

Engineering Connections in the Liberal Arts College Environment
AALAC Workshop Proposal
Late Spring/Early Summer 2016, Macalester College, St. Paul, MN

Workshop Summary

This workshop assembles twenty AALAC faculty members to explore new curricular pathways to serve students interested in engineering as a life pursuit and to expand knowledge of engineering among liberal arts college students in general.

Workshop Description

The 3-2 pathway into engineering has long been a staple of liberal arts colleges. Its attractiveness has though diminished for several reasons, including financial aid issues and the strong tendency among liberal arts college students to identify with their entering class. Meanwhile, engineering scholars have emphasized that good engineering requires the integration of technical expertise with knowledge from the humanities, arts, and social sciences, especially to address multidisciplinary challenges such as those posed by the National Academy of Engineering. Emerging innovations such as driverless cars and the Internet of Things point to the increasingly engineered environment into which all liberal arts college students graduate. These developments prompt our workshop's primary questions:

How might alternatives to the 3-2 pathway into engineering be developed to take full advantage of the liberal arts college environment and serve a wide array of student interests?

How can students from a variety of disciplines become engaged with engineering even if they aren't planning on engineering as a career?

What kinds of courses, course components, and curricular structures can best foster student understanding of engineering as more than a technical way of thinking? How could these contribute to building community among students and help them develop an informed, critical understanding of engineering practices?

How might attention to engineering in a liberal arts college inspire more members of underrepresented groups to become involved with engineering?

Faculty participants, including 3-2 program advisers, will come from physics, engineering, mathematics, philosophy, and other disciplines. We aim for this workshop to lead to (1) a network to sustain the connections formed at the workshop and disseminate information related to the integration of liberal arts and engineering, and (2) a collaborative proposal for curricular development and/or a curricular development concept paper to be submitted to appropriate funding sources.

Workshop Co-liaisons:

Diane P. Michelfelder
Professor
Department of Philosophy
Macalester College
St. Paul, MN 55105
(651) 696-6197
michelfelder@macalester.edu

Daniel E. Flath
Visiting Professor
Department of Mathematics,
Statistics, and Computer Science
Macalester College
(651) 696-6342
flath@macalester.edu

Other Workshop Organizers:

Taylor Allen, Associate Professor of Biology, Oberlin
Amy Banzaert, Lecturer in Engineering, Wellesley
Martha-Elizabeth Baylor, Assistant Professor of Physics, Carleton
Walter Smith, Professor of Physics, Haverford

Additional Faculty Expressing Interest in Participating:

Bill Baker, Professor of Physics, Furman
Steven Doty, Associate Professor of Physics and Astronomy, Denison
Andrew Guswa, Professor of Engineering and Director of the Center for the Environment,
Ecological Design, and Sustainability, Smith
Elijah Huge, Associate Professor of Art, Wesleyan
Lutz Huwel, Professor of Physics, Wesleyan
William Loinaz, Professor of Physics and Astronomy, Amherst
Mark Matlin, Senior Lecturer in Physics, Bryn Mawr
Bryan Penprase, Professor of Physics and Astronomy, Pomona
Daniel Scharstein, Professor of Computer Science, Middlebury
Paul H.J. Tjossem, Associate Professor of Physics, Grinnell
Ann Viano, Associate Professor of Physics, Rhodes
Susan Voss, Professor of Engineering and Director, Picker Engineering Program, Smith

Workshop Schedule

We plan a 2 day workshop spread over a Friday, Saturday, and Sunday to allow for travel to/from the Twin Cities. The schedule provides opportunities for interactions among participants to seed long-term collaborations. The small and full group sessions move from the general questions outlined above to specific questions concerning curricular and program development. The planning committee will choose keynote speakers.

Day 1

6:00-9:00 PM

Dinner and full group conversation
Participants self-introduce and describe their projects and goals relating engineering and liberal arts colleges

Day 2

8:00-9:30 AM	Breakfast and first keynoter
9:30-10:30	Full group discussion
10:30-10:45	Break
10:45-11:45	Small group discussions
12:00-1:30 PM	Lunch and second keynoter
1:30-3:00	Small group discussions
3:00-3:15	Break
2:45-3:45	Panel discussion
3:45-5:00	Full group discussion
5:00-6:00	Reception/hors d'oeuvres
6:00--	Dinner on your own

Day 3

8:30-9:30 AM	Breakfast
9:30-11:30	Full group discussion; planning for next steps
11:30-	Workshop ends (box lunches)

Assessment of the workshop will be via a post-workshop survey and a follow-up survey a year later.

