

Sept. 22, 2008

TEXTBOOK AFFORDABILITY GRANTS PROGRAM COVER PAGE

1. INSTITUTION & PROJECT DIRECTOR

College/University Miami University

Address 500 East High Street
Oxford, OH 45056

Project Director(s) Richard T. Taylor, Ph. D.

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Project leaders from at least two collaborating institutions:

Name:	Institution:	E-mail addresses:
<u>Christopher S. Callam;</u>	<u>The Ohio State University;</u>	<u>ccallam@chemistry.ohio-state.edu</u>
<u>Steven J. Sucheck;</u>	<u>University of Toledo;</u>	<u>ssucheck@UTNet.UToledo.edu</u>
<u>Treasure Sucheck;</u>	<u>Mercy College;</u>	<u>Treasure.Sucheck@mercycollege.edu</u>

2. PROJECT

Title: Organic Chemistry REEL Laboratory Manual

3. BUDGET

Requested funds \$ 50000

CERTIFICATION AND ENDORSEMENT

The applicant certifies that to the best of his/her knowledge and belief, data in the proposal are true and correct, and those responsible for conducting the activity are requisitely responsible and capable. The institution endorses the goals of the project and agrees to participate and support its costs as outlined in the proposal.

Provost/Chief Instructional Officer Jeffrey Herbst
Title Provost
Signature [Signature] Date 11-12-08

Sept. 22, 2008

TEXTBOOK AFFORDABILITY GRANTS PROGRAM
TAGS Information

TAG DISCIPLINE

OSC 010 - Full Year Sequence of Organic Chemistry

Annual Course Enrollment (each institution)
Miami University - 330

Mercy College - 75

The Ohio State University - 700

University of Toledo - 350

Course Text Book(s) ISBN and new list price of text (each institution)

N/A see narrative

LEARNING OBJECTIVES – List three learning objectives supported by the proposal and indicate an example of content used to help students fulfill stated learning objectives (e.g., PowerPoint lecture, simulation, guided notes, practice quizzes, simulations or problem sets).

As the narrative states, the content is uniform, namely a set of research and/or discovery-based laboratory modules. These multiweek exercises promote student engagement with science as a living and growing field of knowledge to which they can make fundamental contributions.

Specific learning objectives that are supported by this approach to laboratory instruction include:

Critical thinking - students obtain data that cannot be looked up somewhere so they need to evaluate and interpret that data based on analogies to previous knowledge and reference to the chemical literature for background, but not for finding the answer.


Communication - students will need to present both the results of their lab work and their conclusions in a coherent manner; such presentation goes well beyond the laboratory notebook

6 Collaborative/Teamwork - The REEL program is one place where large enrollment is an advantage. Significant research results can be generated by choosing projects where data needs to be collected and shared. The students develop an appreciation of the need to interact and share results before making conclusions.

Sept. 22, 2008

The undersigned agree that all works furnished to the USO are either: (1) original works of authorship created entirely by faculty members in connection with this project that are not derivatives of, or do not otherwise contain third-party content ("Faculty Works"); or (2) works that contain, are comprised of, or are derivatives of third-party works for which express written permission has been granted by the rights-holder to use those works in connection with the program ("Third-Party Works"). To the extent that works furnished to the USO consist or are comprised of Third-Party Works, the undersigned agree to completely and accurately identify the specific nature and location of such materials and their rights-holders. The undersigned further agree, together with their employing academic institution, to execute all documents necessary to assign ownership to USO of Faculty Works and all portions of Third-Party Works that contain or are comprised of original works of authorship created by faculty members in connection with this project. Further, we agree to abide by all terms and conditions of rights-holders of Third Party Works. We agree to offer the course at our institution in Autumn of 2009 as a condition of receiving the second installment of our grant award. The third installment is conditioned on satisfactory evaluation of the initial offering as well as a commitment to the second iteration of the course. Faculty stipulate that their use of the digital course pack is consistent with institutional policy and sanctioned by the Institutional Review Board (if necessary). We understand that an OhioLINK server is available to house these materials and to link to servers of commercial content providers if necessary.

