

2006 Assessment Report for the Graduate Program in Chemistry at Cleveland State University

INTRODUCTION

The Chemistry Graduate Program has many components. Students may pursue both the M.S. and Ph.D. degrees, on either a full- or part-time basis. The M.S. degree consists of the traditional master's degree, but a non-traditional "course work" M.S. degree is also offered. The course work master's greatly benefits those students pursuing the degree on a part-time basis. The Department offers the Ph.D. degree in Clinical-Bioanalytical Chemistry. This is a joint program with the Lerner Research Institute of the Cleveland Clinic Foundation. Ph.D. students also have the opportunity to pursue certification in Clinical Chemistry or a specialization in Molecular Medicine, which greatly enhance the student's skills, knowledge, and employability.

Faculty Demographics

There are 13 tenure track faculty in the Department representing five areas of chemistry: Analytical (Bayachou, Guo, zTurner, Xu); Clinical (Anderson, Kalafatis, Wei, Zhou); Inorganic (Duraj); Organic (Masnovi); and Physical (Ball, Gogonea, Ng). The Department has recently completed a successful search for a Biomedical Chemist (Sun), who will join our staff in August 2006. Thirty-five researchers from the Lerner Research Institute of the Cleveland Clinic Foundation hold CCF faculty appointments. The Department also has 12 adjunct faculty and seven part-time lecturers. An additional postdoctoral fellow joined the staff this year bringing the total to five. Two additional fellows are in the process of being hired.

The chemistry faculty continues the partnerships described in last year's assessment report. The Clinical Chemistry program has a history of extensive collaboration with the Pathology Departments at The Cleveland Clinic Foundation, MetroHealth Medical Center and other local hospitals. Other partnerships include cooperative projects with scientists at the NASA Glenn Research Center, the Ohio Aerospace Institute. In addition, nine CSU Chemistry faculty and two CCF Faculty are members in the CSU-established Biomedical and Health Institute (BAHI). BAHI was established at Cleveland State University to enhance and integrate the areas of biomedical science, health, sciences, health policy and health managements.

Student Demographics

There were 80 admitted students in the chemistry graduate program during the 2005-2006 academic year. In the 2005 Assessment report, a total of 125 students were reported. The lower figure is a result of program management "clean up". Many of the students were inactive students (especially the part-time and M.S. students). Others had exceeded the 6 or 10-year program limitations and other students graduated.

Of the current 80 admitted students, 66 are in the Ph.D. program and 18 are in the M.S. program. Further, 14 of these students are pursuing certification in Clinical Chemistry and 25 pursuing specialization in Molecular Medicine. Of the 66 Ph.D. students, 20 were performing research at the Lerner Research Institute of the Cleveland Clinic Foundation. During the Fall Semester 2005 graduate program application cycle, the Chemistry Graduate

Committee considered 37 applications for admission, 25 for admission to the Ph.D. Program and 12 for admission to the M.S. program. All of these applicants were offered admission to the program. Of the 25 admission offers, 10 accepted and 2 declined the admission offers. Four of the entering students were supported on TA or RA, or CCF Fellowship, while the remaining students were self-supporting.

For the current (Fall 2006) application cycle we received 45 applications, 29 for the Ph.D. program and 16 to the M.S. program. Twenty students were offered admission to the Ph.D. program and 10 to the M.S. program. Eleven of the Ph.D. admission offers have been accepted;. Six of these were offered financial support. Data will not be available until Fall Semester as to which students will actually enroll, however, we anticipate that few, if any, of the non-supported students will actually enroll.

Seven students received the Ph.D. degree during this assessment period with an additional 9 students expected to graduate by December 2006. All 7 of these students were employed or entering postdoctoral positions upon graduation. In addition, the M.S. degree was awarded to 11 students.

GOALS

Program Goals

- 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.

Development and Evolution

The Department of Chemistry has benefitted from a number of program reviews during the past decade. These include: internal programs reviews in 1991, 1998 and 2004; a program review of the chemistry doctoral program conducted by the Ohio Board of Regents in 1995. Program modifications were made based on recommendations from each of these reviews.

Program goals relating to assessment were developed in direct response to these program reviews and the university assessment mandate. For the Chemistry Graduate Program, the Graduate Program Director, the Director of Clinical Chemistry and the Chemistry Graduate Committee have been responsible for creating, developing, and implementing Assessment Program Goals, while demographic and supporting information has been supplied by departmental support staff. Changing departmental administration in the above-named key areas of graduate program assessment, has naturally led to continued analysis and refinement of the department's assessment goals.

In academic year 2002-2003, the Graduate Program Director was Dr. Lily Ng. She chaired the Chemistry Graduate Committee at that time and that committee laid the groundwork for assessment of

the graduate program in chemistry. They developed and created the assessment goals and concrete outcome measures (see attached forms).

Dr. Michael Kalafatis was the Graduate Program Director in academic year 2003-2004, and that Chemistry Graduate Committee determined that in order to interpret outcome measures as set by the 2003 team, a structure for data collection needed to be created. As described in the 2004 Chemistry Graduate Program Assessment Report, FINDINGS section, the academic year 2003-2004 was spent in developing a more workable procedure for data collection, establishment of a Graduate Student Profile and Timeline System to track each graduate student from the time he/she enters the program through the terminal degree, and possibly post-graduate career data. Initial data collection resulted in getting students back “on track” in their student careers.

