Report

A Survey of Doctoral Programs in Chemical Education in the United States

by Diana Mason

As professional educators we understand the crucial role doctoral programs have played in our own development. Employment opportunities are expanding in chemical education and chemical education research, and we realize that the key to unlocking the potential of our students in the classroom is education.

Help Expand This Survey

At the ACS National Meeting in Washington, DC, a DivCHED symposium was devoted to doctoral programs in chemical education. Each university represented offers a doctoral program in chemical education through its department of chemistry. Some require course work in science education or pedagogy. A summary of each program described at the ACS symposium is provided here.

Because it is based on participation in the symposium, this list is not comprehensive. However, the Chemical Education Research Committee of the ACS Division of Chemical Education is interested in publishing on its Web site information about all programs that offer doctoral or master's degrees in chemical education. The committee is also compiling information about postdoctoral positions in chemical education.[1] If you know of such programs or positions, please contact Diana Mason at the email address that follows.

Further Information about Programs

For further information about any of the doctoral programs listed below, contact the specific institution at the address given. Neither the author of this article nor the *Journal* have information beyond that which is listed.

Acknowledgment

I thank Vickie Williamson, Texas A & M University, for encouraging me to compile a list of doctoral programs in chemical education. All program descriptions were contributed by the contact persons.

Notes

1. Postdoctoral fellowships in chemical education are available at the University of Wisconsin–Madison (*jwmoore@chem.wisc.edu*), and a program is being developed at California Polytechnic State University, San Luis Obispo, by Christina Bailey (*cbailey@calpoly.edu*).

Diana Mason teaches in the Interdisciplinary Studies Program, The University of Texas at San Antonio, San Antonio, TX 78249; drdiana@swbell.net; dmason@utsa.edu.

Institutions with Doctoral Programs in Chemical Education

University of California, San Diego and **San Diego State University, San Diego, CA** (a joint program)

Web site:
http://public.sdsu.edu/CRMSE/jdpmain.html

Contact person:
Barbara Sawrey, *bsawrey@ucsd.edu*

The Ph.D. program in mathematics and science education is designed to complement the discipline knowledge of students who have a background in biology, chemistry, mathematics, or physics with studies of how people learn mathematics and science. Our graduates are expected to contribute to the growing body of knowledge about cognitive processes in mathematics and science understanding. Admission requirements are a M.S. in biology, chemistry, mathematics, or physics, *or* a strong B.S. in biology, chemistry, mathematics, or physics, plus K–12 teaching experience. Applicants must also have a demonstrated interest in understanding how knowledge in mathematics or science is acquired, developed, and applied. The program is designed to be completed in four years, during which funding is typically provided.

University of Northern Colorado, Greeley, CO

Web site:
http://www.unco.edu/chemist/grad.htm

Contact persons:
Richard M. Hyslop, Chair, *rhyslop@unco.edu;*
Loretta L. Jones, Professor, *lljones@unco.edu*

The Ph.D. in Chemical Education at the University of Northern Colorado, initiated over a decade ago, is a doctoral program in the Department of Chemistry and Biochemistry designed for individuals who intend to pursue careers in chemical education research or chemistry teaching at the high school or university level. All degree candidates receive a comprehensive background in two subdisciplines of chemistry. Graduate course work in chemistry is accompanied by courses in learning theory, science curricula, research methods, statistics, and supporting pedagogical electives. Candidates for the Ph.D. degree must demonstrate research competence in both chemistry and chemical education. An innovative laboratory for chemical education research is being developed for this program.

Iowa State University, Ames, IA

Web sites:
http://hydrogen.chem.iastate.edu/WWW/GREENBOWE/ and *http://www.chem.iastate.edu/DeptInfo/Education.html*

Contact person:
Thomas J. Greenbowe, *tgreenbo@iastate.edu*

The Ph.D. program in chemistry with an emphasis in chemical education is designed for individuals who intend to pursue careers in chemical education research and teaching. Graduate course work in chemistry is accompanied by courses in learning theory, educational technology, statistics, and research and experimental design. Research projects are developed and implemented by each student with the assistance of a major professor. Our chemical education research group is investigating the effectiveness of collaborative distance education, guided-inquiry tutorials, discrepant events, multimedia, WWW, conceptual understanding, mental models, science writing heuristic, cooperative learning, and the particulate nature of matter with respect to the teaching and learning of chemistry. The goal of the program is to enable individuals to contribute original knowledge to the field of chemical education. Postdoctoral positions are available when funding permits.

Purdue University, West Lafayette, IN

Web site:
http://chemed.chem.purdue.edu/chemed/ (Division information)

Contact persons:
G. M. Bodner, *gmbodner@purdue.edu*
http://chemed.chem.purdue.edu/chemed/bodner.html
W. R. Robinson, *wrrobin@purdue.edu*
http://www.chem.purdue.edu/robinson/index.html
M. B. Nakhleh, *mnakhleh@purdue.edu*
http://www.chem.purdue.edu/nakhleh/index.html

Purdue has had a graduate program leading to M.S. and Ph.D. degrees for more than 30 years. There are three tenured faculty in the Division of Chemical Education at Purdue and a fourth will be hired this year. By the end of the fall semester (2000), we will have graduated 34 Ph.D.'s in chemical education. Another nine individuals who worked in the Chemical Education program have gone on to earn a Ph.D. either in one of the traditional disciplines in chemistry or in science education. At any time there are between 20 and 25 students working toward M.S. or Ph.D. degrees in Chemical Education at Purdue.