Diane P. Michelfelder
Professor
Department of Philosophy
Macalester College, St. Paul, MN 55105
(651) 696-6197
michelfelder@macalester.edu

Educational Background:

A.B., Bryn Mawr College, 1975 (with honors in philosophy)
Ph.D., The University of Texas at Austin, 1982

Recent Selected Publications:

Book volume: Michelfelder, D., N. McCarthy, and D. Goldberg, Eds. 2013. *Philosophy and Engineering: Reflections on Practice, Principles and Process*. Dordrecht: Springer Press. Xix + 431 pp.

Journal Articles and Book Chapters:

Jones, S. A., D. Michelfelder, and I. Nair. 2015. "Engineering managers and sustainable systems: the need for and challenges of using an ethical framework for transformative leadership." *Journal of Cleaner Production*. DOI: 10.1016/j.jclepro.2015.02.009.

Michelfelder, D. and S. Jones. 2013. "Sustaining Engineering Codes of Ethics for the 21st Century," *Science and Engineering Ethics* 19 (1): 237-258.

Michelfelder, D. 2012. "Web 2.0: Community as Commodity." In *The Good Life in the Technological Age*, ed. Philip Brey, Adam Briggie, and Edward Spence, pp. 203-214. Oxford: Routledge Press.

Michelfelder, D. 2011. "Dirty Hands, Speculative Minds, and Smart Machines." *Philosophy & Technology* 24 (1): 55-68.

Michelfelder, D. 2010. "The Philosophy of Technology When 'Things Ain't What they Used to Be'." 2010. *Techné: Research in Philosophy and Technology* 14(1): 60-68.

Book under contract:

Michelfelder, D., B. Newberry, and Q. Zhu, Eds. *Philosophy and Engineering: Exploring Boundaries, Expanding Connections*. Dordrecht: Springer Press.

Recent selected presentations:

Invited speaker, "Apps, Clouds, Sensors and the Mystery of Well-Being,"; "The Gender Inequality in 'Smart' World Design and Why it Matters," Well-Being in Digital Media Conference, Ben-Gurion University and Interdisciplinary Center Herzliya, Israel, February 2015.

Invited panelist, "The Sharing Economy meets the Driverless Car," University of Portland, Portland, OR, November 2014.

Invited speaker, “Should Your Volvo Be Your Mother?: Some Thoughts on Technological Paternalism and Design.” Virginia Tech Ethics Week, March 2013. A revised version of this paper was presented at the biennial meeting of the Society of Philosophy and Technology, Lisbon, Portugal, July 2013.

“Critical Thinking and Heuristics: What Philosophy Can Learn From Engineering About the Back of the Envelope,” Forum on Philosophy, Engineering, and Technology (fPET) 2012, Beijing, PRC, November 2012.

“Imagining Techno-Moral Change: From Moral Shortcut to Moral Detour.” 1st International Conference of the Centre for Ethics and Politics of Emerging Technologies. Maastricht University, the Netherlands, July 2012.

Keynote Address, “Creative Innovation: Tautology or Opportunity?” 4th Annual Symposium on Engineering and Liberal Education, Union College, June 2011.

“Hephaestus: God of Engineering and Philosophy Too?,” biennial meeting of the Society for Philosophy and Technology, University of North Texas, Denton, Texas, May 2011.

Other relevant professional activities:

Co-editor-in-chief: *Techné: Research in Philosophy and Technology*, January, 2014—present.

Co-founder and steering committee member, Forum for Philosophy, Engineering and Technology. Conference co-chair, fPET 2010, Colorado School of Mines, Golden, Colorado (May 2010), Executive Committee member, fPET 2012, Graduate University of the Chinese Academy of Sciences (November 2012), Program Committee Member (2012); Conference co-chair, fPET 2014, Virginia Tech, Blacksburg, VA (May 2014)

Editorial Board Member, Philosophy, Technology, and Society book series (Roman and Littlefield International), 2013—present.

Scientific Advisory Board Member, *Philosophy & Technology*, 2010—present.

President, Society for Philosophy and Technology, 2007-2009. Vice-President and President-elect, 2006-2007. Member of Board of Directors and Treasurer, 1999-2005; 2006-2011; SPT 2011 meeting co-chair for track in philosophy/history of technology; Chair, :

Relevant Courses Taught at Macalester: Critical Thinking, Environmental Ethics, Ethics, Ethics and the Internet, Philosophy of Technology

Daniel E. Flath Macalester College

Education

1. Harvard University, PhD(1977), M.A.(1974) in Mathematics.
2. Southern Methodist University, M.S.(1972), B.S.(1972), in Electrical Engineering.
3. Johns Hopkins Bloomberg School of Public Health/Coursera, Data Science Specialization, 2014.

Winner of the 2014 MAA North Central Section Award for Distinguished College or University Teaching of Mathematics (Mathematical Association of America)

Research Experience

2002-present: Macalester College, Department of Mathematics, Statistics, and Computer Science. Visiting Professor 2005, Visiting Assistant Professor 2002.

