Michael W. Pelter

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Educational Background:

Ph.D.	Miami University, Oxford, OH. (1987)
M.S.	Shippensburg University of Pennsylvania, Shippensburg, PA. (1984)
B.S.	Juniata College, Huntingdon, PA. (1982)

Additional Training:

1999-2000	Visiting Scholar, Center for Nanoscale Science & Technology, Rice University, Houston, TX (sabbatical leave with Prof. James M. Tour)
1998	Short Course on Brewing Technology, Siebel Institute of Technology, Chicago, IL.
1990-1991	Visiting Scholar, University of Nebraska-Lincoln, Lincoln, NE. (with Profs. Pat Dussault & Jim Takacs)
1988-1989	Post-doctoral Research Associate, Colorado State University, Ft. Collins, CO. (with the late Prof. John K. Stille)
1980-1981	Philipps Universität, Marburg an der Lahn, Germany. (exchange student)

Books:

M. L. Hackert, R. K. Sandwick, M. W. Pelter, L. S. W. Pelter, "Study Guide and Solutions Manual" for "Chemistry and Life" by Hill, Baum, and Scott-Ennis, Prentice-Hall: New Jersey, 2000.

R. K. Sandwick, M. W. Pelter, L. S. W. Pelter, A. Carter "Instructor's Solutions Manual with Test Bank" for "Chemistry and Life" by Hill, Baum, and Scott-Ennis, Prentice-Hall: New Jersey, 2000.

Selected Publications:

L. S. W. Pelter,* A. Amico, N. Gordon, C. Martin, D. Sandifer, M. W. Pelter, "Analysis of Peppermint Leaf and Spearmint Leaf Extracts by Thin Layer Chromatography." *Journal of Chemical Education*, Submitted for publication.

M. W. Pelter, "Brewing Science: Using Beer and the Brewing Process to Stimulate Interest in Science and the Science Laboratory." *Journal of College Science Teaching*, **2006**, Accepted for publication

M. W. Pelter* and J. McQuade. "Brewing Science in the Chemistry Laboratory: A 'Mashing' Investigation of Starch and Carbohydrates." *J. Chem. Ed.* **2005**, *82*, 1811.

M. W. Pelter,* L. S. W. Pelter,* D. Colovic, R. Strug "The Microscale Synthesis of 1-Bromo-3-chloro-5-iodobenzene: An Improved Deamination of 4-Bromo-2-Chloro-6-iodoaniline." *J. Chem. Ed.* **2004**, *81*, 111.

M. W. Pelter*, R. M. Macudzinski, and M. E. Passarelli "A Microscale Oxidation Puzzle." *J. Chem. Ed.* **2000**, *77*, 1481.

M. W. Pelter*, and R. M. Macudzinski, "A Puzzling Alcohol Dehydration Reaction Solved by GC/MS Analysis." *J. Chem. Ed.* **1999**, *76*, 826-828.

Research Grants Received:

National Science Foundation DUE-ILI—Grant No. DUE 9650826 (Budget period: 9/1/96-8/30/98; Budget amount: $23,904) "Incorporating FT-IR into the Laboratory Curriculum." Principal Investigator: **Michael W. Pelter**. co-PI's: Maria Longas, Charles Kriley.

Courses Taught:

Organic Chemistry
Introduction to Polymer Chemistry
Combinatorial Chemistry
Advanced Organic Chemistry
Introduction to Brewing Science (for non-science majors)

Hobbies:

Homebrewing, Genealogy, BJCP Recognized Beer Judge

Research Focus:

The focus of my research efforts includes work in the area of solid-phase organic synthesis and in the development of experimental curricula for chemical education. While my degrees are in organic chemistry, much of my experimental expertise is in the area of polymer chemistry. Through my post-doctoral work in the laboratories of the late John K. Stille, I was also exposed to the areas of organometallic supported catalysts and metal-mediated carbon-carbon bond forming reactions. During a recent sabbatical in the laboratory of James M. Tour at Rice University, I gained experience in the area of combinatorial synthesis. I have been able to expand on this knowledge through my participation, both as an attendee and as an instructor, in an NSF sponsored workshop entitled "Solid Phase Synthesis and an Introduction to Combinatorial Chemistry."