Dr. Yan Xu became the Graduate Program Director beginning January 2005. This graduate program administration for 2005-2007, has been building upon the work of the previous administrations and focused on the following key issues listed below.

Issue 1. Review the graduate curriculum and implemented major curricular revisions in both the courses and offerings.

2005 Focus: A significant accomplishment of this year’s Chemistry Graduate Committee was to assess the graduate curriculum. Based on students’ needs and enrollment statistics, the course offerings were restructured and the credit hour requirements were changed from 22 to 28 credit hours. The Graduate Program Director revised the course offering strategy to better reflect the curricular needs of the students, and to also coordinate better with the expectations of the Timeline. Fewer course offerings each semester addressed declining enrollments and course cancellations.

The course CHM 600/700 Chemistry Teaching , for chemistry graduate teaching assistants, had not been offered for a number of years. It has been restructured and now is required for all Teaching Assistants in the Fall and Spring Semesters.

2006 Update: Appendix I shows the revised Graduate Curricula for the M.S. degree in Chemistry and Ph.D. in Chemistry. The curricular offerings for each degree program were revised. In addition, Plans for each degree were created to clearly delineate the structure of each degree program.

Issue 2. Continue data collection for the Doctoral Student Profile and Timeline.

2005 Focus: The Student Profile and Timeline have been further developed. A spreadsheet for data collection was created and data collection is on-going. Efforts thus far have provided us easier access to demographics and have also helped us identify each student’s position on the Timeline. Thus far, there is better ability to enforce program requirements, which in turn allow more efficient advising and mentoring of the students.

2006 Update: Appendix II is the Overview of the Chemistry Graduate Program which clearly

defines the Student Timeline to graduation. It also contains the Annual Progress Report which will be implemented for the Fall 2006 Academic Year.

This year we continued our efforts to move each student along to his/her proper place in the career Timeline. This was a very successful endeavor as all of our students are now “on track” for the various phases of the program. This success is also evident by the more than 50% increase in program graduates over the previous cycle.

Issue 3. Streamline program management

2005 Focus: It was determined that a computer database-type system was crucial to long-term assessment. It was decided that time needed to be invested now to develop a system whereby many types of student/faculty/program data could be collected and efficiently analyzed. It was considered that database software could be written specifically for our department’s graduate (and undergraduate) assessment programs. Such software would have the added benefit of assisting in preparation of many types of reports and program reviews. To this end we are pursuing the feasibility of using the university’s “e-portfolio” system to collect data and we are currently in meetings with the e-portfolio personnel to possibly develop a system for chemistry. Our goal is to have a system in place in the upcoming academic year. Should this system not meet our needs our next step would be to consider specialized software that could be written by one of our faculty members.

2006 Update: We had several meetings with the IS&T software developers to modify the “e-portfolio” system for our program. Unfortunately, they did not have the staffing to develop a program to meet our needs. We have met with an outside database software developer who is currently writing a program for us data management, but will also provide a portfolio component for our students to use as a career tool.

In summary, the Department of Chemistry continues to build on its original stated goals by systematically targeting areas of improvement and focusing on the improvements.

OUTCOMES

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

An important outcome for any program is the successful completion of coursework. In a Ph.D.-granting program, another component is the successful defense of the Ph.D. proposal. With one or two exceptions, graduate students successfully defend the Ph.D. proposal on the first attempt, and then become eligible to continue the process toward the granting of the Ph.D. degree. Therefore this is a very high success outcome for Goal #1. The reason for this high success rate is the high standard for admission to the graduate program, excellent preparation in coursework and the research project.

Another indicator for success is the post-graduate success of program graduates. Our Ph.D. graduate students in particular continue to attain 100% employment. The majority of our M.S. students are typically currently employed in the Greater Cleveland area while in the program and the M.S. degree leads to professional advancement. Seven Ph.D. students graduated during the assessment period and each of them was employed immediately upon graduation.

These points show that we have been extremely successful in achieving Goal #1.

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

After the student has progressed in the program beyond the defense of the Ph.D. proposal, the subsequent level is the successful defense of the Ph.D. dissertation. The Department of Chemistry has had no student not bring their Ph.D. research to a successful conclusion and therefore, *we find that we have exceptional outcomes for Goal #2.*

In the field of chemistry it is expected that graduate students, with their research advisors, actively prepare manuscripts for submission to peer-reviewed publications. The Chemistry Ph.D. students are doing very well in these areas with XX publications, XX publication accepted, and XX additional publications in preparation.

At the end of each academic year, the graduate students are required to present the results of their most recent research at the CSU-CCF Student Symposium of the Joint Ph.D. Program in Clinical-Bioanalytical Chemistry. This program is held each October and is attended by faculty and researchers from Cleveland State University, the Cleveland Clinic Foundation and MetroHealth Medical Center. XX students participated in the 9th Symposium held October ?? 2005. This represents a XX% increase in participation.

These two activities are directly related to Goal #2 and demonstrate consistent improvement.

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

Students are also encouraged to participate in local, regional and national professional meetings by presenting papers or poster sessions. For students participation outside the Cleveland area is very difficult without financial support. Chemistry students garnered 23 College of Science Student Travel Awards during over the past academic year, with the Department of Chemistry providing matching funding during the Spring Semester round of awards. An increased level of faculty grant funding, College and Department support enabled 21 Ph.D. students to attend and present their work in the form of posters and presentations at various other professional conferences outside of the Cleveland area, with several winning awards. This is a 33% increase in conference participation over the previous assessment period. Appendix III shows the awardees and the conferences they attended.

