

Scott R. Burt, Ph.D.

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PROFESSIONAL APPOINTMENTS **Brigham Young University, Provo, Utah**

Teaching Professor, Dpt. of Chemistry and Biochemistry, 2019–current
Associate Teaching Professor, Dpt. of Chemistry and Biochemistry, 2014–2019
Assistant Teaching Professor, Dpt. of Chemistry and Biochemistry, 2008–2014

- NMR facility manager
- Teach general chemistry and NMR courses

EDUCATION **University of California, Berkeley, California**

Ph.D. Physical Chemistry, 2004–2008

- Advisor: Professor Alex Pines
- Dissertation: “MRI of Heterogeneous Hydrogenation Reactions Using Parahydrogen Polarization”

Brigham Young University, Provo, Utah

B.S. Chemistry, *Cum Laude*, 1998–1999, 2001–2004

- Advisor: Professor Randy Shirts
- Area of Study: Statistical Mechanics
- Minors: Mathematics, Scandinavian Studies

AFFILIATIONS American Chemical Society

- Faculty advisor for our local student ACS section (Y-chem), 2012–2015
- Central Utah Local Section Chair-elect, 2016–2017
- Central Utah Local Section Chair, 2018–2019
- Central Utah Local Section Chair-outgoing, 2020–current

Association of Managers in Magnetic Resonance Laboratories

ACADEMIC AWARDS **Graduate**

- Karl G. Maeser Professional Faculty Excellence Award, 2020
- Department of Homeland Security Graduate Research Fellowship, 2005–2008
- Eric Abramson Memorial Fellowship, 2005

Undergraduate

- National Merit Scholarship, 1998–2004
- 2 Office of Research and Creative Activities (ORCA) Research Grants, 2002–2004
- 5 Chemistry Department Research (Stipend) Awards, 2002–2004
- 3 Summer-term Academic Scholarships, 2002–2004

RESEARCH
EXPERIENCE

University of California, Berkeley

Graduate Research Assistant

Fall 2004–2008

Dr. Alex Pines, Department of Physical Chemistry

- Nuclear Magnetic Resonance: parahydrogen induced polarization (PHIP).
- Designed and built experimental setup to produce 25%, 50% or 99.7% parahydrogen for use in continuous flow, stopped flow and high pressure applications.
- Demonstrated, for the first time, parahydrogen polarization of gases.
- Studied a variety of systems using my parahydrogen setup:
 - Novel supported catalysts, allowing heterogeneous phase PHIP.
 - Void space MRI using gas phase PHIP.
 - Micro-reactor imaging and flow imaging using gas phase PHIP.
- Used Mathematica and Matlab for data processing and to study the polarized state and its evolution.
- Maintenance of the lab magnets: cryogen fills, coordinated repairs and upgrades.
- Training in and extensive use of the student machine shop.

Lawrence Livermore National Laboratory

DHS Summer Research Intern

Summer 2006

Tom Slezak, Bioinformatics Knowledge Center

- Bioinformatics: Assisted in the development of a forensic analysis chip for Foot and Mouth Disease Virus (FMDV).
- Developed oligomer probes for use on a Nimblegen Microarray chip to identify the serotype and strain of samples known to contain FMDV.
- Python programming: Designed and created several programs to automate data mining tasks, including locating conserved and unique regions of the FMDV genome, generating a set of candidate probes and testing these probes against the known genome for robustness (i.e. using BLAST).

Brigham Young University

Undergraduate Research Assistant

2002–2004

Dr. Randy Shirts, Department of Chemistry and Biochemistry

- Statistical Mechanics: Finite size corrections for isolated systems.
- C++ programming: Designed and created software to simulate a micro-canonical, hard-sphere gas in 1, 2 and 3 dimensions with various boundary conditions to test our analytical results.
- Java programming: Created the physics kernel and helped design Boltzmann 3D, an educational program to demonstrate simple molecular kinetics.

Chemistry Education Workshops

- *ALEKS Chemistry Symposium*, Chicago, IL, 17–18 May 2013.

TEACHING
EXPERIENCE

Introductory General Chemistry (Chem 101)

Course content: Atomic and molecular structure, periodic relationships, states of matter, chemical reactions and stoichiometry, acids and bases.

The 2008 and 2009 semesters included two sections of Freshman Academy. Interaction with these students included weekly discussions over lunch as well as several lab tours of the NMR facility with discussion of the principles underlying MRI.

General College Chemistry (Chem 105)

Course content: Atomic and molecular structure, bonding, periodic properties of the elements, reaction energetics, electrochemistry, acids and bases, inorganic and organic chemistry.

General College Chemistry (Chem 106)

Course content: Chemical kinetics and equilibrium, acid-base equilibrium, chemical thermodynamics, electrochemistry, nuclear chemistry, inorganic and organic chemistry.

Synthesis and Qualitative Organic Analysis (Chem 455)

Presented lectures on the theory of FT-NMR in one and two dimensions as well as the interpretation of 1D and 2D NMR spectra. Trained students to use the NMR Facility and supervised their activities during lab hours. NMR training included magnet safety, sample preparation, locking, shimming, 1D experiments (^1H , ^{13}C , and DEPT), 2D experiments (COSY, HSQC, HMBC, and NOESY), and data processing.

