ASSESSMENT OF THE GRADUATE PROGRAM IN CHEMISTRY
CLEVELAND STATE UNIVERSITY

DEPARTMENTAL OVERVIEW

The Department of Chemistry at Cleveland State University offers both the M.S. and Ph.D. degrees. During the 2003-2004 academic year, 81 students were enrolled in the chemistry graduate program. Of these 81 students, 43 were full-time Ph.D. students, 12 were part-time Ph.D. students and the remaining 26 students were M.S. students. Of the 43 full-time Ph.D. students, 13 hold Cleveland Clinic Fellowships and five hold fellowships in the Molecular Medicine Specialization. It should be noted that the majority of part-time graduate students are Ohio residents.

There are 13 tenure track faculty in the department representing five areas of chemistry: Analytical (Bayachou, Guo, Turner, Xu); Clinical (Anderson, Kalafatis, Wei, Zhou); Inorganic (Duraj); Organic (Masnovi); and Physical (Ball, Gogonea, Ng). In addition, 40 researchers from the Lerner Research Institute of the Cleveland Clinic Foundation hold CCF faculty appointments. Non-tenure track faculty include 10 adjunct faculty and six part-time lecturers. There are currently four postdoctoral fellows on staff.

The Chemistry Graduate Program has many components. Students may pursue both the M.S. and Ph.D. Degrees. The M.S. degree consists of the traditional master's degree, but a non-traditional "course work" only M.S. degree is offered. This degree greatly benefits those students pursuing the degree on a part-time basis. The Department's Ph.D. degree is in the area of Clinical-Bioanalytical chemistry and is offered via a joint program with the Lerner Research Institute of the Cleveland Clinic Foundation. Ph.D. candidates also may pursue certification in Clinical Chemistry or a specialization in Molecular Medicine.

The Molecular Medicine Specialization (MMS) is another collaborative doctoral specialization program between the Lerner Research Institute of the Cleveland Clinic Foundation (CCF) and Cleveland State University (CSU). The Molecular Medicine Specialization (MMS) offers unique opportunities for Biology, Chemistry and Engineering doctoral students who wish to pursue a specialization in the application of molecular research approaches to understanding disease cause and disease mechanism. At Cleveland State University, MMS is a specialization within the three CSU - CCF collaborative doctoral programs in Regulatory Biology, Clinical - Bioanalytical Chemistry and Applied Biomedical Engineering of DRE. The program recruits promising students to the joint programs and provides support for their training. With respect to research, the Molecular Medicine Specialization provides faculty and students with a common focus for collaboration and discussion in order to realize the benefits of interdisciplinary approaches to questions of common interest and immense biomedical significance. Since 2001, nine chemistry graduate students have received MMS fellowships. The criteria for admission in to MMS program is high GPA, impact of the research on the MMS program, and completion of course requirements specific to the MMS program.

The doctoral degree in the area of clinical chemistry is accredited by the Commission for Accreditation in Clinical Chemistry (COMACC) and has a substantial national and international reputation. Medical College of Virginia is the only other accredited doctoral program in the country.

Partnership with local institutions has been a vital component throughout the program's history. The clinical chemistry program has had extensive interaction with the pathology departments at The Cleveland Clinic Foundation (CCF), MetroHealth Medical Center and other local hospitals. This interaction encompassed student training in hospital laboratories in the summer and involvement of the hospital's Ph.D. clinical chemists in course lecturing, and in collaborative research. Continuous, long-standing cooperative projects exist between scientists at the NASA Lewis Research Center and several members of the Department.

The Department is strongly building in the area of biotechnology, which has been identified by the American Chemical Society as a specialty area of chemistry of high growth. Other collaborations and partnerships are planned, including the establishment of a Center for Analytical Instrumentation and Research to expand the collaboration with scientists from local industry. It is expected that the Department will come to be recognized nationally and internationally as a leader in the clinical-bioanalytical area as the program continues to develop. The progress of the program benefits both graduate and undergraduates in cutting-edge technology.

Biomedical and Health Institute. The Biomedical and Health Institute (BAHI) was established at Cleveland State University to enhance and integrate the areas of biomedical science, health sciences, health policy and health management. The goal of BAHI is to: promote research and education address critical issues and foster regional economic development. Currently nine CSU Chemistry faculty and two CCF Faculty are members of BAHI.

The Department successfully launched the Cleveland Mass Spectrometry Facility (CMSF) in December 1997. The facility currently supports the research work of seven faculty members in the Department of Chemistry and over 10 graduate students have had extensive training in the technique. The facility supports grant projects totaling over $2.5 million. It also supports the work of outside users including CSU, CCF, Case Western Reserve University (CWRU), MetroHealth Medical Center, and University Hospitals and industry including joint research projects. The facility has the following instruments funded from State of Ohio Capital Funds, Ohio Board of Regents Hayes Investment Fund, Cleveland Clinic Foundation and Cleveland State University totaling over $600K:

1) HPLC-ESI Ion-Trap Mass Spectrometer (Bruker-Daltonics HCT-Esquire Mass Spectrometer, Agilent Capillary HPLC) (Acquired in Septemeber 2003)

2) HPLC-ESI(or APCI)-MS/MS [Quatro II Triple Quadrupole from Micromass (Waters) coupled with a 1100 HPLC from Agilent] (Acquired in December 1997)

3) HPLC (Shimadzu System 10AQ-VP, including autosampler and UV- visible detector)

Other new instrumentation has also been located in the Department include an EPR instrument bought with funds leveraged from different institutions (Cleveland State, Cleveland Clinic and NASA) totaling $250K. This is the first such instrument in the Cleveland area.

