Simultaneous and anti-separation of β-blockers

DNA α-A LESION

Lipid Bilayer

Simultaneous and anti-separation of β-blockers

CMEKC-UV

CMEKC-M9

α

BW 83

DB-75

Self Study 2005

Georgia State University
Chemistry Department

α-A LE$

\text{NO}_2$

\text{H}$^+$

\text{NH}_2$

\text{CH}_3$

\text{NH}_2$
Elective Self-Study Committee:

Dr. Dabney W. Dixon
Dr. Markus W. Germann
Dr. Paul J. Franklin
Dr. Gabor Patonay
Dr. Binghe Wang
Dr. W. David Wilson (Chair)

Approved by the Faculty on:

November 28th, 2005
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Chemistry Department
Self-Study 2005

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The Georgia State University Department of Chemistry  
2005 Self Study

The following self-study document, with extensive attached tables and appendix material, is presented to give an overview of the progress and development of the Department of Chemistry in the last five years. The report also describes our exciting and ambitious development plans for the next five years.

Section A: Assessment of Strengths and Weaknesses

A.1. Quality of the Instruction, Research and Service: A very important programmatic strength of the GSU Chemistry Department is our long period of stable and very balanced leadership. The previous Department Chair, Professor David Boykin, placed strong emphasis on excellence in all three of the areas of instruction, research and service. This emphasis on excellence has been continued by our current leadership team with Professor Al Baumstark as Chair and Professor Dabney Dixon as Associate Chair. This administrative structure is complemented by a strong system of faculty committees that are listed in Appendix B-2. This stable leadership and continued support for faculty professional development has resulted in a continuous growth and improvement of the Department, especially in our instructional and research programs. A significant weakness of the Department is that the growth in numbers of tenure track faculty has not kept pace with the growth in majors in chemistry, credit hours, or research productivity. This situation must be corrected in the next Academic Program Review (APR) time period if the Department is to continue to be a leader in advancing the status of the University.

At the beginning of the last self-study period the Chemistry Department was a University leader in research. This has continued and the growth of the research and instructional programs has out-stripped projections for productivity increases (Table A-1):

Table A-1: Overview of Chemistry Faculty Productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of TT Faculty</th>
<th># Refereed Publications</th>
<th>Amt. of External Funding (FY2001-FY2005)</th>
<th># Conference Presentations</th>
<th># Credit Hours (FY2001-FY2005)</th>
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<tr>
<td>2001</td>
<td>16</td>
<td>53</td>
<td>$2,417,013</td>
<td>66</td>
<td>12,570</td>
</tr>
<tr>
<td>2002</td>
<td>16</td>
<td>63</td>
<td>$2,887,619</td>
<td>67</td>
<td>13,479</td>
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<tr>
<td>2003</td>
<td>17</td>
<td>65</td>
<td>$3,143,679</td>
<td>80</td>
<td>16,683</td>
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<tr>
<td>2004</td>
<td>18</td>
<td>81</td>
<td>$4,439,307</td>
<td>76</td>
<td>18,723</td>
</tr>
<tr>
<td>2005</td>
<td>18</td>
<td>92</td>
<td>$5,124,698</td>
<td>73</td>
<td>20,080</td>
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</table>

The doubling of the number of publications and external support with the very limited increase in faculty numbers illustrates the dynamic nature and strength of the program. The research program is strongly enhanced by its focus on key problems in chemical biology. This focus has placed the Department in a central position in the University’s Molecular Basis of Disease (MBD) initiative and Department faculty members are playing important roles in the Brains and Behavior (BB) initiative. The research programs of the Department are focused in three key areas of chemical biology that are described below under Strategic Focus. An extensive Table (B-2) describing faculty productivity is in Section B. This Table also includes the many important
professional service activities of the Chemistry faculty including key review, editorial, and organizational activities with many different organizations.

The instructional program of the Department has also undergone extensive growth both in majors and in credit hours taught in the last APR period. From 2001 to 2005, for example, the number of Department majors increased by 78% (Table B-3) and the credit hours taught by the Department increased by 60% (Table A-1, Chart B-2). Throughout this period of growth, the emphasis on program quality and student achievement has been maintained. The contribution from tenure track faculty is essentially “maxed” out. The Department is, however, extremely fortunate to have a strong group of nontenure track faculty, all with Ph.D.s, who are dedicated to high quality in the instructional area. The instructional program of Chemistry Department has been accredited by the American Chemical Society (ACS) since 1971. We have an educational program which meets all of the ACS guidelines and which is reevaluated for accreditation by the ACS at five year intervals. The ACS has generated a series of standardized tests in each area of chemistry and national results are available for all of the tests. As part of our instructional quality assessment, the tests are given at the end of our course sequences and the results are compared to ACS compiled national averages. This is a key quality indicator for the Department programs on a national scale. Our classes typically average above the 50% score and it is clear that our chemistry educational program compares very well to other programs in ACS accredited departments, which includes all major chemistry programs in the US. The dramatic growth in the instructional program has also led to a significant weakness which is related to that described above in faculty numbers. The growth in tenure track faculty has not kept pace with the growth in majors, credit hours or research activities. Space for both research and teaching activities is stretched beyond a reasonable limit and the continued growth in quality and numbers in the Department will be severely curtailed if this situation is not corrected.

A.2. Centrality of the Programs to the University: Chemistry is a uniquely central science that touches on theory, physics, environmental sciences, bioinformatics and geology on one hand and biology, psychology, drug design and medical sciences on the other. The Chemistry Department at GSU is addressing questions that affect our lives in a broad range of areas such as rapid identification of disease, the safety, design and response variations of drugs, damage to our genetic DNA by radiation and chemicals, and the fundamental basis for biomolecular structure, interactions and recognition. Much of modern science, medicine and pharmacology stems from the roots of chemistry at the end of alchemy and the dawn of Renaissance science. Concepts such as the correlation of entropy and time or the question of what specific combination and arrangement of chemical compounds constitute a living organism place chemistry in close touch with philosophy, and such concepts can never be completely understood without a grounding in the basic principles of chemistry. Chemistry is much more than discovery of new information about the universe in that chemists are constantly creating, analyzing and characterizing new compounds, materials and complexes. The Department of Chemistry thus occupies a special, central role in the University and offers an ideal introduction into science for all students at the University. The exciting research that is described below places the Chemistry Department at the heart of the Molecular Basis of Disease initiative of the College of Arts and Sciences and the University. In addition, faculty members from Chemistry are making significant contributions to the Brains and Behavior area of focus.

The development of the Chemistry Department research program is a leading factor in the expansion and recognition of the University's research status. With its current national and international research reputation, the Department provides a model for continued development of GSU as a first class research University as defined in the GSU Strategic Plan. The Department mission is to provide a creative environment for research -- the discovery and
creation of new knowledge, and for teaching -- the transfer of knowledge to students. Our tenure track and non-tenure track faculty are a strong team to carry out this mission.

A.3. Viability of Programs: Although many factors could be listed to showcase the very strong and dynamic programs in the Chemistry Department at GSU, three have been selected to illustrate the point. With regard to our research program, the chemistry faculty have an outstanding level of external grant funds and publications/faculty member. The Department, in spite of being one of the smaller units of the University, consistently ranks near the top in external grant support and publications. Our research program clearly is on par with programs at more established and more highly rated Universities. A more detailed comparison to peer departments is presented in Section A.5 below. The Chemistry Department is thus a strong position to help lead the initiative in the University development plan that calls for dramatic improvement in the ranking and associated external perception of GSU.

Another major factor that very clearly illustrates the viability of the Chemistry Department program is the number and quality of new majors entering the Department each year. The number of majors has increased dramatically in the last five years (see Table B-3 and Chart B-3) and again, the Department has been a University leader in the area of new majors. This is closely paralleled by the very large increase in credit hours that are taught by the Department (Table A-1). At the exit side of our instructional programs, our graduates are in academic, industrial, teaching and research programs around the world and are actively recruited by many different organizations (see, for example, current positions of our recent Ph.D. graduates in Appendix E-1). Currently, the Department grants an average of 20 B.S., 14 M.S. and 6 Ph.D. degrees per year. With the increase in majors this is projected to increase to 35-40 B.S./year; 10-12 Ph.D. graduates per year with M.S. graduation stable.

The service activities of our faculty are another very important part of our mission. As an example, a major NSF instructional program has been located at GSU for over ten years. The NSF Center for Workshops in the Chemical Sciences (CWCS; http://chem.gsu.edu/cwcs) Program at GSU has conducted 57 workshops at diverse locations in the period 2001-2005 (see Appendix E-4). The Center offers intensive, five-day workshops on diverse topics in the chemical sciences with the goal of enhancing education primarily at the undergraduate level. The target audience is faculty and supporting staff members specifically involved in undergraduate instruction in two-year, four-year, or research institutions. Postdoctorals and advanced graduate students committed to teaching at the undergraduate level may also attend these workshops. The workshops consist of lectures and some form of hands-on activity; participants are provided with tested materials that may be readily incorporated into their teaching activities. Thus far in the initial funding cycle, the CWCS program has offered 31 workshops; 16 workshop sites have been utilized. The program has attracted 835 participants from 47 states plus Guam, Puerto Rico, and Washington, D.C., and these participants represented 570 institutions. Other service activities of the faculty are outlined in Sections F4 and F5 and listed in Table B-2.

A.4. Strategic Focus: As a result of a number of factors including increased numbers of student majors, and increased grant support in the last five year development period, faculty members in the Chemistry Department have reorganized our programs in two important ways. Organization of the chemistry undergraduate educational component is governed to a significant extent by the requirements placed on programs by accreditation requirements of the American Chemical Society (ACS). Maintaining our ACS accreditation is a primary, continuing goal for the Department. Our undergraduate program is thus organized in a fairly traditional manner, but our elective courses and our capstone senior research program are oriented to nontraditional areas
of chemical biology. In our research programs and at the graduate educational level we have identified three specific and quite nontraditional focus and development areas for our organization. The three areas are described in detail below. Because of the unique nature of our program for a chemistry group, we have been able to attract outstanding new faculty in the last five years. In addition the focus in these areas gives us a much stronger base for interactions and collaboration both within the Chemistry Department but also with faculty in other departments. This broad multidisciplinary focus has also placed the Department at the center of many current funding initiatives and our external grant support has continued to increase (see Table A-1 and Chart B-1).