CONCLUSION

The Department of Chemistry continues to improve its assessment efforts by consistently fine-tuning the assessment process. We have made steady progress from the original establishment of goals, to streamlining program management and revising curriculum. We find that we have exceptional student outcomes in areas of degree completion and employment rates and our students continue to exhibit steady improvement in areas such as publication and presentations.

Graduate Curricula
Department of Chemistry
(Revised August 2005)

I. M.S. Degree in Chemistry

The M.S. degree in Department of Chemistry at CSU requires a minimum of 32 credit hours of courses. There are three plans for obtaining a M.S. degree in chemistry. University regulations limit the time of M.S. study to a 6-year period.

Plans A (Thesis M.S.) is designed for full-time graduate students with focus on research. This plan requires a minimum of 16 credit hour of "Advanced Chemistry Lab" (CHM 679) and "M.S. Thesis" (CHM 699), 2 credit hours of "Chemistry Seminar" (CHM 695/795) and 14 credit hours of lecture courses from at least three categories of courses listed below. The primary objective of a Thesis M.S. degree is the completion of a research project under the direction of the student's research advisor(s). Once the project is completed, the student must write a thesis describing the project (prepared in the format prescribed by the College of Graduate Studies and acceptable to the student's M.S Thesis Committee) and publicly defend the research and the written thesis. A M.S. Thesis Committee should consist of at least 3 faculty members with graduate faculty status. More courses may be suggested by a student's advisor based on the student's research needs.

Plans B (Non-Thesis M.S.) is designed for part-time graduate students who are currently working in chemistry related fields. This plan requires a minimum of 30 credit hours of lecture courses from at least three categories listed below and 2 credit hours of "Chemistry Seminar" (CHM 695/795).

<i>Category I.</i>	<i>Analytical Chemistry</i>	
CHM 612/712	Advanced Analytical Chemistry	3 cr. hrs.
CHM 613/713	Advanced Electroanalytical Chemistry	4 cr. hrs.
CHM 614/714	Chromatography and Separation	4 cr. hrs.
CHM 615/715	Mass Spectrometry	3 cr. hrs.
CHM 616/716	Advanced Spectroscopic Methods	3 cr. hrs.
CHM 661/761	Macromolecular Structure and Dynamics	4 cr. hrs.
<i>Category II.</i>	<i>Clinical Chemistry</i>	
CHM 651/751	Clinical Chemistry I	4 cr. hrs.
CHM 652/752	Clinical Chemistry II	4 cr. hrs.
CHM 655/755	Biotechnology Techniques	4 cr. hrs.
<i>Category III.</i>	<i>Biochemistry</i>	
CHM 502	Biochemistry	4 cr. hrs.
CHM 653/753	Advanced Biochemistry I	4 cr. hrs.
CHM 654/754	Advanced Biochemistry II	4 cr. hrs.
<i>Category IV.</i>	<i>Inorganic Chemistry</i>	
CHM 640/740	Special Topics in Inorganic Chemistry	4 cr. hrs.
CHM 641/741	Inorganic Mechanism and Structure	4 cr. hrs.
CHM 642/742	Theoretical Inorganic Chemistry	4 cr. hrs.
<i>Category V.</i>	<i>Organic Chemistry</i>	
CHM 531	Advanced Organic Chemistry	2 cr. hrs.
CHM 630/730	Special Topics in Organic Chemistry	4 cr. hrs.
CHM 631/731	Organic Structure and Bonding	4 cr. hrs.
CHM 633/733	Organic Reactions	4 cr. hrs.
<i>Category VI.</i>	<i>Physical Chemistry</i>	
CHM 523	Statistical Thermodynamics	4 cr. hrs.
CHM 524	Chemical Kinetics	4 cr. hrs.

CHM 625/725 Quantum Mechanics 4 cr. hrs.

Category VII

Environmental Chemistry

CHM 503 Environmental Toxicology 3 cr. hrs.
 CHM 504 Environmental Chemistry 3 cr. hrs.
 CHM 506 Environmental Chemistry Lab 2 cr. hrs.
 CHM 604/704 Special Topics in Environmental Chemistry 3 cr. hrs.

Additional Courses (This is not considered a different category for meeting the requirement of choosing courses from 3 categories. However, students can choose courses from this list to fulfill the 32-credit-hour requirement.)

CHM 510 Electronics for Chemical Instrumentation 4 cr. hrs.
 CHM 521 Special Topics in Physical Chemistry 4 cr. hrs.
 CHM 531 Advanced Organic Chemistry 2 cr. hrs.
 CHM 561 Polymer Chemistry 3 cr. hrs.
 CHM 605/705 Analytical Toxicology I 3 cr. hrs.
 CHM 606/706 Analytical Toxicology II 3 cr. hrs.
 CHM 611/711 Special Topics in Analytical Chemistry 3 cr. hrs.
 CHM 618/718 X-ray Crystallography 3 cr. hrs.
 CHM 619/719 Theory of Analytical Chemistry 3 cr. hrs.
 CHM 650/750 Special Topics in Clinical Chemistry 1 cr. hrs.
 CHM 659/759 Clinical Chemistry Seminars 1 cr. hrs.
 CHM 656/756 Internship in Clinical Chemistry I 6 cr. hrs.
 CHM 657/757 Internship in Clinical Chemistry II 6 cr. hrs.