Signature of Project Team Members:

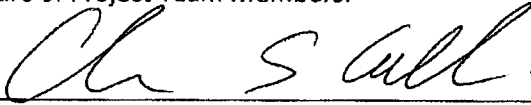


11-11-08 Date

Sept. 22, 2008

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Signature of Project Team Members:



11/10/2008

Date

Sept. 22, 2008

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Signature of Project Team Members:

Stephanie A. Duchick, Professor of Chemistry, Mercy College

11-11-08 Date

Organic Chemistry REEL Laboratory Manual

Collaborating institutions in the state of Ohio have formed an NSF-sponsored undergraduate research consortium entitled REEL – Research Experiences to Enhance Learning (<http://www.ohio-reel.osu.edu/>). The aim of the consortium is to have undergraduate students at partner institutions contribute to authentic research projects early in their undergraduate careers. The ultimate goal of these research experiences is to enhance learning, to attract students into the STEM fields, and to generate new chemical knowledge. Evaluation of the REEL program clearly indicates that the teaching and learning practices in REEL courses, which have a greater emphasis on student-led inquiry, are quite different than those in traditional laboratory courses.

For the past three years, partner institutions have produced research modules and implemented them in the first and second year chemistry courses. The module development and implementation processes have been undergoing a rigorous and continuing evaluation. The challenge for the module development teams is to institutionalize and disseminate the most successful modules in order to enhance the STEM environment throughout the state. It should be emphasized that these modules are not restricted to small majors courses. As our materials indicate, they are being used in the large enrollment courses, where undecided students can sample the research experience and be attracted to the STEM areas.

The organic chemistry module development team feels that the modules they have created are sufficiently well-developed to be deployed on a continuing basis. The purpose of this proposal is to assemble the best research modules so that they are available at no cost to the students using them in their courses. Digital access will foster wider dissemination, both at the host and partner institutions. Moreover, as a model of best practices, these modules will foster further innovation. The modules to be presented will include discovery-based exercises that, while not pure research, will prepare the students for the authentic research experiences later in the course and will also allow faculty members at other institutions to begin the conversion to research modules in a gradual fashion. An ideal outcome would be a dynamic manual, with new modules being added annually as the partnerships grow and research expands throughout the state.

The availability of these materials will also foster commonality in the laboratory curriculum. A full year of organic chemistry is transferable between four-year institutions and between two-year and four-year institutions. If, as we believe can be demonstrated, the REEL concept enhances both the learning environment and the ultimate choices of students for STEM majors and careers, the availability of course materials throughout the state should be of strategic value. The modules chosen can plug into the standard lab syllabus at several strategic points. Equipment requirements vary amongst the modules, so that participation can be tailored to an institution's inventory. The module author will be clearly cited so that nearby resource persons will be located nearby.

The electronic resources developed will replace materials that need to be delivered by other means, often at expense to the students. While some member institutions use online course management systems (e.g. Blackboard), others use course-pack content from local printers to deliver material, with charges according to the pages in the packet. Both methods limit dissemination. The proposed work will make materials available in a fashion that is less expensive and more student and instructor friendly.

While each institution has a lead member of the development team, the production of the materials and the use of REEL modules is an institutional commitment and several faculty members will collaborate in the production of the module materials. Each module will have authorship attributed to afford adopters a resource person and to aid any licensing that authors might seek for dissemination beyond OhioLink.

During the grant period the team will plan a portfolio of digital content and agree upon editorial format and production standards. They will also assign extra-module content in advising later adapters on the use of research activities in the teaching lab. Once this agenda is finalized, the team will work with colleagues to produce the modules and deliver them to the students. Below we list the specific activity of each participating group:

Miami University – lead contact Professor Richard T. Taylor

The target courses at Miami University are CHM 244/245, a year long lab course enrolling about 300 students/year and CHM 254/255, the majors version enrolling about 30 students/year. Modules have been developed for both courses.

R. T. Taylor, “Selectivity in the Free Radical Halogenation of Electron Poor Heterocycles”

The selectivity of a common method for the functionalization of alkanes is examined with new compounds.

M. Novak, “Microwave Promoted Heterocycle Synthesis”

Using microwaves to excite reacting species has become one of the best ways to shorten reaction times. This experiment uses this technique to prepare new molecular species with potential biological activity.