It should be emphasized that rather than limit the research options in chemistry at GSU, the chemical biology foundation opens some of the most exciting and challenging research areas in modern science to the Department. The interdisciplinary emphasis has clearly been of significant benefit to the rapid development and growing national and international reputations of our programs. Descriptions of our programs and goals in the three different focus areas are briefly outlined below and are described in more detail in Section B.

I. Biosensors and Diagnostics - Separations Theory and Practice: Development of rapid, sensitive sensors and diagnostics is essential for prompt results in testing for diseases from those caused by microorganisms to cancer. The GSU Chemistry Department has a strong group in the sensor and separations development areas as well as in theoretical research to better understand the basis of detection and separation.

II. Biomolecular Structure and Interactions - Function, Mechanisms, Design and Recognition: Very little happens in any biological system unless two or more molecules come together to form a stable complex. When molecules interact through specific molecular contacts, all of the principles of thermodynamics, dynamics, and biomolecular structure and recognition come into play. As increasing numbers of new proteins and DNA sequences are entered into databases, methods to characterize their biointeractions are needed. In order to gain a full understanding of the interactions and to begin to design molecules to have an effect on their cellular processes, it is essential to obtain detailed structural models for the biomolecules and their complexes. Biomolecular interactions and structure are, thus, at the core of the research of scientists from all three thematic areas in the Chemistry Department at GSU and constitute an essential component of our research.

III. New Therapeutic Agents and Approaches - Drug Design, Discovery and Development: The Chemistry Department at Georgia State University has a long tradition of strong programs in drug discovery and development. This area is strongly connected to the two focus areas described above in Chemistry but also to research programs in the Biology and Psychology Departments. In the last five year period we have recruited several new faculty in this area including Binghe Wang who has filled an endowed chair position as Georgia Research Alliance Eminent Scholar in Drug Discovery. The Department has taken a leadership role in new approaches to identification and treatment of disease.

In summary, the faculty of the Chemistry Department felt the need to create a strong focused research organization in important but nontraditional areas for a chemistry department. It was realized that a critical mass of faculty with externally-funded, complementary projects would be needed to make this a viable endeavor. We also realized that the projects would have to be relevant to our setting and to the GSU strategic plan. The three areas described above meet these criteria and clearly mesh well with University initiatives such as the Molecular Basis of
A.5. Financial Resource Analysis: With a very small increase in tenure track faculty and space, the Chemistry Department in the last five years has essentially doubled the annual number of refereed publications and the amount of external funding. There has been a growth in non-tenure track faculty that has provided stability to the core instructional programs. The Department still has had to use at least three visiting positions just to cover our courses. At the same time our number of majors (78% increase) and our credit hour generation (60% increase) have experienced dramatic growth with continuing student quality as judged by performance on national standardized American Chemical Society exams. These exciting activities and accomplishments, which were our goals in the last Academic Program Review, are a source of pride for us in the Department. The Department has received a significant increase in funds for research support of graduate student and this has allowed us to attract more and better students into our program. These students have played a significant role in the increase in our publications and grant support. However, overall, the productivity of the Department has expanded to a much greater degree than our University financial support base. This places a strain on our limited staff in grant and instructional/laboratory support as well as on our budget.

It is instructive to compare our Department with others in the southeast. The data are from the latest Annual Survey of Chemistry Departments in the Southeast as well as from the publication of the American Chemical Society, Chemical and Engineering News. For our Self Study, we have chosen 11 cohort universities, with the following criteria: a) the chemistry department has 15 – 30 faculty members, b) the total enrollment is 15,000 to 30,000 students and c) the University does not rank in the top 50 in the nation. Appendix B1 gives nine Figures allowing comparison of the GSU Chemistry Department with the others in this cohort.

Figure (B.1.1, reproduced to the right) shows the total external dollars awarded to the departments, normalized by the size of the tenure track faculty. It can be seen that Georgia State ranks third, behind only Tulane and Vanderbilt. We are very proud of this accomplishment. US News and World Report rankings for Tulane and Vanderbilt are 3.5 and 4.0, respectively. Thus, the GSU Chemistry Department compares very well with chemistry departments at very prestigious universities (for comparison, the GSU US News and World Report ranking is 2.3). Figure B.1.2 plots the amount of outside funds awarded to the chemistry as a function of the total budget of the department given to it by the University. This is essentially an “investment” graph, i.e., it asks the question whether a University is getting a good return on its investment in comparison to other universities. As one can see, there is a
fairly linear correlation between the amount of funds awarded to the faculty and the budget given to the department by the University. We are very near Vanderbilt in the funds awarded per faculty member as a function of the funds given to the department. Figure B.1.3 gives the total number of B.S. degrees and Figure B.1.4 does the same for M.S. and Ph.D. degrees (for FY'04). Overall, we are in the middle of our cohorts in the awarding of degrees.

Figure B.1.5 presents the number of staff members in the Department for each $1M in total funds. This gives a feeling for the extent to which the staff members are working to keep the department going. As can be seen, we are at the low end of staff members per funding. This indicates that our staff members are overworked and/or that needed functions are not being performed as compared to other universities. Finally, we look at the issue of hiring new faculty (Figures B.1.6 to B.1.9). We are in direct competition with the universities shown in hiring of faculty members. Anecdotally, we have lost faculty candidates to other universities when these candidates made living costs/salary comparisons. The Figures show the faculty salaries adjusted for the cost of living. It can be seen clearly that our salaries at the assistant and associate professor level are simply too low to continue to compete with the majority of universities in our cohort.

Section B: Historical and Current Contexts

B.1. Historical: Historically the Chemistry Department was largely involved with undergraduate teaching and research until the end of the 1960's. The graduate program in the Department at GSU is surprisingly new considering the current level of research productivity and grant support. The graduate program began with the M.S. degree in 1970. The strong and very successful record of research productivity of the Department after the establishment of the M.S. program led to an interdisciplinary Ph.D. program with the Department of Biology in 1983. This crucial development step provided the foundation for establishment of the independent doctoral program in Chemistry in 1990 that was and still is built on a strong base of faculty-directed chemical biology research programs. As described in Section A, the emphasis of the Departmental research programs continues to be applications of chemistry to problems in chemical biology with strong collaborations with other departments that have biological, medical or other related projects. The research areas in chemical biology represent some of the most exciting and challenging topics in modern science. The interdisciplinary emphasis has clearly been of significant benefit to the rapid development and growing national and international reputations of the Chemistry Department programs. This focus clearly describes our historical development as well as our current emphasis in chemical biology.

In terms of current status, the Department has had a dramatic increase in credit hours, chemistry majors, research funding and publications over the last five year period with little increase in space or number of tenure-track faculty. As a result, we are very cramped in both teaching and research space. The foundation of faculty expertise, research projects and grants, however, has placed the Department in an excellent position for continued development. With the proper support, the Department can continue to be a leader in the drive to improve the ranking and reputation of the University. At the same time the Chemistry Department is continuing to fill a critical central role in the educational programs of many other departments such as Biology, Psychology, Physics, and Geology. The Chemistry Faculty also have many collaborative research projects with faculty in those areas.

B.2. Current Research Focus Areas: Brief descriptions of our research programs in the three focus areas were given in Section A and more detailed descriptions with examples from different faculty research programs are given below to establish our current research context.
I. Biosensors and Diagnostics - Separations Theory and Practice: Development and applications of new, highly specific sensors is a very important area in modern science. Diagnostics and biosensors, for example, have facilitated drug discovery and revealed insights on infection, disease mechanism, and cancer subtype. A number of Chemistry Faculty members are work in these areas. Dr. Binghe Wang, a Georgia Research Foundation Eminent Scholar, is a leading researcher in the area of fluorescent carbohydrate sensing and recognition. His lab was the first to develop a fluorescent lectin mimic that can recognize cells and tissues based on specific carbohydrate biomarkers that are implicated in cancer. Research in Dr. Thomas Netzel’s laboratory resulted in a GSU patent on the use of photoinduced charge separation in DNA as a detection method for biological and medical assays. Dr. Giovanni Gadda’s research focus is on the mechanistic, biochemical and structural characterization of enzymes that catalyze oxidation-reduction reactions. Due to the consumption of oxygen in the reactions catalyzed by the enzymes, choline oxidase and 2-nitropropane dioxygenase, they can be used in biosensors for the detection of choline in biological fluids and foodstuff, and nitroalkanes in the environment and foodstuff. Dr. Zhen Huang’s laboratory has recently developed a novel RNA detection and quantification strategy. They are developing RNA microchip technology, which will be simple, rapid, accurate, sensitive, high-throughput and cost-effective, and which will be an ideal approach for pathogen detection in biodefense and cancer diagnosis. Dr. Gabor Patonay and Dr. Lucjan Strekowski have been developing new forensic presumptive diagnostics tests. Their work has been highly successful by introducing a new very sensitive and robust method for latent blood and other biological fluid detection. This new method has been validated by the FBI and is widely used by law enforcement laboratories in the US and several European countries.

The separation of enantiomers is widely studied in analytical chemistry as well as the pharmaceutical, agricultural, environmental and biological fields, since chiral drugs are administered either as enantiomers or as a racemic mixture. Thus rapid, sensitive analytical methods of high resolving power are required to control the synthetic chiral process and to understand the molecular basis of disease. Dr. Shahab Shamsi is working on methods such as capillary electrophoresis (CE) coupled to mass spectrometry (MS) for the separation and sensitive detection of chiral compounds. One of the principal separation methods in chemistry is electrophoresis, yet accurately predicting how fast a specific molecule moves in an electric field (its mobility) is a challenge due to the complex interactions present. In Dr. Stuart Allison’s laboratory, modeling the electrophoretic mobilities of biomolecules (peptides, proteins, and nucleic acids) and colloids (silica sols and polystyrene latexes) is under investigation. Dr. Patonay’s lab is developing new non-covalent labeling application to biomolecular CE separations using near infrared dyes in collaboration with Dr. Strekowski. This method eliminates the need for labeling while utilizing all the advantages of NIR detection. In addition, this method is useful for characterization of biomolecular interactions.