Plan C (Non-Thesis M.S.) is designed for both full-time and part-time students who want to get training in Clinical Chemistry. This plan requires a minimum of 32 credit hours of courses, including all those listed below.

CHM 651/751 Clinical Chemistry I 4 cr. hrs.
 CHM 652/752 Clinical Chemistry II 4 cr. hrs.
 CHM 653/753 Advanced Biochemistry I 4 cr. hrs.
 CHM 654/754 Advanced Biochemistry II 4 cr. hrs.
 CHM 655/755 Biotechnology Techniques 4 cr. hrs.
 CHM 656/756 Internship in Clinical Chemistry I 6 cr. hrs.
 Graduate Chemistry Elective* 4 cr. hrs.
 CHM 650/750 Special Topics in Clinical Chemistry 1 cr. hr. (2 times)

* Students choose one course from Categories I, IV, V or VI (Plans A and B)

Graduate courses are numbered 500-899. Courses numbered 500-599 are master's-level courses, but open to selected Cleveland State University graduating seniors. Courses 600-699 are master's-level courses and are not open to undergraduate students. Courses numbered 700-899 are doctoral-level courses. Graduate certificate, licensure, or master's-level students may not register for 800-level courses.

II. Ph.D. Degree in Chemistry

The Ph.D. degree in the Department of Chemistry at CSU requires a minimum of 90 credit hours of courses. There are three plans for obtaining a Ph.D. degree. They are (A) *Ph.D. in Clinical-Bioanalytical Chemistry*; (B) *Ph.D. in Clinical-Bioanalytical Chemistry with Molecular Medicine Specialization (MMS)*; and (C) *Ph.D. in Clinical-Bioanalytical Chemistry with Specialization in Clinical Chemistry, certified by the Commission on Accreditation in Clinical Chemistry (ComACC)*.

Plans A, B and C each requires 28 credit hours of lecture courses, 2 credit hours of “Chemistry Seminar” (CHM 695/795) and 1 credit hour of “PhD Candidacy Exam” (CHM 891). Plan C also requires an additional 6 credit hours of “Internship in Clinical Chemistry I” (CHM656/756). All plans require credit hours in “Advanced Chemistry Lab” (CHM 679/CHM 779) if the student has not passed “Ph.D. Candidacy Exam” (CHM 891) and “Ph.D. Dissertation” (CHM 899) after the student has passed “Ph.D. Candidacy Exam”(CHM 891) to meet the minimum requirement of 90 credit hours of courses.

The “Ph.D. Candidacy Exam” (CHM 891) consists of a written proposal and an oral defense of the proposal based on the candidate’s on-going research and future research plan. Students who do not pass CHM 891 can not advance to doctoral studies.

The primary objective of a Ph.D. degree is the completion of a major research project under the direction of the student’s doctoral advisor(s). Once the project is completed, the student must write a dissertation describing the project (prepared in the format prescribed by the College of Graduate Studies and acceptable to the student’s Ph.D. Dissertation Committee) and publicly defend the research and the written dissertation. A Ph.D. Dissertation Committee should consist of at least of 4 faculty members with Graduate Faculty status within the Chemistry Ph.D. program and one member outside the Chemistry Ph.D. program (Note, if the outside member is from an institution other than CSU, then the member should either have Graduate Faculty status or be approved by the Dean of College of Graduate Studies.

A Ph.D. student must complete at least 90 credit hours of graduate study before becoming eligible for graduation. The time requires for the completion of research and the defense of dissertation is solely dependent on the student’s dissertation committee. University regulations limit the time of Ph.D. study to a 10-year period.

PLAN A: PH.D. IN CLINICAL-BIOANALYTICAL CHEMISTRY

Plan A requires a student to take a minimum of 28 credit hours of lecture courses, including all those listed below (at least one course is required from each of Categories I, II and III). More courses may be suggested by a student’s advisor based on the student’s research needs.

Category I.	Clinical Chemistry/Biochemistry	
CHM 651/751	Clinical Chemistry I	4 cr. hrs.
CHM 652/752	Clinical Chemistry II	4 cr. hrs.
CHM 655/755	Biotechnology Techniques	4 cr. hrs.
CHM 502	Biochemistry	4 cr. hrs.
CHM 653/753	Advanced Biochemistry I	4 cr. hrs.
CHM 654/754	Advanced Biochemistry II	4 cr. hrs.
Category II.	Analytical/Physical Chemistry	
CHM 612/712	Advanced Analytical Chemistry	3 cr. hrs.
CHM 613/713	Advanced Electroanalytical Chemistry	4 cr. hrs.
CHM 614/714	Chromatography and Separation	4 cr. hrs.
CHM 615/715	Mass Spectrometry	3 cr. hrs.
CHM 616/716	Advanced Spectroscopic Methods	3 cr. hrs.
CHM 661/761	Macromolecular Structure and Dynamics	4 cr. hrs.
CHM 523	Statistical Thermodynamics	4 cr. hrs.
CHM 524	Chemical Kinetics	4 cr. hrs.