B. Gung, “Combinatorial Evaluation of Charge Transfer Complexes”

The mixing of electron rich and electron poor aromatic compounds affords an array of colored solutions that can be characterized with simple equipment.

The Ohio State University – lead contact Professor Christopher S. Callam

The target courses at The Ohio State University are CH 254 and 255, annual enrollment over 700 individual students

R. Spinney, C. S. Callam, “Conformational Analysis on Carbohydrate Derivatives”

The module allows students to understand the applications of computational chemistry specifically conformational and structural activity relationships in carbohydrates and their derivatives.

C. S. Callam, "Fluorous Tagged Glycoside Synthesis"

The module allows students to learn modern glycoside bond synthesis reactions and perform advanced purification techniques using solid phase fluorous extractions.

C. S. Callam, "Ammonia Borane Reductions – Studies in Reactivity and Selectivity"

The module allows students to study ammonia borane's selectivity and reactivity with organic functional groups.

C. S. Callam, D. H. Hart, "Hydrolysis and Methanolysis Studies on N-Acylhydrazides using Polymer Supported Acid Resins"

The module allows students to gain an understanding of synthesis and purification techniques coupled with the development of new methodology for hydrolysis and methanolysis reactions of N-Acylhydrazides.

The University of Toledo – lead contact Professor Steven J. Sucheck

The target courses at the University of Toledo are CHEM 2470 and CHEM 2490 with combined enrollment of 350 students. The module coursepack at Toledo is sold at \$60.70/student.

Mercy College – lead contact Professor Treasure Sucheck

The target course at Mercy College is CHM 111 with enrollment at 75 students. The collaborative module developed between these institutions enrolls about 425 students and the availability of the electronic resource would save students about \$25000/year.

T. Sucheck, S. J. Sucheck, "Preparation of 1,2,3-Triazole Oxazolidinone Derivatives"

This collaborative module has an interdisciplinary component as well as microwave chemistry. The compounds prepared are then screened for antibiotic activity.

The Ohio REEL program has many member institutions and all are committed to providing research experiences to undergraduates in the first and second year labs. Miami University has begun general chemistry research modules this year, using modules developed by Ohio State, where substantial effort has been focused. Other institutions have also concentrated on general chemistry. The proposed resource will serve as an ideal vehicle for the next step, providing organic modules to those concentrating on general chemistry and, ultimately, vice versa.

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Process Guidelines

Here is a step-by-step approach to creating and using the repository of learning materials you'll aggregate in your proposal. Even though you won't be identifying and collecting these assets unless your proposal is funded, place a check mark before each, indicating you have read and can meet this expectation:

- ✓1. Identify your TAG (Transfer Assurance Guideline) community.
- ✓2. Indicate the course or courses for which your faculty team is creating a repository of digital learning assets.
- ✓3. List the learning objectives for the TAG course. Under each learning objective, list at least three digital learning assets.
- ✓4. For each asset, indicate whether it is a Faculty Work or a Third Party Work, including necessary identifications related to Third Party Works
- ✓5. Obtain express written permission from rights-holders for use of Third Party Works in such form as required by USO.
- ✓6. Assign to USO in such form as required by USO all Faculty Works and all portions of Third-Party Works that contain or are comprised of original works of authorship created by faculty members in connection with this project.
- ✓7. Create a course syllabus for each campus represented. List the learning assets used to teach the course. (Many faculty find it convenient to build a weekly syllabus that lists the learning objectives by week for pacing, sequence, and interconnectedness.) Link the learning assets to the appropriate week in the course offering will result in no cost to students taking the course.
- ✓8. Assure that the digital assets each faculty has chosen to use in their course offering will result in no-cost to students taking the course.
- ✓9. Compare the digital learning assets used in each of the three courses and check that the overlap (shared assets) range between 60% and 100% of the repository.
- ✓10. Check that the assessments you plan to use are drawn from the digital learning materials you provide your students in the course.
- ✓11. Prepare to teach; plan to use at least the first half of your first class meeting to describe and demonstrate your work with the digital repository.
- ✓12. Teach the course!
- ✓13. Evaluate your successes and failures and use your experiences to improve on your first course offering.
- ✓14. Teach the course again!