Fall 2008: Institute for Mathematics and its Applications, Minneapolis, MN.
Long Term Visitor. (on leave from Macalester College)

1989-2002: University of South Alabama, Department of Mathematics.
Chair 2001, Professor 1996, Associate Professor 1992, Assistant Professor 1989

1996-1997: Centre de Recerca Matematica, Bellaterra, Spain.
Sabbatical leave from the University of South Alabama.

1988-1989: Rutgers University. Lecturer, Department of Mathematics.

1984-1987: National University of Singapore.
Senior Lecturer, Department of Mathematics.

1977-1984. Duke University. Assistant Professor, Department of Mathematics.

1978-1979. Universite de Paris VII.
Maitre de Conferences. (on leave from Duke University.)

Publications (selected)

1. Decomposition of representations into tensor products}, Automorphic Forms, Representations, and L-Functions, Proceedings of Symposia in Pure Mathematics 33, Part I, American Mathematical Society, Providence, R.I., 1979, pp179-183.
2. A comparison of the automorphic representations of $GL(3)$ and its twisted forms, Pacific Journal of Mathematics 97 (1981), 373-402.
3. On the structure of tensor operators in $SU(3)$ (with L.C.Biedenharn), Communications in Mathematical Physics 93 (1984), 143-169.
4. On $so(8)$ and the tensor operators of $sl(3)$, Bulletin of the American Mathematical Society 10 (1984), 97-100.
5. Beyond the enveloping algebra of $sl(3)$ (with L.C.Biedenharn), Canadian Journal of Mathematics 37 (1985), 710-729.

6. Tensor operators I, the concept of a coherent tensor operator (with J.Towber), *Communications in Algebra* 18 (1990), 4047-4086.
7. How to pick out the integers in the rationals: an application of number theory to logic (with S.Wagon), *American Mathematical Monthly* 98 (1991), 812-823.
8. Generators and relations for the affine rings of the classical groups (with J.Towber), *Communications in Algebra* 20 (1992), 2877-2902.
9. Tensor operators II, the algebra of tensor operators (with J.Towber), *Communications in Algebra* 20 (1992), 2903-2917.
10. Tensor operators III, some fundamental tensor operator identities (with J.Towber), *Journal of Mathematical Physics* 34 (1993), 1523-1547.
11. Review of (*Resources for Calculus, vol. 1-5*, Roberts, A.Wayne, Project Director, Mathematical Association of America, Washington, D.C., 1993), *The UMAP Journal* 15 (1994), 86-89.
12. Does the Moebius function determine multiplicative arithmetic? (with A.Zulauf), *American Mathematical Monthly* 102 (1995), 354-356.
13. A Combinatorial Problem in the Representation Theory of $SL(n)$ (with J.Towber), *Annals of Combinatorics* 4 (2000), 257-268.
14. Rocket Math (with S.Wagon and C.Stoll), *College Journal of Mathematics* 35 (2004), 262-273.
15. Finding a Hidden Coin (with S.Wagon), *The UMAP Journal* 27 (2006), 469-490.
16. Planar Rook Diagrams and Pascal's Triangle (with Tom Halverson and Kate Herbig), *L'Enseignement Mathematique* 54 (2008), 1-16.
17. The First Year of Calculus and Statistics at Macalester College (with T.Halverson, D.Kaplan, and K.Saxe), *Undergraduate Mathematics for the Life Sciences: Models, Processes, and Directions*, (G. Ledder, J.P.Carpenter, and T.D.Comar, eds.), MAA Notes, MAA, 2013.
18. Gravity-driven instability of a thin liquid film underneath a soft solid (with S. H. Lee, K. L. Maki, S. J. Weinstein, C.Kealey, W.Li, C.Talbot, S.Kumar), *Physical Review E*, 90 (2014), 053009.

Books (selected)

1. *Introduction to Number Theory*, Wiley, New York, 1988.
2. *Calculus* (with the Calculus Consortium based at Harvard), Wiley, New York, First ed. 1993, Second ed. 1998, Third ed. 2001, Fourth ed. 2004, Fifth ed. 2008, Sixth ed. 2012.
3. *The classical and quantum $6j$ -symbols* (with J.S.Carter and M.Saito), Princeton University Press, Princeton, 1995.
4. *Applied Calculus* (with the Calculus Consortium based at Harvard), Wiley, New York, 1998, Second ed. 2002, Third ed. 2005, Fourth ed. 2009, Fifth ed. 2013.
5. *Functions Modeling Change* (with the Calculus Consortium based at Harvard), Wiley, New York, Second ed, 2003, Third ed. 2006, Fourth ed. 2010, Fifth ed. 2014.
6. *Conceptests for Applied Calculus* (with D.Hughes-Hallett, A. M. Gleason, and P. F. Lock), Wiley, New York, 2006