CHM 625/725 Quantum Mechanics 4 cr. hrs.

Category III.

Organic/Inorganic Chemistry

CHM 631/731 Organic Structure and Bonding 4 cr. hrs.
 CHM 630/730 Special Topics in Organic Chemistry 4 cr. hrs.
 CHM 633/733 Organic Reactions 4 cr. hrs.
 CHM 641/741 Inorganic Mechanism and Structures 4 cr. hrs.
 CHM 640/740 Special Topics in Inorganic Chemistry 4 cr. hrs.
 CHM 642/742 Theoretical Inorganic Chemistry 4 cr. hrs.

Additional Courses (Students may choose courses from this list to fulfill the 28-credit-hour requirement.)

CHM 503 Environmental Toxicology 3 cr. hrs.
 CHM 504 Environmental Chemistry 3 cr. hrs.
 CHM 506 Environmental Chemistry Lab 2 cr. hrs.
 CHM 510 Electronics for Chemistry Instruction 4 cr. hrs.
 CHM 521 Special Topics in Physical Chemistry 4 cr. hrs.
 CHM 531 Advanced Organic Chemistry 2 cr. hrs.
 CHM 561 Polymer Chemistry 3 cr. hrs.
 CHM 604/704 Special Topics in Environmental Chemistry 3 cr. hrs.
 CHM 611/711 Special Topics in Analytical Chemistry 3 cr. hrs.
 CHM 605/705 Analytical Toxicology I 3 cr. hrs.
 CHM 606/706 Analytical Toxicology II 3 cr. hrs.
 CHM 618/718 X-ray Crystallography 3 cr. hrs.
 CHM 650/750 Special Topics in Clinical Chemistry 1 cr. hr.
 CHM 659/759 Clinical Chemistry Seminar 1 cr. hr.
 CHM 656/756 Internship in Clinical Chemistry I 6 cr. hrs.
 CHM 657/757 Internship in Clinical Chemistry II 6 cr. hrs.

PLAN B: PH.D. IN CLINICAL-BIOANALYTICAL CHEMISTRY WITH MOLECULAR MEDICINE SPECIALIZATION

Plan A requires a student to take a minimum of 28 credit hours of lecture courses, including all those listed below (at least one course is required from each of Categories I, II and III), and meet the core-course requirements of the molecular medicine specialization. More courses may be suggested by a student's advisor based on the student's research needs.

Category I.

Clinical Chemistry/Biochemistry

CHM 651/751 Clinical Chemistry I 4 cr. hrs.
 CHM 652/752 Clinical Chemistry II 4 cr. hrs.
 CHM 655/755 Biotechnology Techniques 4 cr. hrs.
 CHM 502 Biochemistry 4 cr. hrs.
 CHM 653/753 Advanced Biochemistry I (**core course**) 4 cr. hrs.
 CHM 654/754 Advanced Biochemistry II (**core course**) 4 cr. hrs.

Category II.

Analytical/Physical Chemistry

CHM 612/712 Advanced Analytical Chemistry 3 cr. hrs.
 CHM 613/713 Advanced Electroanalytical Chemistry 4 cr. hrs.
 CHM 614/714 Chromatography and Separation 4 cr. hrs.
 CHM 615/715 Mass Spectrometry 3 cr. hrs.
 CHM 616/716 Advanced Spectroscopic Methods 3 cr. hrs.
 CHM 661/761 Macromolecular Structure and Dynamics (**core course**) 4 cr. hrs.
 CHM 523 Statistical Thermodynamics 4 cr. hrs.
 CHM 524 Chemical Kinetics 4 cr. hrs.
 CHM 625/725 Quantum Mechanics 4 cr. hrs.

Category III.	Organic/Inorganic Chemistry	
CHM 631/731	Organic Structure and Bonding	4 cr. hrs.
CHM 630/730	Special Topics in Organic Chemistry	4 cr. hrs.
CHM 633/733	Organic Reactions	4 cr. hrs.
CHM 641/741	Inorganic Mechanism and Structures	4 cr. hrs.
CHM 640/740	Special Topics in Inorganic Chemistry	4 cr. hrs.
CHM 642/742	Theoretical Inorganic Chemistry	4 cr. hrs.

Additional Courses (Students can choose courses from this list to fulfill the 28-credit-hour requirement after meeting the requirement of specific categories.)

PHL 529	Bioethics (core course)	1 cr. hr.
CHM 503	Environmental Toxicology	3 cr. hrs.
CHM 504	Environmental Chemistry	3 cr. hrs.
CHM 506	Environmental Chemistry Lab	2 cr. hrs.
CHM 510	Electronics for Chemistry Instruction	4 cr. hrs.
CHM 521	Special Topics in Physical Chemistry	4 cr. hrs.
CHM 531	Advanced Organic Chemistry	2 cr. hrs.
CHM 561	Polymer Chemistry	3 cr. hrs.
CHM 604/704	Special Topics in Environmental Chemistry	3 cr. hrs.
CHM 611/711	Special Topics in Analytical Chemistry	3 cr. hrs.
CHM 605/705	Analytical Toxicology I	3 cr. hrs.
CHM 606/706	Analytical Toxicology II	3 cr. hrs.
CHM 618/718	X-ray Crystallography	3 cr. hrs.
CHM 650/750	Special Topics in Clinical Chemistry	1 cr. hr.
CHM 659/759	Clinical Chemistry Seminar	1 cr. hr.
CHM 656/756	Internship in Clinical Chemistry I	6 cr. hrs.
CHM 657/757	Internship in Clinical Chemistry II	6 cr. hrs.

