Joshua M. Bray

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Academic

- **University of Birmingham** — Birmingham, U.K.
  Postdoctoral Fellow, School of Chemistry — Mar. 2014 – present
  - Supervisor: Dr. Melanie Britton
  - Conducted independent research on electrochemical cells using magnetic resonance imaging (MRI)
  - Designed and built an airtight sample holder and MRI-compatible interface for electrochemical measurements
  - Developed a technique for MR imaging of copper corrosion based on paramagnetic relaxation contrast
  - Co-supervised projects by 3 undergraduate chemistry students
- **Montana State University** — Bozeman, MT, U.S.A.
  Postdoctoral Fellow, Department of Mechanical Engineering — Jan. 2012 – Feb. 2014
  - Supervisors: Drs. Sarah L. Codd and Joseph D. Seymour
  - Conducted independent research on supercritical fluids, CO_2/brine dissolution, and precipitation in porous media
  - Assisted with purchase/testing of custom, MRI-compatible rock core holder for *in-situ* studies of supercritical CO_2
  - Taught select graduate lectures on fluid dynamics, linear algebra, and MRI theory
  - Co-supervised projects by 2 undergraduate and 1 graduate engineering students
  - Created a wiki to assist with "institutional memory" of lab resources, equipment, techniques, *etc.*
- **Dalhousie University** — Halifax, N.S., Canada
  Ph.D. in Physics — Sept. 2006 – Dec. 2010
  - Thesis: Non-Destructive Characterization of Degradation and Drug Release Processes in Calcium Polyphosphate Bioceramics using MRI
  - Principal advisor: Dr. Steven D. Beyea; Co-Advisors: Drs. Gerhard Stroink, Chris V. Bowen, and Mark J. Filiaggi
- **Dalhousie University** — Halifax, N.S., Canada
  M.Sc. in Physics — Sept. 2004 – Apr. 2006
  - Thesis: Magnetic Resonance Imaging of Fluid Ingress into Degradable Calcium Polyphosphate Bioceramics
  - Principal advisor: Dr. Steven D. Beyea; Co-advisors: Drs. Gerhard Stroink, Chris V. Bowen, and Mark J. Filiaggi
  - Executive member of the Dalhousie Graduate Physics Society (Web Designer/Maintainer)
- **Saint Mary's University** — Halifax, N.S., Canada
  B.Sc. Honours First Class in Physics (Minor in Mathematics) — Sept. 1999 – Apr. 2003
  - Thesis: Interactive-Engagement Physics-Teaching Methods: an Evaluation and Inventory
  - Advisor: Dr. Adam J. Sarty

Employment

- **Dept. of Astronomy and Physics, Saint Mary's University**
  Instructor — Sept. – Dec. 2011
  - Delivered lectures on physics, experimental techniques, and data analysis for introductory-level students
  - Administered lab and coordinated teaching assistants
  - Courses included the following:

Number	Course Title
PHYS 1000	Physics for Life Sciences
PHYS 1100	University Physics

- **Dept. of Physics and Atmospheric Science, Dalhousie University**
  Teaching Assistant (TA) — 2004 – 2009, 2011

- Laboratory: delivered lab lectures on safety, procedures, and scientific background, and provided guidance on student term projects
- Resource Center: assisted students with weekly homework problems
- Tutorial Instructor: conducted review sessions on physics concepts and demonstrated problem-solving approaches
- Courses included the following:

Number	Course Title
PHYC1300	Physics In and Around You
PHYC1100	Introduction to Physics
PHYC1500	Dalhousie Integrated Science Program (DISP) Physics
PHYC2150	Physics Tools: Experiment
PHYC3810	Microcomputers in the Real World

- **Dept. of Astronomy and Physics, Saint Mary's University**
  Educational/Administrative Assistant Apr. 2003 – Aug. 2004
  - Built a massive web-based catalog of in-class physics demonstrations used by instructors at Saint Mary's University, integrating descriptions of basic physics, instructional diagrams, and videos of the demonstrations
  - Supervised an undergraduate student employed on the same project
  - Created a series of daily, conceptual physics questions for use with Personal Response Systems used in the curriculum of introductory physics classes
  - Conducted research and interviews with staff to generate an annual report for the department profiling academic output, funding, and community outreach
- **Dept. of Athletics and Recreation, Saint Mary's University**
  "Mini-University" Camp Instructor Summer 2001, 2003
  - Developed an original, 2-week summer camp programme using fun demonstrations and activities to introduce physics to youth ages 10 – 16
  - Taught lessons and led games, activities, and outings with the campers
  - The physics component of the program was very popular, and was used again several times in subsequent years