BIOGRAPHICAL SKETCH: Taylor Allen

A. Professional Preparation

University of Pennsylvania	Bioengineering	B.S.E., 1984
University of Washington	Physiology and Biophysics	Ph.D., 1990
University of Pennsylvania	Physiology	1990-1992
University of Pennsylvania	Cell and Developmental Biology	1992-1996

B. Appointments

2013-present	PULSE Fellow (Partnership for Undergraduate Life Science Education)
2002-present	Associate Professor, Department of Biology, Oberlin College
1997-present	Director of 3-2 Engineering (combined BA/BSE) Program, Oberlin College
2012-2013	<i>Vision and Change</i> Leadership Fellow (HHMI, NIH, and NSF)
2009-2013	Chair of Biology, Oberlin College
1996-2002	Assistant Professor, Department of Biology, Oberlin College
1992-1996	Postdoctoral fellowship with Dr. Elizabeth Bucher, Department of Cell and Developmental Biology, University of Pennsylvania: Genetic, molecular, and physiological studies of the activities of Troponin-T in muscle development and function.
1990-1992	Postdoctoral fellowship with Drs. Yale Goldman and Malcolm Irving (KC-London), Department of Physiology, University of Pennsylvania: Fluorescence spectroscopical study of orientational changes of myosin during force generation.

C. Intellectual Products

N.B. Underline signifies student contributing as an undergraduate.

Products most relevant to the proposal. (Publications chosen because they demonstrate the applicant's integration of teaching and research, as well as mentoring of undergraduates.)

Milkova, L., Crossman, C., Wiles, S., and Allen, T. 2013. Engagement and skill development in biology through analysis of art. *CBE-Life Sciences Education* **12**: 687-700.

Allen, T. (2013) Assessment Section. In *Online PULSE Workshop* (POWER), www.pulsecommunity.org

Burke, A.K., Maday, S.M., Rybicka, K.K., Sulcove, J.A., Ward, J., Huang, M.M., Barstead, R., Franzini-Armstrong, C., and Allen, T.StC. 2004. Functional and structural disruption of muscle caused by mutation of troponin I of *Caenorhabditis elegans*. *Biophysical Journal* **86**: 991-1001.

McArdle, K., Allen, T.StC., and Bucher, E.A. 1998. Ca²⁺-dependent muscle dysfunction caused by mutation of the *Caenorhabditis elegans* Troponin T-1 gene. *Journal of Cell Biology* **143**: 1201-1213.

Five other publications, chosen because illustrative of applicant's biophysical scholarship

Thestrup, T., Litzlbauer, J., Bartholomäus, I., Mues, M., Russo, L., Dana, H., Kovalchuk, Y., Liang, Y., Kalamakis, G., Laukat, Y., Becker, S., Witte, G., Geiger, A., Allen, T., Rome, L.C., Chen, T.-W., Kim, D.S., Garaschuk, O., Griesinger, C., Griesbeck, O. 2014. Optimized ratiometric calcium sensors for functional in vivo imaging of neurons and T-lymphocytes. *Nature Methods* **11**: 175-182.

Kolmerer, B., Clayton, J., Benes, V., Allen, T., Ferguson, C., Leonard, K., Weber, U., Knekt, M., Ansorge, W., Labeit, S., and Bullard, B. 2000. Sequence and expression of the kettin gene in *Drosophila melanogaster* and *Caenorhabditis elegans*. *Journal of Molecular Biology* **296**: 435-448.

Allen, T.StC., Ling, N., Irving, M., and Goldman, Y.E. 1996. Orientation changes in myosin regulatory light chains following photorelease of ATP in skinned muscle fibers. *Biophysical Journal* **70**: 1847-1862.

Myers, C.D., Goh, P.-Y., Allen, T.StC., Bucher, E.A., and Bogaert, T. 1996. Developmental genetic analysis of troponin T mutations in striated and non-striated muscle cells of *C. elegans*. *Journal of Cell Biology* **132**: 1061-1077.

Irving, M., Allen, T.StC., Sabido-David, C., Craik, J.S., Brandmeier, B., Kendrick-Jones, J., Corrie, J.E.T., Trentham, D.R., and Goldman, Y.E. 1995. Tilting of the light-chain region of myosin during step length changes and active force generation in skeletal muscle. *Nature* **375**: 688-691.

D. Examples of Synergistic Activities

1) *Innovation in teaching* Working with three art historians, the applicant developed and assessed an art-based activity that piques biology students' curiosity, broadens ways by which students meaningfully engage with physiological concepts, and nurtures students' critical thinking skills. The activity was described by the applicant at

the 2011 Annual Meeting of the Association of American Colleges and Universities and at the 2013 College Art Association Meeting; a full-length research report has been published: Milkova, L., Crossman, C., Wiles, S., and Allen, T. 2013. Engagement and skill development in biology through analysis of art. *CBE-Life Sciences Education* 12: 687-700.

