 2440-2444.
- Page, M.F.Z., Escott, P., Silva, M., and Barding, G.A. Jr. (2018) The effect of teaching the entire academic year of high school chemistry utilizing abstract reasoning, *Chem. Educ. Res. Pract. 19*, 500-507.
- Huang, C., Lum, B., Liu, Y. (2018) Smartphone-assisted colorimetric analysis of manganese in steel samples, *Curr. Anal. Chem.* doi: 10.2174/1573411013666171117170042.
- Fieser, M.E., Schimler, S.D., Mitchell, L.A., Wilborn, E.G., John, A., Hogan, L.T., Benson, B., LaPointe, A.M., and Tolman, W.B. (2018) Dual-catalytic decarbonylation of fatty acid methyl esters to form olefins, *Chem. Commun. 54*, 7669-7672.
- Gowda, N., G.A., Barding, G.A. Jr., Dai, J., Gu, H., Margineantu, D.H., Hockenbery, D.M., and Raftery, D. (2018) A metabolomics study of BPTES altered metabolism in human breast cancer cell lines, *Front. Mol. Biosci. 5:* 49 1-13.
- Mogul, R., Barding, G.A. Jr., *et al.* (2018) Metabolism and biodegradation of spacecraft cleaning reagents by strains of spacecraft-associated *Acinetobacter, Astrobiol.* https://doi.org/10.1089/ast.2017.1814.
- Zheng, L., Zheng, H., Huo, D., Wu, F., Shao, L., Zheng, P., Jiang, Y., Zheng, X., Qiu, X., Liu, Y., Zhang, Y. (2018) N-doped graphene-based copper nanocomposite with ultralow electrical resistivity and high thermal conductivity, *Scientific Rep. 8*, 9248.
- Starkey, L.S. *Introduction to Strategies for Organic Synthesis*, 2nd ed.; Wiley: New York, 2018.
- Wang, X., Liu, X., Cook, C., Schatschneider, B., Marom, N. (2018) On the possibility of singlet fission in crystalline quaterrylene, *J. Chem. Phys. 148*, 184101.
- Corcoran, T.C. (2018) Compressive detection of highly overlapped spectra using Walsh-Hadamard-based filter functions, *Appl. Spect. 72*, 392-403.
- Locke, A.M., Barding, G.A. Jr., Sathnur, S., Larive, C.K., Bailey-Serres, J. (2018) Rice *SUB1A* constrains remodeling of the transcriptome and metabolome during submergence to facilitate post-submergence recovery, *Plant Cell Env. 41*, 721-736.
- Minasian, S.G., Batista, E.R., Booth, C.H., Clark, D.L., Keith, J.M., Kozimor, S.A., Lukens, W.W., Martin, R.L., Shuh, D.K., Stieber, S.C.E., Tylisczcak, T., Wen, X. (2017) Quantitative evidence for lanthanide-oxygen orbital mixing in CeO_2, PrO_2, and TbO_2, *J. Am. Chem. Soc. 139*, 18052-18064.
- Jezowski, S.R., Baer, R., Monaco, S., Mora-Perez, C.A., Schatschneider, B. (2017) Unlocking the electronic genome of halogenobenzenes, *Phys. Chem. Chem. Phys. 19*, 4093-4103.
- Mogul, R. *et al.* (2017) Microbial community and biochemical dynamics of biological soil crusts across a gradient of surface coverage in the central Mojave Desert, *Front. Microbiol. 8*, 1974.
- Sheng, W., Zheng, L., Liu, Y., Zhao, X., Weng, J., Zhang, Y. (2017) Sensitive detection of dopamine via leucodopaminechrome on polyacrylic acid-coated ceria nanorods, *Nanotech. 28*, 365504.
- Hallan, S., Afkarian, M., Zelnick, L.R., Kestenbaum, B., Sharma, S., Saito, R., Darshi, M., Barding, G.A. Jr., Raftery, D., W., Kretzler, M., Sharma, K., de Boer, I.H. (2017) "Metabolomics and gene expression analysis reveal down-regulation of the citric acid (TCA) cycle in non-diabetic CKD patients" *EBioMedicine*, *26,* 68-77.
- John, A., Dereli, B., Ortuño, M.A., Johnson, H.E., Hillmyer, M.A., Cramer, C.J., Tolman, W.B. (2017) Selective decarbonylation of fatty acid esters to linear α-olefins, *Organometallics 36*, 2956-2964.
- Mathon, C., Barding, G.A. Jr., Larive, C.K. (2017) Separation of ten phosphorylated mono- and disaccharides using HILIC and ion-pairing interactions, *Anal. Chim. Acta 972*, 102-110.
- Jezowski, S.R., Monaco, S., Yennawar, H.P., Wonderling, N.M., Mathers, R.T., Schatschneider, B. (2017) Unusual physical behavior and polymorphic phase transitions in crystalline bicyclic anhydrides, *CrystEngComm 19*, 276-284.