**PLAN C: PH.D. IN CLINICAL-BIOANALYTICAL CHEMISTRY WITH COMACC CERTIFIED
CLINICAL CHEMISTRY SPECIALIZATION**

Plan C has the required courses listed below. More courses may be suggested by a student's advisor based on the student's research needs.

CHM 651/751	Clinical Chemistry I	4 cr. hrs.
CHM 652/752	Clinical Chemistry II	4 cr. hrs.
CHM 655/755	Biotechnology Techniques	4 cr. hrs.
CHM 653/753	Advanced Biochemistry I	4 cr. hrs.
CHM 654/754	Advanced Biochemistry II	4 cr. hrs.
CHM 650/750	Special Topics in Clinical Chemistry	1 cr. hr. (4 times)
	Graduate Chemistry Elective*	4 cr. hrs.
CHM 656/756	Internship in Clinical Chemistry Laboratory I	6 cr. hrs.

* Students choose one course from either Category II or Category III (Plans A and B)

Optional courses may be taken in addition to the required courses.

CHM 657/757	Internship in Clinical Chemistry Laboratory II	6 cr. hrs.
CHM 659/759	Clinical Chemistry Seminar	1 cr. hr. (1-4 times)

Note: Students who wish to specialize in both Clinical Chemistry and Molecular Medicine can do so by taking "Macromolecular Structure and Dynamics" (CHM 661/761, 4 cr. hrs.) to meet their Graduate Chemistry Elective requirement and additionally taking "Bioethics" (PHL 529, 1 cr. hr.).

Graduate courses are numbered 500-899. Courses numbered 500-599 are master's-level courses, but open to selected Cleveland State University graduating seniors. Courses 600-699 are master's-level courses and are not open to undergraduate students. Courses numbered 700-899 are doctoral-level courses. If a student in Ph.D. program has not passed "Ph.D. Candidacy Exam", the student should register for master's-level courses. A student should register for doctoral-level courses only after the student has passed the "Ph.D. Candidacy Exam". Graduate certificate, licensure, or master's-level students may not register for 800-level courses.

Appendix Graduate Student Activities

Appendix III Graduate Student Activities 2005-2006 Department of Chemistry

Award/Grant	Conference	Abstract
COS Travel Award Fall 2005 COS Travel Award Spring 2006 Energizer Award	40th Western Regional Meeting, American Chemical Society, Los Angeles, CA 2nd Annual Interdisciplinary Research Symposium, Cleveland State University	poster presentation
American Society Biochemistry & Molecular Biology Travel Award	American Society Biochemistry & Molecular Biology, Annual Meeting	
COS Travel Award Fall 2005	American Society Hematology Annual Meeting, Atlanta, GA	
COS Travel Award Fall 2005 COS Travel Award Spring 2006	40th Western Regional Meeting, American Chemical Society, Los Angeles, CA	
COS Travel Award Fall 2005	American Society Hematology Annual Meeting	poster presentation
COS Travel Award Spring 2006	American Association for Cancer Research Meeting, Washington DC	poster presentation
Beckman Coulter Award	2nd Annual Interdisciplinary Research Symposium, Cleveland State University	poster presentation
COS Travel Award Fall 2005 Best Poster	American Society Hematology Annual Meeting, Atlanta, GA CSU-CCF 8th Annual Graduate Student Symposium	poster presentation poster presentation

Award

COS Travel Award Spring 2006

American Heart Association
pre-doctoral Fellowship 2005-2007

COS Travel Award Spring 2006

COS Travel Award Fall 2005
National Heart Lung & Blood Institute
Graduate Research Supplement
American Heart Association
pre-doctoral Fellowship 2005-2007

COS Travel Award Fall 2005

COS Travel Award Spring 2006
First Place Oral Presentation
Distinguished Abstract Award
Fisher Scientific Award

Conference

23rd National Meeting of the American Chemical Society, Atlanta, GA, March 2006
College of Science Research Day, October 28, 2005
2nd Annual Cleveland State University Regional Interdisciplinary Symposium, Apr 29, 2006
American Chemical Society Meeting-in-Miniature, Cleveland Section, March 2006

American Association for Cancer Research Meeting, Washington DC

American Society Hematology Annual Meeting, Atlanta, GA

National Meeting, American Chemical Society, Washington, DC

tba

tba
National Meeting of the American Association for Clinical Chemistry, July 2005
National Academy of Clinical Biochemistry Meeting
2nd Annual Interdisciplinary Research Symposium, Cleveland State University