II. Biomolecular Structure and Interactions - Function, Mechanisms, Design and Recognition: The research in this focus area is involved with the structures of biological macromolecules and their complexes as well as the interactions of molecules in cells that control all regulation from replication to metabolism. During the last five year period the Department has established a Georgia Research Alliance-NIH-NSF funded biomolecular interaction core facility. The core facility also has biosensor-surface plasmon resonance instruments for real time detection of binding affinities and kinetics and well as microcalorimeters for analysis of biomolecular interactions. A small sampling of the projects in this area, all of which have received external funding in the last five years, will give an overview of the research. Ca$^{2+}$ is an essential structural component and helps regulate cellular processes. In order to understand these critically important biological processes, Dr. Jenny Yang has
developed novel approaches for creating a single Ca\(^{2+}\) binding site in order to dissect the key structural factors that control Ca\(^{2+}\) binding affinity, conformational change and cooperativity. The key determinants for Ca\(^{2+}\) affinity can be systematically introduced into a stable host protein frame and evaluated by eliminating or minimizing the contribution of conformational change. Dr. Emelita Breyer has developed the Vesicle Affinity Capillary Electrophoresis Technique that can be used to assess drug activity and transport, apolipoprotein exchange and lipid interactions; and other bioactive molecule-lipid interactions. These techniques can give insights into the mechanisms of several disorders such as metabolic syndrome, cardiovascular disease, diabetes, stroke, HIV and other infectious diseases, and atherosclerosis. Dr. Irene Weber is conducting research in AIDS and cancer. Her group carries out both crystallographic and biochemical analysis and interaction studies on proteins implicated in disease. The Tc1 oncoprotein and HIV protease have been recently investigated. The interaction of HIV protease with novel inhibitors is being studies by both structural; and interaction methods. The long range objective of these studies is to develop new therapeutic agents to treat AIDS and cancer.

The biomolecular interactions group also has a very strong base of research in the nucleic acid area. Dr. David Wilson, in collaboration with the drug design and synthesis team of Dr. David Boykin, is investigating the interaction of antiparasitic drugs with specific target sites in the parasite mitochondrial DNA. The information from the interaction as well as QSAR and structural studies is used by the Boykin group in the design of new compounds which have a high potential of improved activity. This effort has already resulted in a clinical candidate which has passed both Phase I and II clinical trials with excellent results. The research of this group has also resulted in a number of fundamental advances in the understanding of nucleic acid molecular recognition. Dr. Markus Germann focuses on RNA-protein regulatory elements that are important in disease. They are investigating the interaction of novel zinc finger proteins with the HIV-1 RNA. They use a broad range of methods, but particularly NMR, to understand how engineered zinc finger proteins bind their RNA substrates. In order to improve the substrate-affinity they use NMR structural data for site directed mutagenesis experiments and structure guided phage display selection. Drs. Germann and Wilson are collaborating on structural studies to better understand the molecular basis of DNA minor groove recognition. Dr. Kathy Grant is carrying out a project on the design, syntheses, and characterization of photoactive DNA intercalators that can act as DNA structural probes and have the development potential to be effective anti-tumor agents. Several of the designed compounds photocleave DNA with high efficiency under near physiological conditions of temperature and pH. Beth Wilson from the Grant laboratory has worked in Prof. Lorente’s laboratory in Spain as a Visiting Scholar and she succeeded in synthesizing a unique series of phenothiazine-based intercalators. Because phenothiazines are activated by wavelengths of light transparent to most biological membranes, they possess a significant, major advantage over most other chromophores for applications in photodynamic cancer therapy. Dr. Zhen Huang recently joined the GSU Chemistry Department and has already established a strong externally funded program that uses Se modification of nucleic acids in structural studies. Dr. Huang’s laboratory is carrying out both the synthetic and x-ray crystallography parts of the project at GSU.

III. New Therapeutic Agents and Approaches: Drug Design, Discovery and Development

The Chemistry Department at GSU has a tradition of strong programs in drug discovery and development. This area is strongly connected to the two focus areas described above but also to research programs in the Biology and Psychology Departments. Dr. Bing Wang has added extensive expertise in drug discovery to the program. He is editor in chief of *Medicinal Research Reviews*, which has been ranked #1 two years in a row in Impact Factor among 36 medicinal chemistry journals. The Department has taken a leadership role in new approaches to
Faculty members in this group recognize that drug discovery and development is an interdisciplinary process with medicinal chemistry at its core. Emphasis is placed on promoting interdisciplinary collaboration aimed at eventually developing therapeutic agents. Since drug discovery generally begins with selection of a target, the drug discovery and development effort naturally overlaps with our Biomolecular Interactions focus area. Currently, five research groups are looking at nucleic acid targets and five research groups are investigating protein targets. The research in the nucleic acid area is described above. Dr. Dabney Dixon is studying the proteins that are involved in heme uptake in the bacteria, with a focus on the lipoprotein that delivers heme to the ABC transporter in *Streptococcus pyogenes*. This work is in collaboration with Dr. Zehava Eichenbaum of the Biology Department. Because some microorganisms get most of their iron from heme, and because some of the proteins are known to be antigenic, inhibition of these proteins offers an effective potential therapeutic strategy. Dr. Giovanni Gadda’s research focus is on choline oxidase and choline dehydrogenase is described above. Dr. Emelita Breyer studies the molecular basis of the regulation of lipid metabolism by exchangeable apolipoproteins. Dr. Jenny Yang is working both on the nonstructural proteins in rubella virus (in collaboration with Dr. Teryl Frey, Biology) and on proteins involved in the immune response of poxvirus. Her work with calcium binding proteins is described above. Some patients with severe depression are refractory to treatment with antidepressants. The ability to predict this at the start of treatment would greatly help these patients. Dr. Kathy Grant is investigating the biochemical basis for this non-responsiveness using molecular biology techniques. Dr. Irene Weber is working on molecular models of human glucokinase to understand the effects of mutations associated with diabetes and other glycemic diseases. Her work with HIV and cancer is described above.

In the synthetic medicinal chemistry and drug development areas, Dr. David Boykin has brought international renown to the Department with his synthetic work on amidines. In early studies, a molecule designed and made in his laboratory (DB289) proved better than the current clinical treatment for some fungal infections. DB289 has also been very successful in treating Human African Sleeping Sickness. Dr. Boykin and a consortium of researchers were recently awarded recently awarded $15.1 million from the Bill & Melinda Gates Foundation to develop these compounds. Clinical trials on this agent are now in Stage III and new trials on additional compounds and diseases are scheduled. Dr. Lucjan Strekowski’s work on the synthesis of molecules that interact with DNA focuses on defining the stereoelectronic factors that control the interaction of DNA with groove-binding molecules as well as stabilization of the double-, triple-, and quadruple-helix structures of DNA. Dr. Strekowski is also working on a practical synthetic route to a novel, highly potent anti-migraine drug. His rational design of Toll-like receptor 9 (TLR-9) antagonists has resulted in a patent that was recently licensed by GSU to Coley Pharmaceutical Group. He has also designed and synthesized iminosulfuranes as novel skin penetration enhancers and the membrane effects of these enhancers is being studied by Dr. Jerry Smith. Very recently, Dr. Strekowski has synthesized a series of compounds that are novel, highly selective antagonists of 5-HT₇ receptor. This work may provide the basis for the development of new drugs against depression. Dr. Baumstark's work on oxygen-atom transfer reagents has lead to useful synthetic approaches to epoxidation and heteroatom oxidation. Dr. Dabney Dixon is part of a team developing vaginal microbicides to protect women against infection by HIV in collaboration with scientists from Emory University, Louisiana State University, Tampa Bay Research Institute and FemmePharma, Inc. Other work in the Dixon group has concentrated on investigating metal-based DNA-binding compounds in conjunction with radiation as a new approach to cancer chemotherapy. This goal of this work (in
collaboration with Dr. Brenda Laster, Israel) is to create clustered damage in tumor DNA. The Wang lab has several drug discovery projects. Through structure-based design, the Wang lab is working on developing sub-family selective phosphodiesterase 4 (PDE4) inhibitors as potential anti-asthma agents. They are also developing antimicrobial agents against drug-resistant strains by targeting the efflux pumps. In collaboration with oncologist Brent Weston (UNC-CH), development strategies for targeted drug delivery to cancer cells based on their molecular biomarkers is in progress. Among the many promising lead compounds, one PDE4 inhibitor is ready for animal testing for asthma treatment.

Research in each of these of the three multidisciplinary areas provides valuable experience for our students. Because generally no one research group can direct all of the many different facets of chemical biology research, students learn early in their careers to collaborate with other research groups. They are exposed to many aspects of the process outside their immediate purview. This broad experience is enhanced by joint group meetings held by groups in this area as well as region-wide.

B.3. Current Context - Faculty Productivity: Through the development of the Department research and graduate programs, strong faculty in each of the above three areas were recruited and they were able to establish highly recognized research programs. With continued development in the last five year period, the Chemistry Department is now a University leader in research support and publications. For example, for 2001 there were 3.2 publications per faculty member and the external support funds/faculty member was $151,000. For 2004 the publications per faculty member increased to 4.2 and the external support funds/faculty member was $247,000 ($4.4 million for 18 tenure track faculty). At Chemistry Departments in well-respected, neighboring peer institutions, such as University of Alabama at Birmingham, Clemson University and Auburn University, the research funding per faculty member in 2004 was less than one-half that of the GSU Chemistry Department (Southeast Department Chair’s Survey, 2004). Specific, quantitative information on productivity is given in Appendix Table B-2. Faculty distribution in various areas is presented in Table B-1.

GSU Chemistry faculty members are having a significant research impact in each of our three research focus areas as can be seen by the CVs in Appendix F-3 and the summary results in Table B-2. In 2005, for example, up to November 1, 17 of 18 faculty had important research publications and grant support for their work. Faculty also serve as reviewers for a number of granting agencies and journals; they have a significant number of patents that have originated from their research at GSU; they are editing books and journals; and, along with their students, they have a large number of conference and symposium presentations. They have chaired and organized many symposia and sessions and given a large number of invited seminar presentations (Table B-2).