  "Mini-University" Instructor (Gambia) Summer 2001, 2002
  - Traveled to The Gambia, West Africa to lead a series of one-week university outreach programs to Gambian high school students
  - Developed and led lessons/workshops on science, computers, careers in science and technology, and university life targeted toward a high school audience
  - Adapted program to widely varying circumstances, such as availability of technology, materials, and instructional resources
- **Associazione Culturale Linguistica Educational** Sanremo, Italy
  English Tutor/Camp Counselor May – Aug. 2001
  - Designed and led English lessons based on instructional games and drama activities for non-English speaking youth, ages ranging from 10 – 16
  - Organized sports, social events, games, and outings for groups of up to 60 campers

Skills

MRI Acquisition: Imaging (spin-echo and projection-reconstruction); pulsed-gradient techniques (velocity/diffusion imaging, displacement propagators); relaxometry and Bloembergen Purcell Pound (BPP) theory; pulse programming on Bruker spectrometers (XWinNMR, Topspin, Paravision); experience with ^{19}F and ^{1}H imaging

Laboratory/Instrumentation: Training in chemical lab health and safety, gas cylinder handling, and glove box use. Experience in electrochemical measurements; Raman spectroscopy; scanning electron microscopy (SEM); energy dispersive x-ray (EDX); glass/ceramics processing; absorbance spectrophotometry; engineering course in biomedical instrumentation; porous media sample design/preparation; high-pressure fluids; computerized pressure/temperature monitoring

Programming/Analysis: Matlab; Prospa; IDL (Interactive Data Language); LabVIEW; Microsoft Excel; BASH scripting; LaTeX; equally proficient using Windows/Mac/Unix/Linux OS

Languages: French-fluent, basic Italian

Hobbies: Swing dancing; cycling; running; guitar; camping; rock climbing

Awards and Scholarships

Science and Art Competition, 2nd place	University of Birmingham, School of Chemistry	(2015)
Teaching Assistant Award	Dalhousie, Dept. of Physics and Atmospheric Science	(2010)
Teaching Assistant Award	Dalhousie, Dept. of Physics and Atmospheric Science	(2008)
Graduate Student Scholarship Supplement Program (GSSSP)	National Research Council of Canada	(2005 – 2008)
Departmental Funding	Dalhousie University	(2004 – 2010)
Dr. C. Henry Reardon Scholarship	Saint Mary's University	(2002)
Achievement Scholarships	Saint Mary's University	(2000 – 2003)
Entrance Scholarship	Saint Mary's University	(1999)
Distinction award for overall contribution to the high school community	Charles P. Allen High School	(1999)

Science Outreach

Public lecture (university open days) "Materials that can save your life: the materials science of rock climbing" (University of Birmingham, June, 2016)

Project Judge, FIRST Lego League Tournament 2012: Montana Regional Championship. Judged design challenge presentations by students grades 4 – 8.

Presenter, "Holo-tent": Hologram-making with junior high school students in the Supernova science camp program (Dalhousie, Jul. – Aug. 2011)

Volunteer, "Physics Fun and Discovery Days": Science demonstrations for visiting high school students (Dalhousie, 2011 and 2008)

Presenter, "Adam Sarty's Physics Show": Physics demonstration show for students in K-12 schools (Saint Mary's University, 2001 – 2004)

Publications

Dr. Joshua M. Bray, Prof. Alison J. Davenport, Prof. Karl S. Ryder, and Dr. Melanie M. Britton (2016). "Quantitative, in situ visualization of metal-ion dissolution and transport using ^{1}H magnetic resonance imaging." Angewandte Chemie 55(32): 9394-9397.

Bray, J. M., Lauchnor, E. G., Seymour, J. D., Fujita, Y., Redden, G. D., Gerlach, R., and Codd, S. L. (submitted 2016). "Impact of mineral precipitation on flow and structure of flow determined by μ-CT and MRI." Environmental Science and Technology.

Prather, C. A., Bray, J. M., Seymour, J. D., and Codd, S. L. (2016). "NMR study comparing capillary trapping in Berea sandstone of air, carbon dioxide, and supercritical carbon dioxide after imbibition of water." Water Resources Research 52(2): 713-724.

Bray, J. M., Rassi, E. M., Seymour, J. D., and Codd, S. L. (2014). "Magnetic resonance measurement of fluid dynamics and transport in tube flow of a near-critical fluid." Experiments in Fluids 55(7).

Bray, J. M., Codd, S. L., and Seymour, J. D. (article in preparation, 2016). "Turbulent Rayleigh-Bénard convection in a supercritical fluid."

Danzcyk, M. L., Bray, J.M., Sinha, S., and Codd, S. L. (article in preparation, 2016). "Pressure drop scaling during immiscible, two-phase flow in a porous medium."