Abstract

oral presentation
poster presentation
poster presentation
presentation

poster presentation

poster presentation

oral presentation

poster presentation

Award	Conference	Abstract
COS Travel Award Spring 2006	Meeting of the Electrochemical Society, Denver, CO	oral & poster presentations
COS Travel Award Spring 2006	23rd National Meeting of the American Chemical Society, Atlanta, GA, March 2006 College of Science Research Day, October 28, 2005 American Chemical Society Meeting-in-Miniature, Cleveland Section, March 2006 2nd Annual Cleveland State University Regional Interdisciplinary Symposium, Apr 29, 2006	oral presentation poster presentation presentation presentation
COS Travel Award Spring 2006	American Association for Cancer Research, Washington, DC	poster presentation
Best Poster	CSU-CCF 8th Annual Graduate Student Symposium	poster presentation
COS Travel Award Fall 2005	American Society Hematology Annual Meeting, Atlanta, GA	paper
COS Travel Award Fall 2005		
COS Travel Award Fall 2005	40th Western Regional Meeting, American Chemical Society, Los Angeles, CA	
COS Travel Award Spring 2006	tba	
COS Travel Award Spring 2006	tba	
Best Poster	CSU-CCF 8th Annual Graduate Student Symposium	poster presentation
OMERIS BioOhio 2005 Poster Award		
COS Travel Award Spring 2006	Experimental Biology Meeting, San Francisco, CA	paper presentation

Chemistry Graduate Program

An Overview



Graduate Committee
Department of Chemistry
August 25, 2005



M.S. Degree in Chemistry (≥ 32 credit hours)

■ Plan A (thesis, full-time)

- 14 credit hours of courses that meet the category requirement.
- 2 credit hours of CHEMISTRY SEMINAR (CHM 695).
- 16 credit hours of ADVANCED CHEMISTRY LAB (CHM 679) and M.S. THESIS (CHM 699).
- Thesis committee (at least 3 Graduate Faculty Members)
- Research advisor (Chair of Thesis Committee)

■ Plan B (non-thesis, part-time)

- 30 credit hours of courses that meet the category requirement.
- 2 credit hours of CHEMISTRY SEMINAR (CHM 695)
- Academic advisor (Director of Graduate Program)



M.S. Degree in Chemistry (Cont.)

- **Plan C (clinical chemistry, non-thesis, full- & part-time)**
 - 24 credit hours of lecture courses.
 - 2 credit hours of SPECIAL TOPICS IN CLINICAL CHEMISTRY (CHM 650).
 - 6 credit hours of INTERNSHIP IN CLINICAL CHEMISTRY I (CHM 656).
 - Academic advisor (Director of Clinical Chemistry Program).

Ph.D. Degree (≥ 90 credit hours)

Plan A: Ph.D. in Clinical-Bioanalytical Chemistry

- 28 credit hours of lecture courses that meet the category requirement.
- 2 credit hours of CHEMISTRY SEMINAR (CHM 695/795).
- 1 credit hour of Ph.D. CANDIDACY EXAM (CHM 891).
- The remaining credit hours are registered as ADVANCED CHEMISTRY LAB (CHM 679/779) & PH.D. DISSERTATION (CHM 899).
- Dissertation committee (at least 4 Graduate Faculty Members and one outside member)
- Research advisor (Chair of Dissertation Committee)
- Academic advisor (a CSU faculty needed for CCF fellow)



■ **Plan B: Ph.D. in Clinical-Bioanalytical Chemistry with Molecular Medicine Specialization (MMS)**

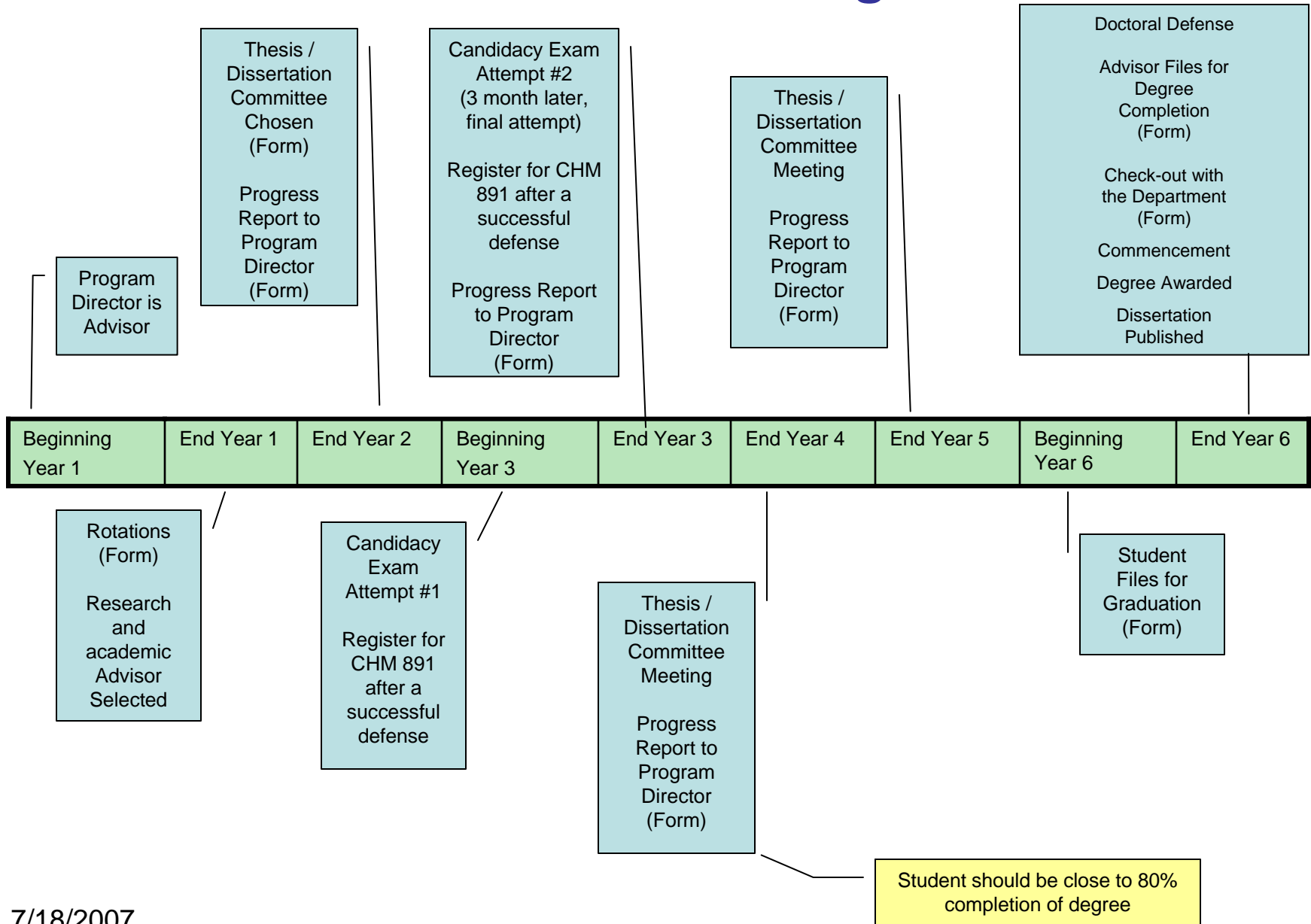
- 28 credit hours of lecture courses that meet the category and core requirements of MMS.
- 2 credit hours of CHEMISTRY SEMINAR (CHM 695/795).
- 1 credit hour of PH.D. CANDIDACY EXAM (CHM 891).
- The remaining credit hours are registered as ADVANCED CHEMISTRY LAB (CHM 679/779) & PH.D. DISSERTATION (CHM 899).
- Dissertation committee (at least 4 Graduate Faculty Members and one outside member)
- Research advisor (Chair of Dissertation Committee)
- Academic advisor (a CSU faculty needed for CCF fellow)