B.4. Current Context - Chemistry Department Organization: The Chemistry Department has a fairly typical organization with a Chair as head and an Associate Chair for specific Departmental functions. The Associate Chair position is new in the Department and became necessary due to the large growth in numbers of students and externally funded projects during the period since the last Self Study. A chart of the complete Departmental organization is given in Appendix B-2 (1 and 2). At the next level of organization there are specific faculty members and committees that are responsible for establishing Departmental policies, review of students, and overview of Department operations. The Executive Committee provides advice directly to the Chair on specific matters brought to or identified by the Committee. Faculty members are appointed as Undergraduate or Graduate Director and have specific functions with regards to those programs and students. The Undergraduate Director is assisted by the Freshman Area
Committee while the Graduate Director is assisted by the area Ph.D. advisors. There are special committees that provide direction for management of the computer, NMR and accounting areas and staff members. Others committees have standard functions that are identified by their names in Appendix B-2(1). Staff are organized into four general areas: (i) accounting/personnel; (ii) teaching laboratories/stockroom; (iii) general Department/grant support and (iv) equipment and facilities management. A listing of staff positions is given in Appendix B-2(2).

B.5. Current Context - Educational Program: Thirty years ago the GSU Chemistry Department was almost completely an undergraduate unit with only a few M.S. students. At that time the initial research faculty were already receiving grant funds and were publishing a significant number of papers with undergraduate co-authors. The undergraduate teaching program was organized in a unique manner. From the first freshman course for all science majors to the capstone senior research project for chemistry majors the courses were oriented to a question/problem based learning approach. Students were given projects to work on and wrote research reports on their results, observations and conclusions. For example, each student in a particular laboratory had an individual problem that was related to the problems assigned to other students in the laboratory. In this way the students could learn standard material (such as how to do analytical titrations and acquire infrared spectra), but they realized that they were learning the information and technical methods to solve a specific problem in chemistry. As they organize the information they have and develop a laboratory plan for proceeding with the project, the students begin to gain an understanding of the creative process in science. These were our first writing intensive courses and as the research program of the Department has exploded, the problems-based approach with a significant senior research component has been maintained by the faculty. This commitment to providing our students with a view to the way science is actually conducted illustrates the premium that the GSU Chemistry Faculty place on education.

As our entrance standards and quality of undergraduate students have increased, the Chemistry Department has experienced a dramatic increase in credit hours and in the number of majors. The Department, for example, had 119 majors when we began the current five year review period and in an unparalleled period of growth, the number of majors has now more than doubled to 261 (in Appendix Table B-3). With regard to credit hours, the faculty taught 16683 in 2003 and in just two years it has increased to 20080 (Appendix Table B-4). This growth has been possible, in part, because of the addition of outstanding non-tenure track faculty in our instructional program. Clearly a much larger number of GSU undergraduate students are recognizing the critical role of chemistry in their education either as chemistry majors or in some other area where chemistry plays a leading role. The Chemistry Department has traditionally served a broad range of students including those majoring in biology, chemistry, geology, physics, psychology, medical science, and non-science disciplines requiring a rigorous introduction to the basic principles of chemistry. Due to the urban nature and educational traditions of GSU, both day and evening programs are still maintained by the Chemistry Department to serve non-traditional as well as students on a typical four year path.

B.6. Current Context - Program Relevance: The Department of Chemistry has proven itself to be highly responsive to the challenges facing the field of Chemistry today. Faculty members are at the forefront of applications of fundamental chemical-biology research to issues of human health. The three focus areas described above place the GSU Chemistry Department at the heart of modern chemical biology. Chemistry faculty members are involved in cutting edge research collaborations in both the Molecular Basis of Disease and Brains and Behavior
initiatives. Our graduates from both the undergraduate and graduate programs are having a very significant impact in industry and education.

Section C: Progress Toward Goals and Objectives

The following is a summary of the goals and objectives from the previous Self Study as well as progress in reaching those goals and objectives.

C.1. Research Programs: The key program goal in the last Chemistry Self Study was to build on the existing strength of the Department in chemical biology areas and expand in areas that involve applications of chemistry to therapeutics and drug design. This has been one of our primary successes and we now have strong research programs in each of the three chemical biology focus areas that are described above. The medicinal chemistry/therapeutic development area received a strong boost with the hiring of Professor Binghe Wang as a GRA Eminent Scholar in Drug Design in 2004. During the last Self Study, the Department realized that significant improvement in the research program would require hiring a significant number of new tenure track faculty as well as obtaining significantly more external research support funds. The Department has been awarded external research funding that has exceeded expectations and that establishes it as a leader in the University effort for increased research recognition (Table A-1). Hiring of new tenure track faculty did not meet the objectives set in the last Self Study. We had 16 tenure track faculty in 1995, for example, and now have only 18. It is essential that a significant number of new tenure track faculty, with appropriate research space, be hired as quickly as possible to maintain the strong record of progress that the Department established in the previous Self Study period (see Section H).

C.2. Undergraduate Programs: A specific faculty group was established to develop new innovative methods and approaches to teaching chemistry. A goal of this group was to enhance our established, NSF funded program to upgrade teaching chemistry at four-year colleges. The lack of sufficient additional faculty to match our dramatic increase in credit hours has significantly limited our development of novel education programs. We have, however, as described above, been able to maintain our tradition of project-oriented teaching laboratory programs in many of our laboratory courses. We have also been successful in continuing an NSF funded program for enhancing teaching in four year colleges. We are particularly proud of our efforts and success with African-American majors in all of our programs. GSU has consistently ranked #1 for non-historically black institutions in B.S. degrees in physical sciences to African-American students. The Chemistry Department is a major contributor to the University success in this area. For example, from 2001 to 2005 26% of our B.S. graduates were African Americans and 62% of our graduates were African American or other minorities. In the same period 38% of our Ph.D. graduates were minorities. Clearly, the Chemistry Department at GSU is having a significant impact on training minority chemists. African Americans are assisted in there programs at GSU by a student chapter of the National Organization for Professional Advancement of Black Chemists and Chemical Engineers (NOBCCHE).

C.3. Graduate Programs: At the end of the last self study we had little continuing graduate student support from the University. To attract more and better research students a stronger University commitment was essential. Recently, there has been a significant improvement in the University research support of graduate students which has already contributed to our progress, and whose impact will continue to improve our graduate student population. Specifically, we have received several Molecular Basis of Disease (MBD), and Brain and Behavior (BB) student research fellowships which are awarded based on research area and merit. These fellowships will be a significant benefit to our graduate student recruiting efforts. It
should be noted, however, that because of the dramatic increase in credit hours and laboratory enrollment, the number of graduate teaching assistantships in the Department is not enough to provide satisfactory laboratory teaching support and this must be corrected to maintain the quality of the instructional program.

**C.4. Staff Support:** It was clear in the last Self Study that the Chemistry Department had too few support staff members and that the staff members were strained past a reasonable limit. Faculty members were performing standard staff functions at the expense of their research and instructional activities. Unfortunately, although there has been a small expansion in our staff positions, the increase has not matched our dramatic expansion in credit hours, undergraduate majors, research support and publications. The situation is even worse in 2005 than it was five or even ten years ago. Faculty are forced to expend too much of their time on routine matters such as tracking grant budgets, purchasing, and other similar grant-related processes.

**C.5. Space and Facilities:** Directly prior to the last Self Study the Chemistry Department had an increase in research and teaching laboratory space with the opening of the Natural Science Center (NSC). Because the new space was not sufficient for all of the Chemistry research and teaching activities, however, laboratories in Kell Hall and the Science Annex buildings were maintained. It was recognized that the Kell and Science Annex space was inadequate and that the entire research and teaching space allocated to the Chemistry Department would not accommodate our projected growth. University assistance in alleviating this problem was requested. Unfortunately, in 2005 we still must use the Kell and Science Annex space and the Department has no significant room to grow. The dramatic growth in our teaching credit hours, undergraduate majors and external research funding has significantly exceeded projections and the research and teaching functions of the Department are crowded into an unacceptably small amount of space. The Department space in the proposed new Science Park will not meet our current and projected needs unless significant increases are allocated.

**Section D: Curricular Quality**

Chemistry education differs from many other disciplines in that the degrees are held to national standards promulgated by the American Chemical Society. Programs are evaluated every 5 years. Our most recent evaluation was submitted in the Spring of 2005 and we continue our accreditation, which has been uninterrupted since 1971. Accreditation requires certain advanced courses including Inorganic Chemistry, Advanced Synthesis, and Senior Research. It also requires that undergraduates have access to, and learn to use, research-quality instrumentation. Our students going into industry or government labs will be using state-of-the-art equipment, and it is important that they have experience with modern instrumentation and techniques as an integral part of their education. To date, we have been able to obtain funds to keep the equipment in good repair, and to purchase new instruments as necessary to replace those that have become out-dated. It is vital that we continue to do this. Our primary concern in design of our program is that our courses properly provide all science majors with a modern basic knowledge of chemistry upon which they may build their advanced studies and/or careers.

**D.1. The Freshmen Learning Community.** The Chemistry Department sponsors a Freshmen Learning Community (FLC) entitled "An Introduction to the Natural Sciences". As part of this effort, we offer a special class for the FLC in General Chemistry (a special section of GSU1010). This is an orientation class for beginning freshmen who plan to enter chemistry or a related discipline. All students in the FLC take the same classes together promoting bonding and exchange of ideas among our new students. A faculty member from the department teaches the chemistry class of GSU1010.
D.2. Senior Research and Project-oriented Laboratories: Our capstone course for undergraduates, Senior Research (CHEM4160 with the option for a second semester, CHEM4170), is a time-intensive commitment for faculty and students. As of July, 2005, we had 254 majors, all of whom are required to take Senior Research before they graduate. Students are given significant research projects that can lead to publishable results and that are challenging for the students to execute. Faculty members work closely with research students to hone their writing and presentation skills. These as well as the lower division project-oriented laboratory courses have a significant writing component to complement the laboratory work. Before the project begins, the student writes a research plan and introduction to the project that is based on a literature survey and discussions with the faculty research director. After the experiments have been conducted the student writes a results presentation and this is followed by a discussion section that provides an overview of the entire project. Each of these written sections is reviewed by the faculty research director and feedback is provided to the student. Essentially all of our students also give oral or poster presentations on their work and many of them become coauthors on publications. Part of the ACS accreditation process requires that the Department submit a sample of Senior Research reports for review by the ACS’s Committee on Professional Training. Three typical reports from 2004 are included in Appendix D-7 as examples of papers from undergraduate student research.