Bray, J. M., Filiaggi, M. J., Bowen, C. V., and Beyea, S. D. (2012). "Degradation and drug release in calcium polyphosphate bioceramics: An MRI-based characterization." Acta Biomaterialia 8(10): 3821-3831.

Bray, J. M., Petrone, C., Filiaggi, M., and Beyea, S. D. (2007). "Measurement of fluid ingress into calcium polyphosphate bioceramics using nuclear magnetic resonance microscopy." Solid State Nuclear Magnetic Resonance 32(4): 118-128.

Bray, J. M. and Sarty, A. J. (2004). "In-class concept quizzes using personal responders: evaluating an interactive-engagement physics teaching method." Canadian Undergraduate Physics Journal, 2(3): 7-10

Conference Abstracts

Hydrodynamics mediates structure during abiotic growth of a calcite precipitate barrier: a combined MRI/CT study.
Interpore - 8th International Conference on Porous Media & Annual Meeting, May 9 - 12, 2016, Cincinnati, Ohio, USA
Joseph D. Seymour, Joshua M. Bray, Ellen Lauchnor, Yoshiko Fujita, George D. Redden, Robin Gerlach, Sarah L. Codd

MRI of Electroplating in Ionic Liquids
International Conference on Magnetic Resonance Microscopy, August 2015, Munich, Germany.
Joshua M. Bray, Alison J. Davenport, Karl S. Ryder, Melanie M. Britton

Magnetic resonance imaging visualisation of corrosion and electroplating
College of Engineering and Physical Sciences Research Conference, University of Birmingham, October 22, 2014, Birmingham, UK.
Joshua M. Bray, Alison J. Davenport, Karl S. Ryder, Melanie M. Britton

Turbulent Rayleigh-Bénard Convection in a Supercritical Fluid (Young Investigators Session)
International Conference on Magnetic Resonance Microscopy, August 2013, Cambridge UK
Joshua M. Bray, Sarah L. Codd, Joseph D. Seymour

Magnetic resonance imaging study of Rayleigh-Bénard convection in near and supercritical hexafluoroethane
65th Annual Meeting of the APS Division of Fluid Dynamics, November 2012, San Diego CA
Joshua M. Bray, Sarah L. Codd, Joseph D. Seymour

Microstructure changes in a degradable bioceramic characterized in-vitro by NMR relaxation and diffusion mapping
International Conference on Magnetic Resonance Microscopy, August 2009, West Yellowstone MT
Joshua M. Bray, Steven D. Beyea, Mark Filiaggi

Monitoring degradation of implantable drug delivery devices using relaxation and diffusion MRI
International Society for Magnetic Resonance in Medicine, April 2009, Honalulu HI
Joshua M. Bray, Mark Filiaggi, Chris V. Bowen, Steven D. Beyea

Invited talk: Characterization of implantable drug delivery bioceramics using magnetic resonance imaging (MRI)

The Minerals, Metals & Materials Society, February 2009, San Francisco CA
Joshua M. Bray, Mark Filiaggi, Steven D. Beyea

Nuclear magnetic resonance imaging for characterization of degradable calcium polyphosphate bioceramics
Nano Drug Delivery Symposium, October 2008, Toronto ON
Joshua M. Bray, Mark Filiaggi, Steven D. Beyea

Magnetic resonance imaging: a window on the process of drug release from bioceramic bone implants
Dalhousie Radiology Research Day, April 2008, Halifax NS
Joshua M. Bray, Mark Filiaggi, Steven D. Beyea

Non-invasive evaluation of microstructural evolution in functionalized calcium polyphosphate biomaterials using MRI
Canada Nanoscience & Nanotechnology Forum, June 2006, Edmonton AB
Joshua M. Bray, Mark Filiaggi, Steven D. Beyea

Magnetic resonance imaging of calcium polyphosphate drug delivery devices
Society for Biomaterials, April 2006, Pittsburg PA
Joshua M. Bray, Mark Filiaggi, Steven D. Beyea

NMR microscopy of calcium polyphosphate drug-delivery bioceramics
International Conference on Magnetic Resonance Microscopy, August 2005, Utsunomiya, Japan
Joshua M. Bray, Mark Filiaggi, Steven D. Beyea, Carl Petrone

Magnetic resonance imaging characterization of drug delivery
International Society for Magnetic Resonance in Medicine, April 2005, Miami FL
Steven D.Beyea, Joshua M. Bray, Mark Filiaggi, S. Jill Glass

The design and implementation of an activity-based physics class for children
Atlantic Undergraduate Physics and Astronomy Conference, 2002, Halifax, NS
Joshua M. Bray, Adam J. Sarty (Talk awarded 2^{nd} prize)

The design and implementation of an activity-based physics class for children
Canadian Undergraduate Physics Conference, 2001, Winnipeg, MB
Joshua M. Bray, Adam J. Sarty