Organic Spectroscopic Identification (Chem 555)

Presented lectures on the theory of FT-NMR in one and two dimensions as well as the interpretation of 1D and 2D NMR spectra. Held weekly training sessions for advanced NMR instruction. NMR training included magnet safety, sample preparation, locking, shimming, probe tuning, 1D experiments (^1H , ^{13}C , ^{19}F , ^{31}P , DEPT), 2D experiments (COSY, TOCSY, HSQC, HSQC-TOXY, HMBC, NOESY), selective experiments (TOCSY-1D, NOESY-1D), and variable temperature experiments.

Advanced Techniques in Nuclear Magnetic Resonance (Chem 655, 596R)

Course content depends on student interest and background. Common topics include the quantum origins of the NMR signal, understanding pulse sequences using the density matrix and product operators, the theory of 2D NMR, the quantum theory of nuclear spin relaxation, heteronuclear NMR, basic approach for structure determination of biomolecules, software tools for analyzing multiple 2D and 1D spectra in concert for structure elucidation, and a review of the important 2D NMR experiments (COSY, HSQC, HMBC, TOCSY, NOESY and variations).

Scientific Writing and Ethics (Chem 694)

Course content: Technical writing (sentence and paragraph structure, grammar and rhetoric, cohesion and coherence, emphasis, concision, shape) and ethics (treatment of data, mistakes and negligence, plagiarism, research misconduct, allocating credit, intellectual property, patents and copyright, conflicts of interest, pathological science).

NMR in Biochemistry, Guest Lectures (Chem 489, 581)

Primary Instructors: David Belnap, Steven Graves, & Barry Willardson

Topics: NMR parameters and their relation to biomolecules, multi-dimensional NMR, practical aspects of protein NMR, spectral assignment strategies, conformational constraints, and generating a family of structures.

PUBLICATIONS

Faculty research at Brigham Young University:

1. Machicao, P.A.; **Burt, S.R.**; Christensen, R.K.; Lohner, N.B.; Singleton, J.D.; Peterson, M.A. An Efficient Microwave Assisted Synthesis of N¹-Aryl/(alkyl)-substituted N-(4-hydroxy-6-phenylpyrimidin-2-yl)guanidines: Scope and Limitations. *Tetrahedron Letters*, **58**, 2017, 2318-2321.
2. Cryer, M.; Lane, K.; Cates, R.; **Burt, S.R.**; Andrus, M.; Zou, J.; Rogers, P.; Hansen, M.; Panayampalli, S.; Burgado, J.; Day, C.; Smee, D.; Allen, R.; Johnson, F.B. Isolation and Identification of Compounds from *Kalanchoe Pinnata* Having HSV-2 and Vaccinia Antivirus Activity. *Pharm. Biol.*, **55**, 2017, 1586-1591.
3. Son, D.J.; Kim, D.H.; Nah, S.; Park, M.H.; Lee, H.; Han, S.; Venkatarreddy, U.; Gann, B.; Rodriguez, K.; **Burt, S.R.**; Ham, Y.W.; Jung, Y.Y.; Hong, J.T. Novel synthetic (E)-2-methoxy-4-(3-(4-methoxyphenyl) prop-1-en-1-yl) phenol inhibits arthritis by targeting signal transducer and activator of transcription 3. *Scientific Reports*, **6**, 2016, 36852.
4. Paudyal, M.P.; Adebessin, A.M.; **Burt, S.R.**; Ess, D.H.; Ma, Z.; Kürti, L.; Falck, J.R. Dirhodium-Catalyzed C-H Arene Amination Using Hydroxylamines. *Science*, **353**, 8 Sep. 2016, 1144-1147.
5. Udumula, V.; Nazari, S.H.; **Burt, S.R.**; Alfindee, M.N.; Michaelis, D.J. Chemo- and Site-Selective Alkyl and Aryl Azide Reductions with Heterogeneous Nanoparticle Catalysts. *ACS Catalysis*, **6**, 2016, 4423-4427.
6. Bennallack, P.R.; **Burt, S.R.**; Heder, M.J.; Robison, R.A.; Griffiths, J.S. Characterization of a Novel Plasmid-Borne Thiopeptide Gene Cluster in *Staphylococcus epidermidis* Strain 115. *Journal of Bacteriology*, **196**, 2014, 4344-4350.
7. Jarenwattananon, N.N.; Glöggler, S.; Otto, T.; Melkonian, A.; Morris, W.; **Burt, S.R.**; Yaghi, O.M.; Bouchard, L.-S. Thermal Maps of Gases in Heterogeneous Reactions. *Nature*, **502**, 2013, 537-540.
8. Khosravi, M.; Andrus, M.B.; **Burt, S.R.**; Woodfield, B.F. Generalized Preparation Method and Characterization of Aluminum Isopropoxide, Aluminum Phenoxide, and Aluminum *n*-Hexyloxide. *Polyhedron*, **62**, 2013, 18-25.
9. Curtis, A.D.; **Burt, S.R.**; Calchera, A.; Patterson, J.E. Limitations in the Analysis of Vibrational Sum-Frequency Spectra Arising from the Nonresonant Contribution. *Journal of Physical Chemistry C*, **115**, 2011, 11550-11559.
10. Shelton, J.R.; **Burt, S.R.**; Peterson, M.A. A Broad Spectrum Anticancer Nucleoside with Selective Toxicity Against Human Colon Cells In Vitro. *Bioorganic & Medicinal Chemistry Letters*, **21**, 2011, 1484-1487.