It is to be noted that in addition to the Senior research project, our Freshman and Organic Chemistry labs are project oriented. In particular, the Organic I lab involves identification of several unknown compounds in an open-ended manner; each student in a given laboratory has a different set of unknowns. The Organic II lab involves two different synthetic sequences. Each person in the lab begins with different compounds for each synthetic step. Having each student working on a different compound in each lab is an excellent learning experience, but it is very intensive in terms of faculty teaching time. Our Physical Chemistry labs are writing intensive and the students write 5 to 6 reports in each lab. The faculty member gives the student feedback on his or her report, and the student is able to rewrite the report. This is again an excellent experience for the student, but very time-intensive for the faculty.

Starting in 2000 the Department initiated formal tutorial courses for the Freshman, Organic and Physical Chemistry courses. Students can self-select to sign up for peer-led tutorials. They receive a grade, which is averaged into the GPA, but the hours do not count toward the total hours required for the degree. This system has been a considerable help in reducing the drop rates in these courses.

Since most of our tenure track faculty members have external research support, the research students generally have excellent equipment and adequate supplies for their research projects. The students at the research level are able to obtain hands-on experience with state of the art equipment. A current limitation on this approach to training students and a potentially even more serious problem for development is that the Chemistry Department does not have nearly enough space for all of our students to carry out research projects. We have experienced a dramatic increase in student numbers from the beginning laboratory courses to chemistry majors carrying our senior research projects. When this is coupled to the increases in our graduate program, faculty members and postdoctoral research students, the space shortage of the Department is understandable. It is essential that the Department receive a significant increase in laboratory space if our growth in students and research projects is to continue.

D.2. Learning Outcomes: The Department has developed a rubric on learning outcomes. We have carefully assessed each course in terms of learning outcomes involving analytical skills,
critical thinking skills, communication skills, collaborative/group skills, acquisition of knowledge, understanding of professional standards in the discipline, and learning to solve original problems. The rubric is given in Appendix D-1. The assessment has been performed using the national standardized America Chemical Society exams. More recently, the Department has developed a further assessment methods outlined in Appendix D-1. The assessment methods and learning outcomes have been approved both by the Dean’s Office and the Provost’s Office.

D.3. Careers: Our students go on to many careers including industry, graduate school and professional schools including medical, dental, law, pharmacy and veterinary schools. We provide courses not only for our own majors, but for all students applying to these professional schools, particularly those majoring in Biology. The pre-professional students take Freshman chemistry and lab, Organic Chemistry and lab, and Biochemistry. The increases in the Chemistry and Biology majors over the last few years have put a substantial strain on the limited number of faculty in Chemistry as well as on laboratory teaching space. Our class sizes have increased substantially in the last few years; examples are given in Appendix D-4.

D.4. Programs Outside the Curriculum: To enhance our efforts to train additional minority chemists, we have options for summer undergraduate research largely in connection with the McNair Program for minority students. We have also had Bridge funding (summer funds to help minority students make the transition from two-year colleges to a University) for most of the last 7 years. Some faculty members have been able to obtain funding for undergraduate students but more opportunities are needed. We have an active Chem Club that also helps foster interactions among chemistry majors. The Club brings in speakers, serves to integrate the students socially, and plays a role in presenting possible career options to the students. The Department helps sponsor University Scholars who work part-time in the Department, giving them the opportunity to interact with faculty. This helps socialize them into the Department; it has also led to students going into research labs earlier in their career and has given us some good teaching assistants for longer than the usual period.

D.5. Faculty and Students Assess the Curriculum: 24 tenure track and non-tenure track faculty members in the Chemistry Department completed the APR survey (92.3% response) and we can thus be sure that the results represent the consensus view of the faculty. A summary of surveys responses is in Appendix D-5(1) and full survey results are in Appendix D-5(2). Faculty responded very favorably regarding the frequency (average of 4.42/5) and variety (average of 4.33/5) of course offerings. With regard to too much or too little emphasis on teaching the response was 3.33 where 3.0 would be a perfect balance. The Chemistry Department faculty responses were significantly more favorable than those of the University faculty as a whole on the first two questions and were essentially equal to the University response on the last question. It is clear that the Chemistry Department faculty are satisfied with our general emphasis on teaching and course offerings. Perhaps, more importantly, the faculty have worked very hard to make sure that all of our courses are taught at a level that is appropriate for an American Chemical Society certified Department. It should also be noted that current students and alumni and the undergraduate and graduate level also rated the curriculum, our program and faculty. The responses were encouragingly positive and are better than the University average in most categories. Particularly with current students, it is clear that they have a very favorable opinion of our instructional program. An important part of our development efforts in the next five year period will be to find methods to improve in areas where students felt our program had some weakness.
Section E: Student Quality:

Overall, the student quality at GSU has improved significantly since the last Self Study. In Chemistry both the numbers and quality of students have increased (see Appendix E-2).

E.1. Graduate Students: Since 2003 we accepted approximately 20 new M.S. students per year (admission requirements are in Appendix E-1). The combined GRE scores for the applicants are around 1060 while those that are enrolled scored 1092 (Table E-1). It is noteworthy that our applicant pool also contains a significant portion of foreign M.S. applicants; however, since we only have limited means to support foreign M.S. students, the numbers reflect domestic students. In the Ph.D. program, we have accepted nearly twice the number of students in FY05 as in FY03. This was made possible in part due to University-wide initiatives. For the Ph.D. applicants, the GRE score of the pool was 1172 and for the enrolled students it was 1167. It is relevant the latter number stayed constant FY 03-05 despite the large increase in enrollment (Table E-2).

A number of our students have been awarded nationally competitive fellowships, including American Heart Association, AGEP-NSF, NIH, and Solvay fellowships. We currently have 10 students on competitive Molecular Basis of Disease (8) and Brain and Behavior fellowships (2). Our graduate students have been the recipients of numerous prices, awards and fellowships (Appendix E-2). They also have been actively representing GSU at scientific meetings where they have given oral and poster presentations. An increasing number of our former graduate students are now holding faculty positions at various institutions (including the Emory University Department of Radiology; Perimeter College, Atlanta; Georgia Southern University, Statesboro, GA; Tuskegee University, Alabama; Berea College, Kentucky; SUNY Geneseo, New York; Universidad de Zulia, Maracaibo, Venezuela; United Arab Emirates; University of Alexandria, Egypt and Universidad de Pontificia de Ponce, Puerto Rico). Many other students have been desired prospects by industry both local and country-wide as is evidenced from their starting salaries. Students have taken postdoctoral positions at prestigious universities including UCLA and the University of San Diego (with a Howard Hughes fellowship). The accomplishments of these students are particularly gratifying considering that our doctoral program has only been established for 20 years. A full list of our Ph.D. graduates from 1997, with their positions, is in Appendix E-3.

E.2. Undergraduate Students: The number of students in the Department has increased steeply over the last five years, with numbers of majors increasingly yearly from 2001 to 2005: 132, 151, 189, 217, and 261. Even as the numbers of students were increasing, the SAT scores were increasing also, with total scores of 1013, 1029 and 1046 in 2003, 2004 and 2005, respectively, for entering freshmen in chemistry.

The GSU Chemistry Department's Chem Club (ACS Student Affiliate Chapter) won an honorable mention Chapter Award from the American Chemical Society. A plaque will be presented at the 231st ACS National meeting. The Club has consistently won national awards for activities with the community, industry and academics.

Georgia State sends many students into professional careers in the health sciences, including medicine, dentistry, pharmacy, optometry and veterinary medicine. The University processed 70 application files in 2003 and 78 application files in 2004 for entry into the health-related professional schools. For acceptances, the University only has statistics for medical school (based on AAMC information released to GSU). In 2003, 59 applications resulted in 21 acceptances and in 2004, 57 applications resulted in 32 acceptances. Many of these students are postbaccalaureate students, coming to GSU to take science courses after receiving an undergraduate degree in another area (33% and 56% in 2003 and 2004, respectively). Essentially all the students going into the health-related professional schools take Freshman Chemistry I and II and labs, Organic I and II and the labs, and Biochemistry. The Chemistry
faculty work with these students in advising and writing letters for their applications. Our students also move into industry, government or academic laboratories and a number of students go on to graduate school (e.g., the University of Georgia, NC State and Purdue).

Section F: Quality of the Chemistry Department Faculty

The Department of Chemistry has a skilled and accomplished faculty who have led remarkable enhancements in the research and instructional activities of the Department in the last five years. As will be described in detail in this section, members of the faculty are leaders in their fields and most of the tenure track faculty have active externally-funded research programs with strong publication records. They are heavily involved with many professional activities including positions as reviewers for federal agencies, foundations and other institutions, reviewers for essentially all of the leading journals in the research areas covered by the Department and as editors and members of editorial boards. A description of the areas of faculty focus and specialization in the GSU Chemistry Department can be found briefly in Section A and in more detail in Section B. The Department is also fortunate to have a strong group of nontenure track faculty, all with Ph.D.s, who are dedicated to high quality in the instructional area.