2) *Contribution to science of learning* Through auspices of an NSF CAREER Award (IBN 9985315) and an NSF CCLI grant (DUE-0411070), the applicant tested two curricular innovations for efficacy in promoting students' (i) critical thinking skills, (ii) positive attitude toward biology, and (iii) epistemological understanding of science. Examined were semester-long, discovery-based research projects and Cambridge-Oxford-style tutorials. Also tested was the impact of replacing cumulative final examinations with portfolios. Preliminary communications of findings were made by the applicant at the Sixteenth International Worm Meeting (2007) and by a collaborator (M. Laskowski) at Plant Biology 2011. A manuscript is being readied for submission. Also, through an NSF EAGER grant (EF 1355894), applicant and collaborators are establishing an educational network across the Great Plains and Midwest and testing hypotheses concerning the dynamics of curricular transformation within undergraduate biology programs.

3) *Development of database* Authored the section on assessment for the PULSE Online Workshop, POWER, (www.pulsecommunity.org). Also for PULSE, authored handbook on creative problem solving and facilitative leadership; this handbook is being incorporated into the PULSE Online Workshop and is providing the framework of the Midwest and Great Plains PULSE Network Conferences (Washington University, June 2014 and June 2015).

4) *Broadening participation* Annually conduct an outreach activity for secondary school students, typically from Oberlin High School. Also, mentored two female high school students in summer research projects (summer 2004 and summer 2013).

5) *Service to STEM* The applicant has made pedagogically related contributions to the broader academic community in a variety of ways, including the following: serving on two NSF CCLI review panels (2005 and 2006); co-organizing workshops on teaching for International Worm Meetings (2001 and 2005); reviewing manuscript for *Advances in Physiology Education* (2006) and *CBE-Life Science Education* (2014); presenting on assessment for pedagogical workshop at the 2007 International Worm Meeting; participating in the Assessment Working Group of the conference *Chronicling the Change*, (Washington, D.C. September 2013), sponsored by AAAS and NSF; co-organizing four workshops to promote department-level improvement in undergraduate life science education, two for biology department chairs from approximately twenty Midwest institutions (January 2014 and 2015), and two for teams of 3 to 8 instructors from selected institutions (nineteen institutions in June 2014 and twenty-six in 2015); serving as one of forty *Vision and Change* Leadership Fellows (2012-2013) selected by HHMI, NIH, and NSF to formulate national strategies to catalyze department-level transformation of undergraduate biology education; and, growing from the *Vision and Change* Fellowship, serving as one of approximately 50 PULSE Fellows to implement and to assess the national strategies for transforming undergraduate biology education.

E. Courses Taught and Undergraduate Research Students Mentored

Applicant's annual teaching includes the following courses: Bio 100, *Organismal Biology* (with lab); Bio 312, *Physiology* (with lab); Bio 501/502, *Mentored Research*; and either FYSP 60, *Finding One's Muse: Creativity, Innovation, and Design*, or FYSP 182, *The Body in Health and Disease*. Between 1996 and 2014, applicant mentored 114 students in research, including 21 Biology Honors students and 38 summer research students, with students' research terms averaging 7.4 months. Overall, 77% of all Oberlin research students in applicant's lab since 1996 have been women. Nine have thus far completed doctorates, and others soon will.

Amy Banzaert

39 Malcolm Road Jamaica Plain, MA 02130
+1 781 283 3756
abanzaert@wellesley.edu

Education

Massachusetts Institute of Technology	Cambridge,MA
Ph.D., Mechanical Engineering, GPA: 4.8/5.0 Co-advisors: Prof. J. Kim Vandiver; Prof. Amos Winter V	February 2013
M.S., Mechanical Engineering, GPA: 4.8/5.0 Advisor: Prof. David Wallace	September 2006
B.S., Mechanical Engineering, GPA: 4.3/5.0 Thesis Advisor: Prof. Anna Thornton	June 1998

Professional Experience

Wellesley College	Wellesley,MA
Lecturer In Engineering	2014 - present
Visiting Lecturer In Engineering	2012 – 2014

Leading emerging engineering program, including developing and teaching introductory engineering curriculum (three-four classes per year), advising students, organizing seminars, conducting outreach within and beyond college, collaborating with community partners locally and internationally who are recipients of student service-learning projects, grant writing, and oversight of engineering teaching studio.

