

CASPiE Implementation Guidebook

A step-by-step approach to transforming the
chemistry undergraduate laboratory course
into a research-based environment via the
CASPiE model



*Gabriela Weaver, Donald Wink, Fred Lytle, William Fornes, William Robinson,
Pratibha Varma-Nelson, Robert Morris, Anne Bentley*

Center for Authentic Science Practice in Education
Purdue University
560 Oval Drive
West Lafayette, IN 47907
Phone: 765.494.2348 Fax: 765.494.0239
www.caspie.org

Funding provided by the National Science Foundation



Table of Contents

Acknowledgments	iii
Chapter 1: CASPiE Philosophy and Overview	1
CASPiE Model Overview	1
Pedagogical Goals.....	1
CASPiE Compatibility with Existing Laboratory Programs.....	2
Chapter 2: CASPiE Modules.....	3
Available and Planned Modules	3
Effective Research Environments for CASPiE modules	4
Skills and Knowledge Needed to Involve Students in Research.....	5
Implementing CASPiE modules	6
Chapter 3: Assessment of Students.....	8
Content and Structure of the Rubrics	8
Implementation Issues	10
Chapter 4: Peer-Led Team Learning for CASPiE	14
PLTL Workshops for a CASPiE Laboratory Course	14
Implementing PLTL Workshops with the CASPiE Laboratory	16
Peer Leader Recruitment and Training.....	17
Compensation for Leaders.....	18
PLTL Prentice-Hall Series.....	21
Chapter 5: Remote Instrumentation.....	19
Instrument Network	19
Available Instrumentation	20
Tutorials	20
Procedures for Using Instruments with a CASPiE Module.....	20
Appendix A: Description of Modules to Date	A-1
Phytochemical Antioxidants with Potential Health Benefits in Foods	A-2
Development of an Old Reagent for the Reduction of Solid-Supported Alkenes: Total Synthesis of Zingerone and Raspberry Ketone	A-4
Band Gap Tuning of Zinc Oxide films for Solar Energy Conversion	A-5
Biochips: Ligand Surface Attachments for Biosensors	A-9
Lipids: Chemistry, Biology, Food and Health	A-11
The Plasmin Enzyme System and its Impact on Dairy Foods	A-12

Biodiesel from Waste Fats	A-14
Appendix B: PLTL Workshop Descriptions	B-1
Orientation to CASPiE and PLTL.....	B-2
Keeping a Research Lab Notebook Part 1.....	B-3
Keeping a Research Lab Notebook Part 2	B-4
Data Collection, Organization, and Interpretation	B-5
Ethical Conduct in Science.....	B-6
Getting Started in Research	B-7
Reading a Research Paper	B-8
Experimental Design	B-9
Poster Preparation.....	B-10
Peer Review Part 1.....	B-11
Peer Review Part 2	B-12
Writing a Scientific Paper	B-13
Writing an Abstract	B-14
Oral Presentations.....	B-15

Acknowledgments

The authors gratefully acknowledge the assistance of the faculty, staff, and graduate students involved with the Center for Authentic Science Practice in Education, especially William Boone, Jeong Hwang, Cianán Russell, and Phillip Wyss. George Bodner and the CASPiE Advisory Board improved an earlier draft of this guidebook and provided valuable input to the direction of the overall project. We also thank the module authors, Jay Burgess, Kyoung-Shin Choi, Veronica Curtis-Palmer, Devon Durkee, Ana Fraiman, Kirby Hayes, Baraem Ismail-mroueh, Albena Ivanisevic, Duncan Wardrop and Bruce Watkins, for their willingness to bring their research into the undergraduate laboratory. Much of this project would not have been possible without support from Purdue University's Discovery Learning Center and the Information Technology at Purdue group. Finally, we also thank the faculty and administrations at the CASPiE partner schools, Ball State University, College of DuPage, Harold Washington Community College, Moraine Valley Community College, Northeastern Illinois University, Purdue University, Olive-Harvey College, University of Illinois at Chicago, Vincennes University, and Wilbur Wright Community College for their willingness to try this exciting new model of undergraduate research.

Support for this work was provided by the National Science Foundation (CHE-0418902 and CHE-0513525).