The University of Montana, Missoula, MT

Web site:
http://www.cas.umt.edu/chem/cracolic/

Contact person:
Mark S. Cracolice, *markc@selway.umt.edu*

Our program is a specialization that includes close research interaction with two faculty mentors, one in chemical education and one in a traditional area of chemistry, and course work in small, personalized classes, leading to a Ph.D. in chemistry with an emphasis in chemical education. In addition to coursework in chemistry and chemical education, the student completes courses in psychology and curriculum and instruction. Traditional chemistry research is conducted under the guidance of any of the faculty in chemistry or biochemistry, and Cracolice mentors chemical education research. The program prepares students for numerous careers, such as a professor directing graduate research in chemical education and supervising traditional undergraduate chemistry research, or as a college instructor who has unique expertise in developing curricula that maximize students' intellectual development. Postdoctoral positions are available depending on current funding.

Miami University, Oxford, OH

Web site:
http://www.terrificscience.org/miami/mu_phd_chemed.pdf

Contact persons:
Mickey Sarquis, *SarquiAM@muohio.edu*
Jerry Sarquis, *sarquijl@muohio.edu*

A Ph.D. is a research degree awarded to those who demonstrate ability to make significant original contributions in a certain field. In our Chemical Education program, this requires a combination of talents built from a strong background in chemistry, cognitive psychology, learning theory, statistics, technical communication, and behavior research methods. In the Department of Chemistry and Biochemistry at Miami University, these talents are developed through graduate-level courses in chemistry, chemical education, and related areas and mentoring of students through a three-point approach to chemical education research: materials or technology development and testing, course development and testing, and analysis of student learning problems. Students complete all departmental requirements including comprehensive examinations, an original research proposal, submission of a manuscript for publication, and preparation and defense of a dissertation. Postdoctoral positions are available.

The University of Oklahoma, Norman, OK

Web site:
http://cheminfo.chem.ou.edu/faculty/mra/mra.html

Contact person:
Michael R Abraham, *MRAbraham@OU.edu*

The Department of Chemistry and Biochemistry at the University of Oklahoma offers a Ph.D. in Chemistry with an emphasis in Chemical Education. This degree program is designed (i) to give prospective college chemistry faculty members a thorough academic experience in chemistry and chemical education so that they will be able to plan, instruct in, and direct an undergraduate chemistry program; (ii) to provide these students with sufficient background in learning theory so that they will be able to design and implement instructional strategies; design, develop, and evaluate curriculum materials; and perform research in science education; and (iii) to provide a research experience in chemistry that will enable these students to direct undergraduate research projects in chemistry.

Middle Tennessee State University, Murfreesboro, TN

Web site:
http://www.mtsu.edu/~chem

Contact persons:
William H. Ilsley, *wilsley@mtsu.edu*
Martin V. Stewart, *mstewart@mtsu.edu*

The Doctor of Arts, D.A., in Chemistry was established at MTSU in 1980 as a terminal degree designed to prepare chemists who are effective in teaching undergraduate chemistry. It differs from the more specialized Chemistry Ph.D. by the broader curriculum and by including education courses and teaching internships. It differs from the Ed.D. through its emphasis on subject

continued on p 160

Report: A Survey of Doctoral Programs in Chemical Education in the U.S.

continued from p 159

content in chemistry and in the requirement of a dissertation focused on chemistry, chemical education, or a blend of both. While some students are in continuous residence, the program can be completed entirely during summer semesters to accommodate the schedules of students who are already faculty at other colleges and who view the D.A. as professional development. The program had produced 18 graduates as of summer 2000.

Texas Tech University, Lubbock, TX

Web site:
http://www.ttu.edu/~chem/

Contact persons:
Dennis Shelly, *kzdcs@ttu.edu*
Dominick J. Casadonte, *dcasadon@ttacs.ttu.edu*

Graduate degrees in chemical education result from a fusion of graduate-level studies in any of the five participating subdisciplines of chemistry and graduate research in chemical education. The Master's degree requires 33 hours, featuring five chemistry and two education courses. The Doctoral degree requires 75 hours and consists of five chemistry and four education courses. Focal areas include: (i) course/curriculum development (including the creation of a seamless chemical curriculum), (ii) communication/motivation in the classroom, (iii) implementation of distance education, and (iv) service learning in the chemical sciences. Our primary goals are creating technology intensive educational solutions (TIES) that will better link chemistry students from across the large agriculturally based South Plains area and developing novel outreach programs for unique target groups, ranging from preschoolers to senior citizens.

The University of Texas at Austin, Austin, TX

Web site:
http://chemed.cm.utexas.edu/

Contact person:
J. J. Lagowski, *jjl@mail.utexas.edu*

The Chemical Education Program at The University of Texas exists at several levels. It offers degrees only through the Department of Chemistry and Biochemistry; that is, they are focused on the chemistry part of chemical education. The education components are a "minor key" in these programs. Programs in Science Education are offered through the College of Education. Students can get a B.S. in chemistry, which is certified by ACS and by the state of Texas. Graduate level programs exist at the M.S. and Ph.D. levels. The Ph.D. program involves a strong research component; the Master's program, as is usual, has a lesser research component. In principle, all faculty in the department have some chemical education research interests, but these are not necessarily expressed explicitly in the faculty member's official research interests. Arrangements for postdoctoral positions are made on an individual basis.