MIT Public Service Center and Edgerton Center	Cambridge,MA
Service Learning Coordinator and Instructor	2001 – 2004

Managed and developed the Institute's service learning initiative. Provided collaborative leadership, planning, and implementation, expanding the program in three years from 3 classes in 2 departments to 56 classes in 11 departments. Managed \$30K annual budget, including responsibility for grant writing and reporting. Recruited and supported faculty service learning practitioners, advising on curriculum development and service learning implementation. Oversaw program assessment and revision. Created and ran Service UROPs, Public Service Design Seminars, and Service Learning Grants programs. Taught one MIT engineering design seminar with service learning approach each year.

Texas Instruments, Automotive Sensors and Controls Division	Attleboro Mansfield,MA
Design and Manufacturing Engineer	1998 – 2001

Design: responsible for automotive capacitive acceleration sensor: Numerous projects resulting in 3% cost reduction across various product lines. Developed and presented problem-solving presentation for suppliers: adopted by TIs quality group. Redesign and prototyped device bracket for possible \$300K/year cost reduction. Guided subordinates to complete projects. Collaborated with automotive customers and suppliers, including metal stamping, plating, and injection molding. Manufacturing: responsible for automotive pressure switch manifolds: Improved new device to optimize manufacturability: design saved profitable \$20M business. Collaborated with design engineers to create and optimize designs and associated manufacturing lines, ranging from highly automated to manual. Presented multiple capital packages to management for cost reduction programs; all approved. Lead cleanliness improvement team, wrote equipment specifications, supported customers.

Research Experience

PhD Research Assistant MIT D-Lab	2007 - 2012
----------------------------------	-------------

Viability of Waste-Based Cooking Fuels for Developing Countries: Combustion Emissions and Field Feasibility. Characterized the gaseous and particulate combustion emissions associated with a novel form of charcoal (AWC) made from carbonized plant waste as well as fuels made from certain household and industrial wastes, compared to wood charcoal. Introduced study of ultra-fine particles to the study of cooking fuels in developing countries. Ag. waste charcoal found to be viable from an emissions and socioeconomic standpoint, with laboratory studies complemented by investigations under field conditions in Nicaragua. Household and industrial waste fuel emissions found to be hazardous from a health perspective.

Masters Research Assistant MIT CADLab

2004 - 2006

Experiments in Service Learning: the development of an alternative form of charcoal made from sugarcane waste products and an exploration of the benefits of the pedagogy of service learning for mechanical engineering students.

Honors, Awards, & Grants

MIT Center for Design and Technology Fellowship, 2012

MIT Graduate Woman of Excellence, 2010

Carroll L. Wilson Award, 2010

Martin Family Society Fellow for Sustainability, 2009-2010

MIT Legatum Fellow, 2008-2009

Xerox MIT Fellow, 2007-2008

World Bank Development Marketplace winner of \$200K on team Fuel from the Fields, 2007

MIT \$100K Competition Development Track winner on team Bagazo, 2007

Hugh Hampton Young Fellow, 2004-2006

NSF Department-Level Reform Grant: Integrating Service Learning into Mechanical Engineering Pedagogy at MIT, as part of collaboration between MIT Public Service Center, Department of Mechanical Engineering, and Edgerton Center, PI: David R. Wallace, 2004.

MIT Excellence Award: Service Learning Initiative & IDEAS Competition, 2003

Selected Journal Articles, Conference Papers, & Posters

Morrison, E.H.J., Banzaert, A., Upton, C., Pacini, N., Pokorn, and Harper, D.M. (2014) "Biomass briquettes: a novel incentive for managing papyrus wetlands sustainably?". *Wetlands Ecology and Management*, 22(2) 129-141. (refereed journal article)

Banzaert, A., Winter, A. (2013). Design of Agricultural Waste Charcoal Cooking Fuel for Developing Countries. 2013 ASME International Design Engineering Technical Conference, ASME, Portland, OR. (paper & oral presentation)

Banzaert, A. (2011) Amy Banzaert: Research, Background, and Passions. Women in Technology & Design Forum, Singapore University of Technology and Design, Singapore. (poster session)

Banzaert, A., Dias Carlson, R. (2011). Fuel from the Fields. 2011 MIT Energy Conference Friday Night Energy Showcase. (poster session)

Gutowski, T., Taplett, A., Banzaert, A., et al. (2008). Environmental Life Style Analysis (ELSA). Proceedings, 2008 IEEE International Symposium on Electronics and the Environment, IEEE, San Francisco, CA. (paper)

Martha-Elizabeth “Marty” Baylor

Department of Physics and Astronomy
Carleton College
One North College St
Northfield, MN 55057

Tel : 507 222-4149
Fax : 612 625-4583
mbaylor@carleton.edu

PROFESSIONAL PREPARATION

Kenyon College	Physics	B.A., 1998
University of Colorado, Boulder	Physics	Ph.D., 2007
University of Colorado, Boulder	Postdoc in Electrical Engineering	2008-2010
University of Colorado, Boulder	Junior Sabbatical in Electrical Engineering and Chemical Engineering	June 2014-Nov 2014

