

NEW!
Available in Spring 2006!

Clean, Fast Organic Chemistry:

Microwave-Assisted Laboratory Experiments

By Cynthia McGowan, PhD & Nicholas Leadbeater, PhD

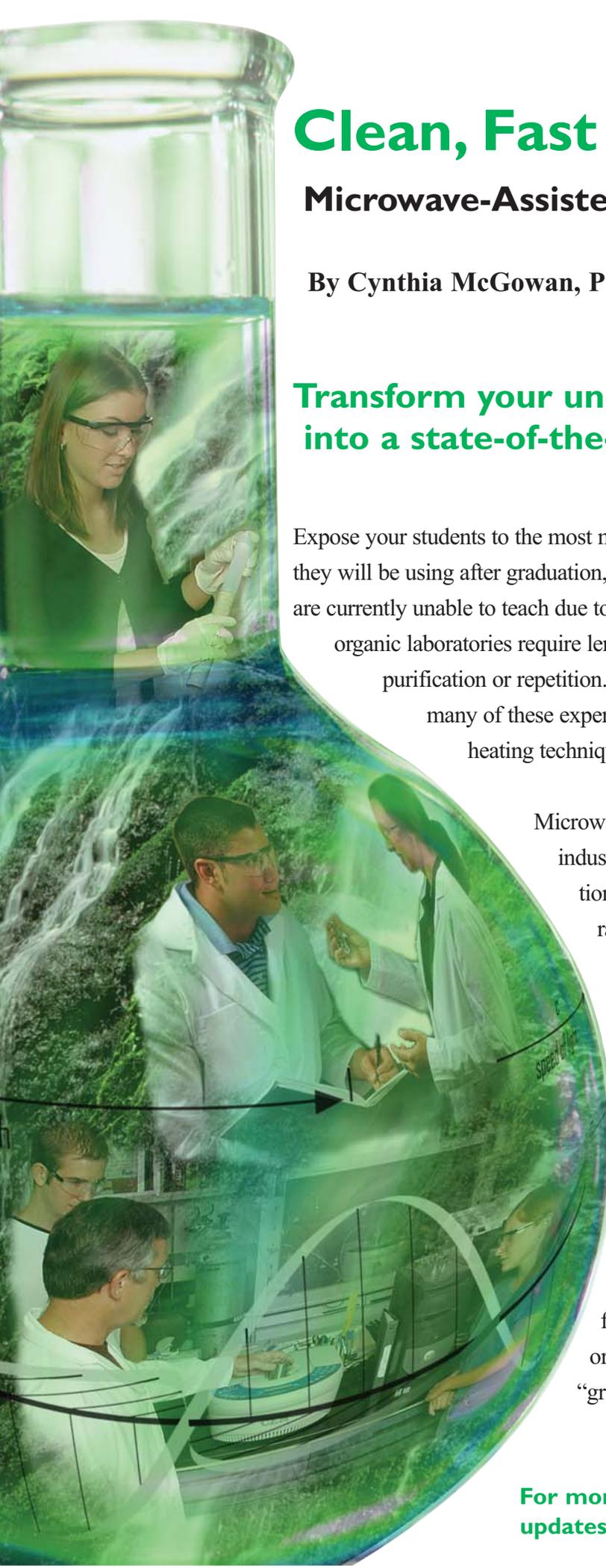
Transform your undergraduate organic laboratory into a state-of-the-art learning experience!

Expose your students to the most modern synthetic methods and the complex chemistries that they will be using after graduation, including multi-step and multi-component reactions that you are currently unable to teach due to time restrictions! Reactions typically covered in academic organic laboratories require lengthy reflux times and leave little time for characterization, purification or repetition. The authors of *Clean, Fast Organic Chemistry* have taken many of these experiments and converted them to include microwave-assisted heating techniques.

Microwave energy is fast becoming the method of choice for both industrial and academic chemists for driving reactions to completion, as it offers the safest, most effective way to increase reaction rates and improve product yields, while promoting green chemistry. Reactions that previously took hours, or even days, to complete can now be performed in minutes.