Polymer-Supported Catalysts

My background in polymer chemistry and polymer-supported reagents serves as the basis for my present project, which is in collaboration with Dr. Libbie S. W. Pelter (PUC) and Dr. James M. Takacs (UNL). The study will focuses on two classes of palladium catalysts used for the formation of carbon-carbon bonds. To date, we have developed several novel catalyst-ligand systems, and are investigating the novel use of single substrate with three different halogens to probe substrate reactivity. Using a combinatorial approach, we are seeking to maximize reactivity as each halogenated site through subtle variation in reaction conditions and choice of catalyst. My focus in this project is the development of solid-supported analogs of the catalyst-ligand systems used in their studies. At present we are working on the synthesis and utilization of *N*-heterocyclic carbene-palladium catalysts.

Optimization of reaction conditions will be accomplished using a statistical design approach to predict the optimized reaction conditions for each of the catalysts. Multivariate analysis allows for the efficient evaluation of interacting variables and provides a means to detect interactions that could not be detected using single variable analysis. The application of multivariate strategies provides great advantages in optimizing desired properties (product yield, compound specificity, catalytic activity, etc.) by simultaneous variation of experimental conditions—which may be continuous (temperature, time, concentrations, etc.) and discrete (solvent, catalyst, etc.) variables. Outcome measures for the studies will be turn-over number (TON) to determine catalytic efficiency, number of reactions per active site to determine catalyst stability and product specificity to determine catalyst selectivity. As these studies will be carried out on both the homogeneous and heterogeneous catalysts, a detailed comparative study will be achieved.

Microwave Heating in the Undergraduate Organic Laboratory

Most organic laboratory textbooks use a standard “cookbook” approach, where the students know everything about the product and results of the experiment before starting. In the investigative approach, students are given the experimental procedure and the structures of starting materials and reagents. They are provided with no information on the product. The identity of the product is determined through NMR, IR, and GC/MS analyses. Thus, this approach mimics the situation they would find in a professional appointment. Students are provided with the tools and knowledge to identify the product through critical reasoning and careful evaluation and to justify their own conclusions.

As I have continued to develop these inquiry-based experiments, I have found the types of reactions that can be performed are limited if only those that will fit into a three-hour time slot are chosen. Also, many of those require reaction times of over one hour. This “hurry up and wait!” mentality leaves little time for the acquisition and interpretation of spectral data and leads to the following questions:

•How can we do less waiting?

•How can we shorten reactions times?

My approach to this problem is to enlarge the number of inquiry-based experiments that can be developed through the utilization of microwave heating. A reaction requiring heating at 80°C for 8 hours can be completed in 8 minutes at 140°C under microwave irradiation.

Brewing Science in the Undergraduate Curriculum

Additionally, I am interested in developing experiments based upon the science of the brewing process. These are designed for incorporation into an allied health chemistry course or a general education laboratory science course. I have been a homebrewer for over ten years and am a "Recognized" beer judge in the Beer Judge Certification Program (BJCP). As part of this program, I serve as a judge at a number of professional and homebrew beer competitions each year. I am presently serving as a "scientific-content reviewer" for *Brew Your Own*, the How-To Homebrew Beer Magazine. This allows me to apply my professional scientific training to my hobby in order to increase the scientific literacy of the home brewing population.

SCI 150: Introduction to Brewing Science (lecture 2, lab 2, credit 3)

A novel way to introduce non-science majors to the chemistry laboratory using hands-on experiments can be done with a favorite beverage of college students – beer. Following the brewing process from "grain-to-glass," this course uses the biological and chemical principles of brewing to teach science to the non-science major. Students learn about the fermentation process, the malting and mashing process to liberate and break down starch to simple sugars, and the importance and chemistry of water, yeast, and hops. The students gain, by hands-on experience, an understanding of each step in the brewing process. Sensory evaluation exercises are included to develop student's ability to critically evaluate a product and convey that analysis using accurate descriptors. A major goal of the course is to provide the students with scientific knowledge they can use for the rest of their lives. SCI 150 meets the Purdue University Calumet General Education Requirements as a laboratory science course. All enrollees must by 21 years of age on or before the first day of class.