APPOINTMENTS

Assistant Professor	Physics, Carleton College	2010-
Ford Foundation Postdoctoral Fellow Electrical Engineering	University of Colorado	2008-2010
Visiting Assistant Professor	Physics, Carleton College	2007-2008
Electrical Engineer & Optical Engineer	NASA Goddard Space Flight Center	2000-2002
Middle & High School Teacher	Physics, Maret School	1998-2000

PUBLICATIONS/PRODUCTS

- M-E. Baylor, B. W. Cerjan, R. W. Boyne, C. R. Pfeifer, N. B. Cramer, C. N. Bowman, R. R. McLeod, “Monolithic integration of optical waveguide and fluidic channel structures in a Thiol-ene/Methacrylate photopolymer,” *Optical Materials Express*, **2**, 1548-1555 (2012). doi:10.1117/12.899719
- M. A. Tadayon, M.-E. Baylor, and S. Ashkenazi, “High quality factor polymeric Fabry-Perot resonators utilizing a polymer waveguide,” *Optics Express*, **22**, 5904-5912 (2014). <http://dx.doi.org/10.1364/OE.22.005904>
- B. A. Kowalski, A. C. Urness, M.-E. Baylor, M. C. Cole, W. L. Wilson, and R. R. McLeod, “Quantitative modeling of the reaction/diffusion kinetics of two-chemistry diffusive photopolymers,” *Optical Materials Express*, **4**, 1668-1682, (2014). doi: 10.1364/OME.4.001668
- M. A. Tadayon, M-E. Baylor, S. Ashkenazi, “Polymer waveguide Fabry-Perot resonator for high-frequency ultrasound detection,” *Ultrasonics, Ferroelectrics, and Frequency Control*, accepted pending revisions, July 2014.
- C. Zimmerman*, M. White*, M-E. Baylor, “Effects of Interfacial Surface Tension on Macroscopic Polymer Lenses,” submitted to *SPIE Optical Engineering* in May 2015.

COURSES TAUGHT

Introductory Courses

Newtonian Mechanics, Relativity and Particles, Electricity, Magnetism, and Optics

Intermediate Courses

Atomic and Nuclear Physics

Advanced Courses

Classical and Quantum Optics, Advance Optics, Advanced Electricity and Magnetism, Contemporary Physics Lab

TARGETED COURSE REVISION

These course revisions were designed to increase the applied, engineering design, and/or real-world components to these courses.

- HHMI Curricular Development Funding: Photonics Project with Academic and Civic Engagement Component (Summer 2014)
- QuIRK Curricular Development Funding: Adding Content Rich Real-world problem-solving in Introductory Electricity, Magnetism, and Optics (Winter 2014)
- HHMI Curricular Development Funding: Lab Development for Advanced Optics (Summer 2011)

EXTRACURRICULAR ACTIVITIES

- Mentor: 23 Undergraduate Research Students (2010-present)
- Advisor: Carleton College Pre-Engineering program (2010-present)
- Mentor for 8th grade student in Tackling Obstacles and Raising College Hopes Program
- Developer, Instructor, Consultant of Hands-on Electromagnetic Waves Course for Denver Have A Dream Program & Denver Boys and Girls Club, University of Colorado, CU Science Discovery (2009-2011)

HONORS AND AWARDS

RCSA Cottrell Award	2014
University of Minnesota MRSEC	2011
National Society of Black Physicists Dissertation Award	2009
Ford Foundation Postdoctoral Fellow	2008
Optical Science and Eng. Program NSF-IGERT Fellowship	2002-2007

PROFESSIONAL MEMBERSHIPS

American Physical Society (APS)
American Association of Physics Teachers (AAPT)
National Society of Black Physicists (NSBP)
Optical Society of America (OSA)
Society of Photo-optical Instrumentation Engineers (SPIE)

Walter Fox Smith
Physics Dept., Haverford College, Haverford PA 19041
610-896-1332 wsmith@haverford.edu

Professional Preparation

Wesleyan University	Physics	B.A. with High Honors in Physics, 1981
<i>Johnston physics prize, 1981</i>		
Harvard University	Physics	Ph. D., 1989
<i>Rudenberg prize for electron microscopy, 1988</i>		
<i>Whiting Fellow, 1982-1983</i>		
University of Texas at Austin	Physics	Postdoctoral Fellow, 1989-1992

Appointments

1999-present	Professor, Physics Dept.	Haverford College
Students' Association Award 2003 and 2012, Innovation in Teaching Award 2005		
1999-2009	Associate Professor, Physics Dept.	Haverford College
1992-1999	Assistant Professor, Physics Dept.	Haverford College
Leave years	Visiting Scholar, Physics Dept.	University of Pennsylvania
1989-1992	Postdoctoral Fellow, Physics Dept.	University of Texas at Austin

Engineering-related activities:

- * Initiated 3/2 Engineering Program with CalTech
- * 2002-present Coordinator, 3/2 Engineering Program with CalTech
- * Co-organized the 4+1 program with University of Pennsylvania, under which students spend four years at Haverford College, then one year at U. Penn., and receive a Master's in Engineering.
- * 2012-present Coordinator, 4+1 Engineering Program with University of Pennsylvania

Publications:

Book: *Waves and Oscillations: A Prelude to Quantum Mechanics*, Oxford Univ. Press, 2010.