For example, nucleophilic aromatic substitutions, typically requiring 60-90 minutes reflux in toluene, are complete in less than 10 minutes in aqueous solution with microwave heating. Decreasing reaction times offers teaching opportunities: students have more time for design, optimization, characterization and analysis of reaction processes and products. Additionally, microwave-assisted reactions are often performed in aqueous solutions or neat, minimizing the need for organic solvents, simplifying the work-up process, and providing “green” reaction conditions.

For more information on *Clean, Fast Organic Chemistry* and updates on its publication, visit www.cem.com.



Go Green!

It's time to think about the environment and our impact on it. Microwave energy is an inherently efficient way to transfer energy to a reaction, as it transfers kinetically rather than thermally. Because of this quality, it is the ideal energy source for driving reactions.

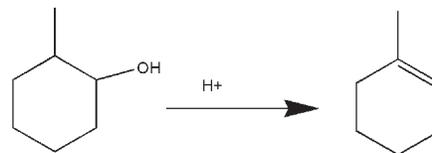
- Use water, ethanol or other environmentally benign solvents
- Neat reactions/high conversions help eliminate waste
- Non-hazardous reagents help students design safer syntheses
- Use catalysts, not stoichiometric reagents

Safe!

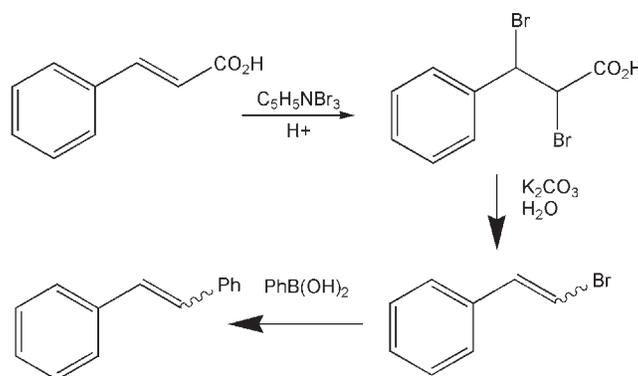
Not only is microwave-assisted chemistry good for the environment, it is also safer for chemists. Microwave synthesis systems designed for the laboratory offer an unmatched level of safety.

- Eliminate hot plate burns
- Reactions are completely contained
- Reactions return to room temperature before removing from microwave

Take your students from the chemistries of yesterday's hot plate...



to the microwave-assisted reactions they'll be using tomorrow quickly & easily!



Give your students more! The speed of microwave-assisted synthesis allows more time to learn about

- purification and analysis;
- more complex chemistries; and,
- varied research techniques!

About the Authors

Cynthia B. McGowan, PhD, is Associate Professor of Chemistry at Merrimack College, North Andover Massachusetts. Dr. McGowan graduated from Russell Sage College, completed her doctorate in organic chemistry at Brandeis University, and worked a number of years as an industrial chemist before joining the faculty of Wellesley College prior to her current position at Merrimack College. A committed and popular undergraduate teacher, recognized by her peers with a teaching excellence award in 1999, she continues to adapt her material to the ever-changing world of technology so that her students are well-prepared for graduate work or positions in industry. Her pioneering work in the use of microwave technology for organic chemistry experiments and teaching is 'student-tested' and refined. Dr. McGowan comes from a family of chemists (husband, daughters) and believes that giving students a serious and meaningful science experience can be powerful in helping with future career choices.

Nicholas E. Leadbeater, PhD, is an Assistant Professor of Chemistry at the University of Connecticut. Dr. Leadbeater, a native of the United Kingdom, graduated from the University of Nottingham, completed his doctorate in inorganic chemistry at the University of Cambridge and stayed there as a research fellow for three years before joining the faculty of King's College London prior to his current position at UCONN. Dr. Leadbeater's research interests are focused around development of new synthetic methodology and the majority of his group's recent research effort has been directed around the use of microwave heating as an enabling technology. His Suzuki and Heck couplings using sub-ppm levels of palladium, as well as his studies directed at new microwave techniques are examples of his recently published work. Dr. Leadbeater is a strong advocate of incorporating undergraduate students into research and of promoting clean chemistry and modern technology in education.

All reactions in this lab manual were performed in affordable, benchtop systems. Grants are available to assist in the implementation of laboratory courses on microwave-assisted organic synthesis. For more information on grants or equipment, contact CEM Corporation.

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