GOALS

The objectives of the program in the Department of Chemistry are centered on the delivery of excellent education in the chemical sciences, in terms of teaching and research at the undergraduate and graduate levels, for the purpose of positioning its graduates for employment and advancement in the field of chemistry. Students are educated in the intellectual and practical skills needed by future employees in the chemistry field. Education in chemistry at the university level consists of three components which must be imparted to the student: a solid foundation of knowledge in chemical principles, substantial practical training in chemical techniques, and development of innovative and critical thinking skills for keeping up with and fostering future advances within the field. Excellence in chemical education requires faculty with accomplished teaching and research abilities, who are not only keeping abreast of the advances in the field but are advancing the field themselves. Promotion of faculty scholarship through research endeavors, which entails writing and securing funding for research from grants, publication and presentation of research results, and performing other related activities is thus an important objective of the program. Another objective of the program is to form partnerships with medical institutions (such as CCF), other institutions (such as NASA) and industry to more effectively teach and increase research productivity. These partnerships allow the program to broaden its base of expertise to effectively educate its students and is an effective strategy for receiving increased funding for research. Finally, niche expertise in the program, such as clinical chemistry, which is a national and international strength, and bioanalytical chemistry, which is an exclusive regional strength, as well as being an essential complement to the clinical chemistry program, are utilized to their fullest extent to help CSU fulfill its mission of impacting the economic development of the region and the State. This niche expertise, combined with the Department's extensive effort for establishing collaboration and partnership with industry, as well as the Department providing a well-trained biotechnology and chemistry work force are all aspects of a concerted effort by the Department to affect economic development. Development of this niche expertise is important to the University's development, as the University seeks to establish future markets in various niche expertise.

Development of Goals

The Department of Chemistry benefited from several program reviews in the last decade: i.e., internal program reviews in 1991 and 1998; a program review of the chemistry doctoral program conducted by the Ohio Board of Regents in 1995. Program modifications were based on recommendations resulting from each review.

Program goals relating to assessment have been developed in direct response to these program reviews by the Associate Chair for Graduate Programs and the Chemistry Graduate Committee, while demographic information is compiled by the departmental support staff.

Goal #1
Students attain a fundamental understanding of all areas of modern chemistry and a sophisticated knowledge and understanding of a specialized area of modern chemistry.

Goal #2
Students attain a deep understanding of the design and execution of experimental and/or theoretical working in the area of specialization

Goal #3
Students attain a professional-level ability to communicate in chemistry and especially in the area of specialization.

OUTCOMES

An important indication of the success of the program is the performance of the students after graduation. The placement rates of our Ph.D. students, in particular, are excellent. Over the past five years, 52 students have received graduate degrees; 30 students receiving M.S. degrees and 22 students receiving Ph.D. degrees. All of the Ph.D. recipients were already employed or were employed immediately after graduation (e.g., the Center for Disease Control, Mayo Clinic, the Cleveland Clinic Foundation). The majority of the students receiving the M.S. degree were part-time students, already employed in the Greater Cleveland area and pursuing the degree on a part-time basis. The excellent employment rates of our graduates show that we have been successful in achieving Goal #1 (Students attain a fundamental understanding of all areas of chemistry and a sophisticated knowledge and understanding of a specialized area of modern chemistry). It is important to note that graduates from the Chemistry Ph.D. program obtain successful employment at such prestigious institutions as The Cleveland Clinic Foundation, The Mayo Clinic Foundation, and the University of Chicago, and Harvard Medical School. (see findings on page 7),

The Chemistry Graduate Committee meets annually to evaluate the knowledge, skills, and abilities of the graduate students and their progress toward the degree. The Chemistry Graduate Committee Assessment is based on the annual reports of each individual student's graduate committee. Progress is evaluated at least weekly by the PI/Research Advisor in group laboratory meetings. In the field of chemistry it is expected that graduate students, with their research advisors, actively prepare manuscripts for submission to peer-reviewed publications. This activity is directly related to Goal #2 (students attain a deep understanding and execution of experimental and/or theoretical working in the area of specialization).

In addition, the graduate students have established a biweekly meeting to solicit opinions. Two presentations are given at each meeting and each is critiqued and analyzed by the student peer colleagues. Again, this exercise of peer review/learning is a Goal #2 outcome.

Finally, at the end of each academic year the graduate students present the results and their most recent research data at The CSU-CCF Symposium of the Joint Ph.D. Program. This symposium is held each May and is attended by faculty and researchers from Cleveland State University, the Cleveland Clinic Foundation, and MetroHealth Medical Center. Students receive certificates and monetary awards for several levels of Best Oral Presentation or Best Poster. This year over two-thirds of the full-time Chemistry Ph.D. students participated in the symposium.