Five most recent journal publications:

1. D. J. Rigotti, B. Kokona, T. Horne, E. K. Acton, C. D. Lederman, K. A. Johnson, R. S. Manning, S. Amador Kane, W. F. Smith, and R. Fairman, Quantitative AFM Image Analysis of Unusual Filaments Formed by the the Anathamoeba Castellanii Myosin II Rod Domain, *Analytical Biochemistry* 346, 189-200 (2005).
2. W. F. Smith, Organic Electronics: Self Assembly is Ready to Roll, *Nature Nanotechnology* 2, 77-78 (2007). (A "News and Views" short review article, not peer-reviewed.)
3. A. L. Yeats, A. D. Schwab, B. Massare, D. E. Johnston, A. T. Johnson, J. C. de Paula, and W. F. Smith, Photoconductivity of self-assembled nanotapes made from meso-Tri(4-sulfonatophenyl)monophenylporphine, *J. Phys. Chem. C* 112, 2170-2176 (2008).
4. C. K. Riley, C. M. Cross, E. A. Muller, B. E. Feldman, K. L. van Aken, D. E. Johnston, A. T. Johnson, J. C. de Paula, and W. F. Smith, "Effects of oxygen, xenon, and gating on the photoconductivity of self-assembled porphyrin nanorods", *J. Phys. Chem. C* 114, 19227-19233 (2010).
5. A. P. Schall, J. Menko, P. Iavicoli, Y. Lu, Z. Qi, J. C. de Paula, A. T. Johnson, D. Amabalino, W. F. Smith, "Photoconductivity of nanofilaments that are self-assembled from a chiral porphyrin", Manuscript in preparation

Five Most Recent Grants:

Nano-Bio Interface Center at University of Pennsylvania, awarded July 2006: "Lateral photoconductivity measurements on porphyrin/peptide systems and development of optically activated scanned probe

techniques”, \$26,710 for one year.

National Science Foundation: Awarded October 2006: “RUI: Self-Assembling Porphyrins and Porphyrin-Modified Peptides and Studies of Their Photoelectronic Properties”. (Rob Fairman, Karin Akerfeldt, and I co-wrote this proposal). \$400,000 for three years, with two one-year no-cost extensions.

National Science Foundation: Awarded August 2009: “MRI: Acquisition of molecular and cellular imaging instrumentation”. (There are five PIs; Rob Fairman was the lead PI.) \$ 996,294 for one year. This grant funded the acquisition of six pieces of equipment. I had sole responsibility for the electron beam lithography system (\$62,460 including required accessories), 50% responsibility for the scanning electron microscope (\$105,690), and 25% responsibility for the sputter coater (\$8,485).

National Science Foundation: Awarded October 2011: “MRI: Acquisition of a UHV multi-source sputtering system for multidisciplinary material research”. (Xuemei Chang at Bryn Mawr college was the PI. There were three co-PIs, including myself.) \$239,550 for one year.

National Science Foundation: Start date 7/1/13: “RUI: Photoelectronic properties of DNA-chromophore hybrids and porphyrin nanowires”, \$240,000 for three years. (I am the sole investigator.)

Synergistic Activities:

Innovations in teaching:

1. Author of *Waves and Oscillations: A Prelude to Quantum Mechanics*. This is a sophomore/Junior-level text which strongly emphasizes applications of waves and oscillations in current research, and also the connections between classical coupled oscillator systems and quantum mechanics. Published May 20, 2010 by Oxford University Press.
2. Wrote over 30 songs for use in physics instruction. Created website www.PhysicsSongs.org to make song lyrics and recordings available to all instructors, students, and the public. Website includes a searchable database of physics songs by all authors, as well as recordings and lyrics contributed by other authors. Host annual sing-along at APS March Meeting.
3. Substantially revised Junior/Senior level advanced laboratory course to include a strong emphasis on principles of low noise measurements and computer data acquisition, modern optics (including quantum optics), as well as on independent research projects.

Broadening participation of underrepresented groups:

4. Of the 24 research students supervised in the last six years, 12 are from groups underrepresented in physics (8 women, 2 African-americans, one Latino, and one from Myanmar). Supervised at least one woman research student every year except leave years. (Women are very underrepresented in physics.)