Graduate research at U.C. Berkeley:

11. Bouchard, L.-S.; **Burt, S.R.**; Anwar, M.S.; Kovtunov, K.V.; Koptuyug, I.V.; Pines, A. NMR Imaging of Catalytic Hydrogenation in Microreactors with the Use of para-Hydrogen. *Science*, **319**, 25 January 2008, 442-445.
12. Bouchard, L.-S.; Kovtunov, K.V.; **Burt, S.R.**; M. Anwar, M.S.; Koptuyug, I.V.; Sagdeev, R.Z.; Pines, A. Parahydrogen-Enhanced Hyperpolarized Gas-Phase Magnetic Resonance Imaging. *Angewandte Chemie International Edition*, **46** (22), 25 May 2007, 4064-4068.

13. Koptug, I.V.; Kovtunov, K.V.; **Burt, S.R.**; Anwar, M.S.; Hilty, C.; Han, S.-I.; Pines, A.; Sagdeev, R.Z. Parahydrogen-Induced Polarization in Heterogeneous Hydrogenation Reactions. *Journal of American Chemical Society*, **129** (17), 2007, 5580-5586.

Undergraduate research at Brigham Young University:

14. Shirts, R.B.; **Burt, S.R.**; Johnson, A.M. Periodic Boundary Condition Induced Breakdown of the Equipartition Principle and Other Kinetic Effects of Finite Sample Size in Classical Hard-Sphere Molecular Dynamics Simulation. *Journal of Chemical Physics*, **125** (16): 28 Oct 2006, 164102.

PRESENTATIONS

1. **Burt, S.R.**, Improving Undergraduate NMR Labs with Automation Tools. *Bootcamp for NMR Educators*, Lake Superior State University, Sault Ste. Marie, MI, 23-24 May 2011. (Oral)
2. **Burt, S.R.**, VnmrJ Automation and Customization Tools for Improving Undergraduate Labs. *Agilent Users' Meeting before the Experimental NMR Conference*, Santa Clara, CA, 9 April 2011. (Oral)
3. **Burt, S.R.**, Automation and Walkup Operation in Undergraduate Labs. *Varian/Agilent Users' Meeting at the SMASH 2010 Small Molecule NMR Conference*, Portland, OR, 26 September 2010. (Oral)
4. **Burt, S.R.**; Bouchard, L.-S.; Anwar, M.S.; Kovtunov, K.V.; Koptug, I.V.; Theiss, T.; Trease, D.; Pines, A. Imaging of Catalytic Hydrogenation in Microreactors using Parahydrogen. *Experimental Nuclear Magnetic Resonance Conference*, Asilomar, California, March 2008. (Poster)
5. **Burt, S.R.**; Kovtunov, K.V.; Anwar, M.S.; Bouchard, L.-S.; Koptug, I.V.; Pines, A. Parahydrogen Spin Order in Heterogenized Homogeneous Catalytic Systems. *International Symposium on Relations between Homogeneous and Heterogeneous Catalysis XIII*, Berkeley, California, July 2007. (Poster)
6. **Burt, S.R.**; Bouchard, L.-S.; Kovtunov, K.V.; Anwar, M.S.; Koptug, I.V.; Sagdeev, R.Z.; Pines, A. Parahydrogen Induced Polarization via Heterogeneous Hydrogenation Reactions. *Ampere NMR School*, Bukowina, Poland, June 2007. (Poster)
7. **Burt, S.R.**; Anwar, M.S.; Kovtunov, K.V.; Hilty, C.; Han, S.-I.; Koptug, I.V.; Sagdeev, R.Z.; Pines, A. Parahydrogen Induced Polarization in Heterogeneous Hydrogenation Reactions. *Experimental Nuclear Magnetic Resonance Conference*, Daytona Beach, Florida, April 2007. (Poster)
8. Bouchard, L.-S.; Anwar, M.S.; **Burt, S.R.**; Kovtunov, K.V.; Koptug, I.V.; Sagdeev, R.Z.; Pines, A. Gas-Phase Hyperpolarized Imaging Using Parahydrogen. *Experimental Nuclear Magnetic Resonance Conference*, Daytona Beach, Florida, April 2007. (Poster)
9. **Burt, S.R.**; Shirts, R.B. Boltzmann Distribution is Wrong for Small, Isolated Systems. 227th *ACS National Meeting*, Anaheim, California, March 2004. (Poster)