- **Plan C: Ph.D. in Clinical-Bioanalytical Chemistry with COMACC Certified Clinical Chemistry Specialization**

- 28 credit hours of lecture courses.
- 2 credit hours of CHEMISTRY SEMINAR (CHM 695/795).
- 6 credit hours of INTERNSHIP IN CLINICAL CHEMISTRY I (CHM 656/756).
- 1 credit hour of PH.D. CANDIDACY EXAM (CHM 891).
- The remaining credit hours are registered as ADVANCED CHEMISTRY LAB (CHM 679/779) and PH.D. DISSERTATION (CHM 899)
- Dissertation committee (at least 4 Graduate Faculty Members and one outside member)
- Research advisor (Chair of Dissertation Committee)
- Academic advisor (a CSU faculty needed for CCF fellow)

Timeline of Ph.D. Program





Year One --- graduate director is your advisor

- **Fall**
 - Register 9 credit hours of courses.
- **Spring**
 - Register 9 credit hours of courses.
 - Interview 3-5 faculty members to learn their research and select two laboratories for research rotations. The **Lab Rotation Form** should be submitted to Graduate Program Director before April 15.
- **Summer** --- research starts here
 - Rotation I (6 weeks).
 - Rotation II (6 weeks).
 - Choose a research/academic advisor and turn in the **Advisor Notification Form** to Graduate Program Director before August 1.
- **Spoken English Test**
 - TA must pass the SPEAK test/ESL courses; or will lose TA contract for the following years.



Year Two --- research/academic advisor is your advisor from this point

- Register 9 credit hours per semester except summer.
- Continue research with the chosen advisor.
- Choose your Thesis/Dissertation Committee members.
- The **Thesis/Dissertation Committee Notification Form** needs to be submitted to Graduate Program Director (due on May 1).
- Submit **Annual Progress Report Form** including advisor's comments to the Graduate Program Director (due on August 1).



Year Three --- Ph.D. candidacy exam

- Register 9 credit hours per semester except summer.
- Continue research with the chosen advisor.
- Defend your research proposal in Fall semester (The 1st attempt).
- If you can't pass in the 1st attempt, try it again within three months.
- If you pass your proposal defense, turn in the **Proposal Approval Form** to Graduate Program Director (due on the defense day) and register 1 credit hour of "Ph.D. Candidacy Exam" (CHM 891) in the following semester.
- If you fail your proposal defense, you are out of the Ph.D. program. You may pursue your Thesis M.S. degree; however, TA support will be terminated at the end of the Spring semester.
- Submit **Annual Progress Report Form** including advisor's comments to the Graduate Program Director (due on August 1).



Year Four & Later --- student should be close to 80% completion of degree

- Register 9 credit hours per semester except summer.
- Continue research with the chosen advisor.
- Call meeting of the Dissertation Committee at least once a year.
- Submit **Annual Progress Report Form** including advisor's comments to the Graduate Program Director (due on August 1).



Year of Graduation

- File for the **Degree Application Form** (two semesters prior to graduation).
- Ph.D. Dissertation Defense.
- File for the **Completion for Degree Requirement Form** (due at the end of final semester).
- Check-out with the Department, **Lab Exit Form** (due when completed the lab work).
- Commencement (May or December).
- Degree Awarded.
- Dissertation Published.