F.1. Faculty Diversity: Table B-1 in Appendix B delineates the faculty composition by gender and ethnicity. Women and certain minorities are still underrepresented in chemistry. Nationally, in the 2002–03 academic year, women held 12% of the total chemistry faculty positions at the 50 institutions identified by the National Science Foundation as having spent the most on chemical research in 2000 (Chemical and Engineering News, September 23, 2002, pp 110-111). There are very few women at the full professor level and the numbers of women in the assistant and associate professor ranks were therefore about twice the overall percentage of positions. Currently, 26% (5 of 19) of the GSU Chemistry Department tenure track faculty are women and this puts us in line with other nationally-ranked chemistry departments. We note that the general record of major Ph.D.-granting chemistry departments in Georgia with respect to women on the faculty is exceptionally poor with two women out of 38 faculty at UGA, one woman out of 27 faculty at Emory and two women out of 38 faculty at Georgia Tech. Thus, the other research universities of Georgia (Emory, Georgia Tech, and University of Georgia) have a total of five women chemistry faculty members which equals the number we have in our Department at GSU. We are a leader in the recruitment of women for chemistry faculties in Georgia. We are also pleased to have one African American on the tenure-track faculty. We have two women and one African American who are lecturers. We are proud of our progress in recruiting under-represented groups to our faculty and also determined to increase these numbers in the next five year period. We will do this both by recruiting and by providing a supportive environment in the Department for the faculty to reach their full potential.

F.2. Research Productivity: Details of faculty research productivity for the review period are given in Appendix Table B-2 and a summary for the years 2001-2005 is given in Table A-1. As can be seen in the tables, the faculty had an excellent record of publications, grant support and presentations in 2001 and that record has increased dramatically during the past APR period. Peer-reviewed publications per faculty member, for example, have increased by 55% while grant support per faculty member has essentially doubled. Many of our faculty hold awards from two or more major external granting agencies, which is a remarkable record given recent tight research budgets at most agencies. All of our tenure track faculty members were active in publishing and competition for grant support during that period (Table B-2). The Department realizes that for students to best learn a subject and to be inspired to use it, it is imperative that they be taught by active scholars of that subject. The extremely strong research program in Chemistry insures that we follow the scholar/teacher model. This balance of research with both
teaching and service activities places the Chemistry Department in a central position to support the challenging goals of the GSU Strategic Plan.

**F.3. Faculty Honors:** The high quality of the faculty in the Chemistry Department has led to significant recognition in the last five years both within and outside of the University. Internally, there are two Regent’s Professors, one of the four Georgia Research Alliance Eminent Scholars at GSU, one winner of the Outstanding Faculty Achievement Award, an Arts and Sciences Outstanding Junior Faculty Award winner, and two Outstanding Teaching Award winners. Three faculty members are Georgia Cancer Coalition Distinguished Scientists. Dr. Grant has a NSF Career Award for 2000-2006. Professors Boykin and Netzel were awarded the Georgia Section ACS Outstanding Service Award in 2004.

**F.4. Professional Service.** Externally, our faculty members serve on the editorial board of leading professional journals including *Biochemistry, Current Medicinal Chemistry, Archives for Biochemistry, Drug Design*, and others. The Department is also home to the editorial offices of one book series entitled “A Wiley Series in Drug Discovery and Development,” and two journals, *Heterocyclic Communications and Medicinal Research Reviews*. The latter journal was ranked #1 in Impact Factors two years in a row among 36 medicinal chemistry journals. Faculty members serve on review panels of national funding agencies such as the National Institutes of Health (NIH), the National Science Foundation (NSF), the Research Corporation (RC) and the American Chemical Society Petroleum Research Fund (ACS PRF). Faculty contribute to the organization of numerous professional meetings; Professor Netzel was General Chair for the 55th Southeastern American Chemical Society. Faculty review for all major agencies related to chemistry including the National Science Foundation, the National Institutes of Health, the American Cancer Society, Research Corporation, and the American Chemical Society Petroleum Research Fund. Drs. Dixon and Germann are on the Oversight Committee for the 900 MHz NMR at the University of Georgia. Additional material may be found in descriptions of professional service to the communities of scholars in their areas of focus (described in Section B) and professional service outside the University (Table B-2).

**F.5. Service and Outreach.** Our goal for service is to enhance all programs and aspects of the University while at the same time improving chemistry as a profession. The Chemistry Faculty feel that these activities are essential for the development of Georgia State as a first-rate University and they take a University-wide approach for effective participation in Departmental, College, and University activities. Departmental participation in the College of Arts and Sciences and University governance has been extensive. For example, over the past five years members participated on most of the College committees (Executive, Chairs, Promotion and Tenure, Graduate Council, Petitions, By-Laws, Pre-Medical Advisory, and Graduate Student Appeals). Departmental faculty participated on many University-wide committees including: Biosafety, Chemical Safety, and many of the Senate Committees.

Chemistry faculty and students have served as the event coordinators and judges at the Science Olympiads (both regional and state levels) held at the University for several years. A senior lecturer in the Department, Dr. Keith Pascoe, was the Assistant Tournament Director for two years and the Tournament Director in 2004. The Chemistry Club has interacted with local industries and has assisted teachers in local school systems. The Chemistry Department has involved students in the quite successful BioBus outreach program for improving science education in local school systems. The Department has helped in the development of chemistry teaching modules for the BioBus program and has also helped in the presentation of the material related to chemistry. Faculty members have also helped judge science fairs and given presentations at schools. The Glactone Project (gamma-lactones give peaches their...
characteristic smell and flavor) under the direction of Dr. Dixon has provided resources for visualization of chemicals and biochemicals throughout the State and the nation via both teaching and the Glactone website.

For the period 2001-2005, the NSF Center for Workshops in the Chemical Sciences (CWCS) Program that is centered at GSU conducted 57 workshops at diverse locations shown in Appendix E-4. CWCS currently has access to over twenty workshop sites to allow a wide variety of courses to be presented around the country. The program, which is described in more detail in Section A-3, has attracted 835 participants from 46 states plus Guam, Puerto Rico, and Washington, D.C. The participants represented 570 different institutions that are distributed around the country and this illustrates the very significant impact that this program has on science teaching in undergraduate institutions.

F.6. Promotion and Tenure: All candidates for promotion to assistant, associate and full professor with tenure during the review period have been successful. One non-tenured faculty member left the Department to take an academic position at another institution.

Section G: Resource Adequacy

G.1. Faculty Resources: An impressive feature of the productivity in the Chemistry Department since the last Self Study was the parallel dramatic increases in credit hours, chemistry majors, research publications, and external grant funds with a very small increase in the number of Chemistry tenure track faculty (Table A-1). Clearly the team of Chemistry tenure track and non-tenure track faculty members are doing an almost unbelievable job in both the instructional and research areas. As a result of the growth and quality of the research and instructional programs, the Department is in a strong position to help lead the University forward in the strategic plan goal of increasing the ranking and recognition of GSU programs. Peer comparisons, described above, show that our grant support and publication record far out-strips most other Universities at our development stage. It must be emphasized that this dramatic increase in research productivity has been accomplished with (i) no decrease in instructional quality (for example, the scores of our students on American Chemical Society national exams are consistently above the 50th percentile mark), and (ii) a doubling of the number of chemistry majors in the last five years with a similar marked increase in credit hours taught. In Section H we propose an increase in tenure track faculty to match the increase in credit hour generation.

G.2. Administrative Resources: Because of the increase in instructional load, credit hours and majors, and research productivity, publications and grant support, with little increase staff support, both our faculty and staff are stretched to the limit. The current level of productivity and growth is unsustainable without added resources. We are having particular difficulty with grant accounting, purchasing and personnel matters due to the increase in our grant support and publications in the last five years (Table A-1). To maintain the competitiveness against our peer departments, to sustain our upward movement, and to help lead the University to its goals of excellence in research, we need to increase our support staff size. An essential need is for a skilled research support accountant who can manage our grants affairs.

G.3. Technological Resources: Faculty and staff offices as well as research and teaching laboratories are currently well equipped with standard PC computers and associated hardware. These computers are essential for modern instructional and research activities. They are used in data collection, analysis and plotting as well as graphics and text preparation for presentations and publications. The computers must be replaced on a routine schedule in order to keep pace with data collection software, advances in analysis and plotting programs and other related research and instructional computer needs.
Research laboratories are equipped with standard small equipment that is essential for individual research projects. The equipment is different for laboratories involved in different research areas. A laboratory involved in drug design and synthesis, for example, will need appropriate fume hoods, evaporators, drying apparatus and related preparatory equipment. Laboratories conducting research on enzymes will need pH meters, spectrophotometers, filtration and lyophilizing apparatus, and related materials for biological sample preparation. Such equipment is used on a routine basis and is essential for each research laboratory. It should be noted that the initial investment to setup a new laboratory with equipment such as that described above along with essential glassware and related supplies is quite large. Startup costs for new faculty members in Chemistry, just for basic laboratory operation, are thus quite high. Any major equipment required adds considerably to the startup costs for new faculty.

The Chemistry Department, with assistance from Georgia Research Alliance (GRA) funding, has established a powerful array of multi-user research instrumentation that is listed in Appendix G-3. The availability of this excellent research instrumentation has significantly enhanced the research projects that can be undertaken by faculty and students in the GSU. The GRA funding of major equipment is a significant factor in our dramatic increase in grant support and publications since the last Self Study (Table A-1).

G.4. Space Resources: The lack of space in the Chemistry Department has reached the critical point because of the dramatic growth in credit hours, chemistry majors and externally funded projects. One obvious indicator of this serious situation is in the area of "bottleneck" courses for students who take chemistry as a requirement. In spite of being a relatively small department at GSU, the Chemistry Department had four of the top twenty "bottleneck" courses (Chem 1211, 2400, 3100, 3110). These are courses that are completely full each semester. Many students are unable to register for these courses and as a result they can not proceed with their programs. Because these are introductory courses that are required not only by chemistry majors, but also by a broad range of other students, including Biology, Psychology, Physics and pre-medical majors, this situation is causing very serious problems in many departments. The Biology Department, for example, requires these introductory chemistry courses be taken before Introductory Biology. Failure to get into these courses can cause a full year of delay in a student's degree program. Every Fall roughly 300 Biology majors are unable to register for introductory chemistry due to lack of capacity. Biology and pre-medical students have filled the organic chemistry courses to the maximum. Students are forced to delay entry into these courses until Spring or even Summer semesters. Many of the classes essentially are filled upon opening of registration. Clearly, the Chemistry Department will require a very significant increase in space, faculty members and funding in the next five years to correct this situation.