Students are also strongly encouraged to participate in local, regional, and national professional meetings by presenting papers or poster sessions. Student participation in symposia and professional meetings directly relates to Goal #2 (Students attain a deep understanding of the design and execution of experimental and/or theoretical working in the area of specialization), and Goal #3 (Students attain a professional-level ability to communicate in chemistry and especially in the area of specialization). For students, participation outside the Cleveland area is difficult without financial support. However, as more external funding is received by the department faculty, it is hoped that faculty will be able to support travel for the students in his/her research group.

RESEARCH

The Department of Chemistry continues to play a significant role in the development of the University. Benefiting from effective leadership during its formative years, the Department has been at the forefront of the University's growth in several areas.

In the last five years significant growth in the Chemistry Program has occurred. A restructured doctoral program in Clinical-Bioanalytical Chemistry was successfully defended before the Ohio Board of Regents in January 1998 and implemented in Fall of 1998. The salient feature of the restructured doctoral program is the partnership of CSU's Department of Chemistry and CCF's Lerner Research Institute in jointly administering the program. This restructured program greatly expands the interaction of the program with CCF, which formerly was only associated with CCF's Department of Clinical Pathology.

Significant strides in the Department's productivity have occurred since the doctoral program's restructuring. Over $5M in federal funding has been received in the last six years including the first NIH funding to be received by the Department. During the period from 1999-2004, the Department of Chemistry received $3.2M in federal funding, of this amount $2.3M was received from the National Institutes of Health (NIH). During this same time period, the 40 Cleveland Clinic researchers who hold faculty positions in the department of chemistry received $82M in NIH funding. Therefore, the total NIH funding in the graduate program was $84.3M. Successful graduate education in chemistry begins by expanding and increasing a student's understanding of the field through advanced course work and seminars. This education phase is rapidly replaced by the process of teaching and equipping a student to become an independent investigator and problem solver. The Ph.D. degree in Clinical/Bioanalytical Chemistry has enjoyed continuous accreditation by the Commission on Accreditation in Clinical Chemistry. The COMACC accreditation process has been invaluable in program assessment.

Suggestions/recommendations as a result of the COMACC reviews have been implemented.

FINDINGS

We are currently developing a more workable procedure for data collection. The most recent data presented below is extracted from the upcoming COMACC accreditation that is in progress. We have also some data for several recent graduates. In addition, we are developing a Student Profile/Timeline system to track each graduate student from the time he/she enters the program through the terminal degree. If possible, we hope to include post-graduate career data. The Timeline would ensure that program criteria are met in a timely fashion and allow for easier data collection.

1. Recent Graduates with Doctoral Degrees in Clinical Chemistry (1998-Present)

Beatrix Budy, Ph.D. (as of June 2004)
Graduated: Ph.D. August 2003
Present Position: Assistant Professor, Saint Xavier University
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Linnea Baudhuin, Ph.D. (as of June 2004)
Graduated: Ph.D.,May 2002
Present Position: Post-Doctoral Fellow, Clinical Chemistry, Mayo Clinic Foundation
Address: Div Clin Biochemistry/Immunology
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Mayo Clinic Foundation
200 1st Street SW
Rochester, Minnesota 55905

Lorraine M. Rusch, Ph.D. (as of April 2003)
Graduated: Ph.D., May 2002
Present Position: Senior Research Scientist, Chemistry; Aton Pharma, Inc.
Address: Aton Pharma, Inc.
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Tarrytown, NY 10591-6717
Phone: 914-784-1143
Email: LRUSCH@ATONPHARMA.COM

Lian Shan, Ph.D. (as of June 2004)
Graduated: Ph.D., May 2002
Present Position: Senior Scientist, LPL Technologies (biotech company)
Address: LPL Technologies
10265 Carnegie Ave
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Samir L. Alleryani, Ph.D.
Graduated: Ph.D., August 1999
Present Position: Fulbright Postdoctoral Fellow, Harvard Medical School and Mass General Hospital.
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Aimin Zhou, Ph.D. (As of June 2004)
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Juliet Park, Ph.D.
Graduated: Ph.D., June 1998
Present Position: Director of Clinical Chemistry, VA Medical Center
Address: Laboratory Service (113W)
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Zhongzhou (Andrea) Shen, Ph.D.
Graduated: Ph.D., June 1998
Present Position: Senior Research Chemist, Merck Research Laboratory
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2. Other Recent Graduates (not clinical chemistry):

Zhiping Wu, Ph.D. (As of June 2004)
Graduated: Ph.D., Dec 2003
Present Position: Post Doctoral Fellow, Cole Eye Institute, Cleveland Clinic Foundation

Shuo Zheng, Ph.D. (As of **June 2004**)
Graduated: Ph.D., May 2002
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Weijia (William) Wu, Ph.D. (As of Dec 2000)
Graduated: Ph.D., August 2000
Present Position: Associate Service Fellow, CDC
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Vladimir Capka, Ph.D. (As of 2001)
Graduated: August 2000
Present Position: Research Scientist, DuPont

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