G.5. Laboratory Resources: The Chemistry Department's available laboratory research space is adequate for our current faculty but that is primarily because we have added only two new tenure track faculty in the last ten years. Essentially all available space in the Natural Science Center that can be converted to laboratory space has been converted. The Department, for example, has only one small room, which can hold approximately 15 people, remaining for research interviews for faculty candidates, graduate oral exams and similar activities. Our critical need for new faculty will require a substantial increase in laboratory research space and it is essential that such space be programmed into the new science research facility.

G.6. GSU Foundation Resources: The Chemistry Department has a moderate endowment in the GSU Foundation which is primarily used to support the seminar program. In addition the
Department has two small endowment graduate fellowships named after Professors: Boykin and Pendergrast. These are used for the support of highly qualified Ph.D. graduate students.

**G.7. Library Resources:** On site library resources, with internet access of the most important journals and interlibrary loan, are adequate for our basic needs. A University Library Report is in Appendix G-2.

**Section H: Goals and Objectives**

To summarize the material presented above, the Chemistry Department at GSU is clearly in a strong position to help lead the University forward in its strategic plan goal of increasing the ranking and recognition of GSU programs. The Department is especially strong in developing its nationally-recognized research program at the interface of chemistry and biology, and in increasing its credit hours in the high-quality graduate and undergraduate instructional programs. During the last five years, the Chemistry Department has more than doubled its external funding and increased its credit hours by 7,400 (Table A-1) while maintaining excellence in program quality with almost the same number of tenure-track faculty. Internally, the Chemistry Department is a lead department in the recently approved University initiative, Molecular Basis of Diseases, and is a participating department in another, Brains and Behavior. Externally, the Chemistry faculty brings enormous recognition to GSU by organizing national and international symposia, serving on journal editorial boards and NIH/NSF review panels, and giving invited lectures at other institutions and international meetings. We are proud that pharmaceutical agents developed by the Chemistry faculty are in clinical trials or being considered for clinical trials for more than one disease. The Department is also home to the editorial offices of one book series entitled "A Wiley Series in Drug Discovery and Development," and two journals, *Heterocyclic Communications* and *Medicinal Research Reviews*. The collective workload, productivity, contribution, and name recognition of the Chemistry faculty far outpaces other institutions at a similar developmental stage. As shown elsewhere, we are very similar to more prestigious universities, including Tulane and Vanderbilt, in our productivity.

Behind the recent success of the Chemistry Department are stretched financial and human resources and a severely over-worked faculty. The current levels of productivity let alone growth are unsustainable without added resources. To maintain the competitiveness against our peer departments, and to sustain our upward movement, growth in faculty size and additional resources are severely needed. With this support, the Chemistry Department will continue to be a leader in the University’s drive for excellence and improved recognition.

**H.1. New Faculty:** Currently, the Department has three visiting lecturers, which will be converted in a 1:2 ratio to yield 6 tenure-track positions. To increase our faculty size to that of comparable peer departments, we request that our size be increased by 6 additional full-time tenure track faculty. We request that 3 of the new positions be at the senior level with one being an eminent scholar in chemical biology. The expansion will be in the general area of chemistry at the interface of chemistry and biology including bioanalytical, biophysical, bioorganic and medicinal, and biochemistry. Such a plan is in line with our existing strength and the University focus on the Molecular Basis of Disease for which Chemistry is a lead department. This plan will also allow us to continue our productive and synergistic collaboration and interaction with the Department of Biology.
There are three key issues in the planned faculty growth, which will require extensive support by the University: (1) salary lines that are competitive at the national level, (2) space, which will be detailed separately in the next section, and (3) start-up costs.

First, hiring high quality faculty is crucial to our growth, and yet it is a very competitive process. One major issue we are facing is the depressed salary level for our incoming assistant/associate professors (see Section A-5). It is critical that the salary lines provided are competitive based on the Chemical & Engineering News annual national survey conducted by the American Chemical Society.

The start-up costs for new chemistry faculty in the last few years have been in the range of a minimum of $400K per assistant professor to approximately of $1M at more senior levels. If the Georgia Research Alliance (GRA) continues to support the Georgia Research Universities by providing equipment funds, the Department will be able to put together the remaining portion of the start-up packages using indirect cost revenue funds. However, if the GRA switches its funding strategy, the Department will need to rely on significant University help to come up with the needed resources.

**H.2. Space Needs:** The Department’s current space may allow for the addition of two more junior faculty members. Any expansion after that point will require new space. We estimate that for each new assistant professor, we will need 900 square feet of research space plus office space as well as access to instrumental facilities. At more senior levels, at least two research labs plus support space will be needed. Therefore, the total space needs for the proposed expansion will be significant, but can be programmed into the new science research facility. We also need undergraduate laboratory space that is commensurate with our rising number of majors. Laboratory space should not be decommissioned unless equivalent space is made available.

**H.3. Graduate Student Funds:** The dramatic increases in credit hours and laboratory enrollment require a correlated increase in the number of graduate teaching assistantships (GLA) in the Department. The current number of GLA positions in the Department is not enough to provide satisfactory laboratory teaching support and this must be corrected to maintain the quality of the instructional program. Additional graduate students will also be needed as we increase our number of tenure track faculty positions and the requests for faculty and graduate student increases are complementary.

**H.4. New Staff:** As detailed elsewhere, we are already understaffed compared to our peer institutions, and at least two new additional staff members are required to use our resources wisely, and to reduce the extent to which are faculty are doing tasks that are more appropriately handled by staff. In addition, the Department will need to add staff lines at least proportional to the proposed growth in faculty in the next five years. Our top priority is the addition of a Grants Management Specialist. At least one more accountant is also needed due to the increase in grant awards. Our second priority is an additional full time support person for information technology. Our third priority is a Ph.D.-level coordinator of the Freshman and Organic undergraduate laboratory sequence. With the large number of majors, we also need a person to work with our undergraduates in advising, career planning and general problem solving. Such a position might be combined with that of Graduate Admissions. Finally, we continue to be concerned about the salary available for visiting lecturers and lecturers. The people in these positions bear a heavy responsibility of teaching a complicated subject that is the focus of many state and national laws and regulations. We are not able to attract enough qualified candidates
for these jobs at the salaries available. In view of the safety issues and complexity of the laboratory courses, it is imperative that we have a qualified, stable teaching staff.

**H.5. Major Equipment Operation, Upgrades, and Replacement:** Modern research in chemical and biochemical sciences requires sophisticated instruments. With the construction of the new research labs, it is assumed that they will be properly equipped for chemical biology research. In addition, these sophisticated instruments require regular maintenance and upgrades. Resources are needed for the upkeep of these instruments (Appendix G-3). We plan to dedicate part of the time of one of the information technology staff to oversee the instrumentation.

**H.6. Major Computational Resources:** High level computation has become a routine part of chemical and biochemical research. This may include computer-aided drug design, quantum mechanics calculations to understand molecular structural features, protein-protein interactions, protein-nucleic acid interactions, and small molecule-macromolecule interactions. The Department intends to further strengthen its computational research areas. Therefore, it is critical that computational resources are provided at the University level in support of the research activities described in the document.
Appendices, Tables and Charts

Self Study for Academic Program Review

December 2005
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* Partial year
## Table B-1
### Faculty Distribution by Numbers for 2003-2005
Chemistry Department
Self Study 2005

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<td>$415,000</td>
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<td>Dr. Shahab Shamsi</td>
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<td>Dr. Jerry Smith</td>
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<td>Dr. L. Strekowski</td>
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<td>Dr. Binghe Wang</td>
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<td>Dr. David Wilson</td>
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<tr>
<td>Dr. Jenny Yang</td>
<td>8</td>
<td>$842,293</td>
<td>5</td>
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</table>

**2005**
| Total | 90 | 3 US patent  
1 Edited book  
2 Book chapter  
5 Conference Publications | $5,124,698 | 73 |
<table>
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<td>Annual Avg.</td>
<td>5.0</td>
<td>$284,705.4</td>
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1 International Editorial Board Heterocyclic.  
7 Invited seminars as speaker  
5 Invited symposia  
2 Organized symposium  
7 NIH Study Sections  
2 Chaired Symposium  
1 ACS national meet. as speaker  
2 Advisory boards  
1 invited lecture

*Jointed the Chemistry Department in 2004 and *jointed the Chemistry Department in 2003.

Senior Lecturers had a total of $13,900 from FY 2001-2005 with a yearly average of: $2,780
Table B-4  
Chemistry Department  
Self Study 2005

FY 2003 Credit Hours Taught by Chemistry Faculty by Level and Faculty Type

<table>
<thead>
<tr>
<th>FACULTY TYPE</th>
<th>UGRD CORE</th>
<th>UGRAD LOWER</th>
<th>UGRAD UPPER</th>
<th>GRAD</th>
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<tr>
<td>PTI</td>
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</tr>
<tr>
<td>GTA</td>
<td>842</td>
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<td>4</td>
<td>12</td>
<td>894</td>
</tr>
<tr>
<td>OTHER</td>
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<td>2440</td>
<td>3978</td>
<td>3453</td>
<td>16683</td>
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FY 2004 Credit Hours Taught by Chemistry Faculty by Level and Faculty Type

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<th>UGRAD UPPER</th>
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<td>7491</td>
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<td>2593</td>
<td>2524</td>
<td>110</td>
<td>8225</td>
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<tr>
<td>TRACK</td>
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<td>160</td>
<td>108</td>
<td>174</td>
<td>692</td>
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<tr>
<td>PTI</td>
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<td>283</td>
<td>35</td>
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<td>946</td>
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<tr>
<td>GTA</td>
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<td>53</td>
<td>19</td>
<td>17</td>
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<td>OTHER</td>
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<td>18723</td>
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## FY 2005 Credit Hours Taught by Chemistry Faculty by Level and Faculty Type

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<th>UGRAD UPPER</th>
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<td>GTA</td>
<td>592</td>
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<td>TOTAL</td>
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Table B-3
Program Types by Majors and Unduplicated Number of Major Students and Degrees Conferred
FY 2003- FY 2005
Chemistry Department
Self Study 2005

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<tr>
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<td></td>
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<td>3</td>
<td></td>
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<td>53</td>
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<td>312</td>
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*Through Summer ’05 included

Table B-3 Supplemental

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<td>CHM</td>
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<td></td>
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<td>39</td>
<td>4</td>
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<td>33</td>
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<td>207</td>
<td>37</td>
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Table B-5
Summary Average Annual: Credit Hours, Faculty Members
Chemistry Department
Self Study 2005

Average Annual # of Faculty Members by Rank and Status

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<th>FY 04</th>
<th>FY 05</th>
<th>3 YR AVG</th>
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<tbody>
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<td>Prof</td>
<td>8</td>
<td>9</td>
<td>9</td>
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<tr>
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<td>Total PT</td>
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<td>9.3</td>
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Average Annual Credit Hours by Level

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Average Annual Credit Hours by Faculty Type

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<th>3 YR AVG</th>
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</thead>
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<tr>
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<td>8225</td>
<td>10294</td>
<td>9177.3</td>
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Appendix B-1
Rationale for Choices of Peer Programs
Chemistry Department
Self Study 2005

In comparing ourselves with other universities, we have been fortunate to have access to the Annual Survey of Chemistry Departments in the Southeast. The data herein are the most recent for which a full survey is available, the 2004 report. Graduation data are from the publication of the American Chemical Society, Chemical and Engineering News, September 26, 2005, pp. 55-60. All data from both sources are for FY 2004.

For our Self Study, we have chosen 11 cohort universities, with the following criteria: a) the chemistry department has 15 – 30 faculty members, b) the total enrollment at the university is 15,000 to 30,000 students and c) the university does not rank in the top 50 in the nation.

The data are presented in a series of graphs, as indicated below.

1. Total external funds (K)/TT faculty member.
2. Outside support (K) vs. budget (K).
3. Staff members/$1M total funds (sum of university support and external funds).
7. Salaries of assistant professors, adjusted for cost-of-living.
Figure 1

Total External Funds (K)/TT Faculty

- VCU
- Vanderbilt
- Tulane
- Tennessee
- South Carolina
- Miss State
- U Miss
- Memphis
- Georgia State
- FL International
- Auburn
- Alabama Birmingham

Total external funds (K)/TT faculty

Figure 1
Appendix B-6
Chemistry Ph.D.'s Awarded by Fiscal Year
Chemistry Department
Self Study 2005

1995
Dr. Shaikh Rahman
Dr. Hui Mao
Dr. Robert Pullen
Dr. Maryam Hojjat

1996
Dr. L. Ratmeyer-Fleming
Dr. Steve Patterson

1997
Dr. Ted Rigl
Dr. Richard Williams
Dr. David Hamilton
Dr. Elba Michelena-Baez
Dr. Varsha Vaishnav
Dr. Maryam Daneshvar

1998
Dr. Kishia Towns

1999
Dr. Lawrence Evans
Dr. Tim Baranowski
Dr. Derrick Bennett

2000
Dr. Iris Francesconi
Dr. Katherine Hopkins
Dr. Alesia Parker
Dr. Mark Cunningham
Dr. Leila Tarazi
Dr. Menno Baars
Dr. S. Edwards-Bennett
Dr. Ge Xiao
Dr. Anand Swamy
Dr. Hyeran Lee

2001
Dr. Marty Say
Dr. Yiming Ye
Dr. Eilyn Lacy
Dr. Binh Nguyen
Dr. Wei Yang (Biology)

2003
Dr. Kimberly Agnew-Heard
Dr. Doyle Barrow
Dr. Patricia Ruiz
Dr. Tony Testino
Dr. Adalgisa Batista-Parra
Dr. Jose Gonzalez-Roman
Dr. Chuanying Chen
Dr. Yasser Abdulrazek
Dr. John Sowell
Dr. Samir Gaballah
Dr. A. Navarro-Eisenstein

2004
Dr. Nichole Powell
Dr. Ruel McKnight
Dr. Jianguo Zhang
Dr. Reem Arafa

2005
Dr. Alfred Eiser (Geochem.)
Dr. Ekaterina Paliakov
Dr. Rucks Winkeljohn

2006 (+projected)
Dr. Anna Wilkins Maniccia
Dr. Brian Crow
Fan Fan (Biology)
+April Ellis
+Lisa Jones
+Hsiau-Wei Lee
+Beth White
+Tanya Myers
+Jie Zheng
+Mahmoud Ghanem
+Beth Wilson
Figure 2
Figure 3

Undergraduate Degrees - FY 2004

Number of students
Figure 4

Graduate Degrees - FY 2004

Number of students

PhD Graduates
MS graduates

Figure 4
Staff Members/$1M Total Funds

Figure 5

Section B
Salaries Asst Prof - COL Adjusted

Figure 7
Figure 9

Salaries Prof - COL Adjusted

- VCU
- Vanderbilt
- Tulane
- Tennessee
- South Carolina
- Miss State
- U Miss
- Memphis
- Georgia State
- FL International
- Auburn
- Alabama Birmingham

Section B
Appendix B-2 (1)
Departmental Organization Diagram

Faculty

- Special Committees
  A. Computer
  B. NMR
  C. Accounting

- Standing Committees elected
  A. Curriculum
  B. Petitions
  C. Advisement
  D. M.S. Admissions and Honors
  (M.S. Admissions reports to Grad. Dir.)

Chair

- Executive Committee (3 elected staggered terms)
  A. Curriculum
  B. Petitions
  C. Advisement
  D. M.S. Admissions and Honors

Director of Undergraduate Studies

Freshman Area Committee

- Academic Area Committees
  A. Bioanalytical
  B. Biochemistry
  C. Bioorganic/Medicinal
  D. Biophysical

Graduate Director

Area Ph.D Advisors
  A. Bioanalytical
  B. Biochemistry
  C. Bioorganic/Medicinal
  D. Biophysical

Associate Chair

Hiring

- Visiting Lecturers
- Space Evaluation & Planning
- Long Term Building Plans
- Other Projects

Contract Renewal Committee

P&T Committee

Graduate Faculty Committee
Chemistry Department Staff Organizational Chart

Appendix B-2 (2)

Chair

Section B

26
ARTICLE I. MEMBERSHIP

The faculty of the Department of Chemistry shall consist of any individual who holds the academic rank of professor, associate professor, assistant professor, senior lecturer or lecturer.

ARTICLE II. PROGRAMS AND AREAS

The degrees in the department’s programs are awarded as B.S.’s, M.S.’s and Ph.D.’s in Chemistry. There are four areas in the department: Bioanalytical, Biochemistry, Biophysical and Bioorganic/Medicinal made up of faculty groups with expertise in the discipline.

ARTICLE III. PHILOSOPHY OF GOVERANCE

The faculty consists of groups of members who cooperate in carrying out the goals of the department within the guidelines set by the College of Arts and Sciences. Each faculty member participates in the departmental processes.

Section 1: Responsibilities of the Department Chair and Other Faculty Members

A. The Chair makes decisions related to the Chair’s duties specifically listed in the department and college bylaws.

B. The Chair makes decisions that require immediate action.

C. All faculty shall be given and have the opportunity to participate in departmental decision-making.

Section 2: Use of Committees

A. The work of the department is shared through the use of standing and ad-hoc committees. Committee descriptions and selection procedures are found in the bylaws.

B. Committees shall give timely, adequate information regarding decisions to other faculty members.

C. Committees shall solicit input from other faculty whenever it is appropriate and possible.
D. Unless restricted by department or college bylaws, membership on these committees shall be open to all faculty members, with preference given to those with the most knowledge and interest in the issue at hand.

E. As approved by the Chair, visiting faculty may serve as additional members on designated committees and shall have voting rights in those committees.

Section 3: Faculty Decision-Making Procedures

A. A consensus decision-making approach shall be used in all meetings of the faculty.

B. Every effort shall be made to inform the faculty five (5) working days in advance of the meeting, allowing a reasonable time for reflection before discussion. When possible, supporting material for agenda items will be distributed with the call for the meeting. Every effort will be made to deal with major issues during the academic year.

C. Following the introduction of an issue, all views shall be solicited first, and an attempt shall be made to find a consensus. Additional supporting data should be distributed/presented to the faculty. Electronic voting (e-mail) is allowed unless a voting member of the faculty objects prior to the vote.

D. If no consensus can be achieved, a (simple) majority vote of faculty present shall prevail. A quorum should be present during the academic year to hold a vote.

ARTICLE IV. MEETINGS

A. The faculty of the department shall hold at least one meeting every term of the academic year. The first faculty meeting of the academic year shall occur as soon as possible in the Fall semester.

B. The Chair may call a special meeting on his or her own initiative or he/she shall call a meeting upon receipt of a petition stating the purpose of the meeting and signed by twenty percent of the voting members of the faculty.

C. Departmental faculty meetings are chaired by the departmental Chair. In the absence of the Chair, the Chair’s appointee shall preside.

D. At least five working days prior to a meeting of the faculty, except in emergencies, the Chair shall notify each faculty member of the time and place of the meeting. At least three working days prior to any meeting of the faculty, the Chair shall supply to the faculty a working agenda listing all the matters the Chair expects to be presented or considered and supporting material necessary to the decision making process.
E. Minutes shall be kept at all faculty meetings and distributed to all faculty members in the department via e-mail. All corrections/additions/objections should be distributed to the entire faculty (e-mail). If no consensus can be achieved, approval will require a formal vote at the next faculty meeting. Minutes will be kept on file electronically.

F. A simple majority of the voting members of the departmental faculty shall constitute a quorum.

G. All meetings shall be conducted according to the most recent edition of Robert’s Rules of Order.

**ARTICLE V. CHAIR**

**Section 1.**

The position and duties of a department Chair are as defined in the Statutes of Georgia State University, Article X, Section 3. The Chair of the Department of Chemistry shall perform all duties designated there.

**Section 2.**

The Chair of the Department of Chemistry shall perform these additional duties:

A. Communicate regularly with the department about pertinent information from the higher administration and matters of concern to the department and its welfare.

B. Appoint program directors for graduate studies and for undergraduate studies.

C. Appoint committee chairs as specified by the bylaws.

D. Provide written notice to the faculty of the projected schedule for the next term, including summer term.

E. Annually evaluate each faculty member, as provided in the Policies of the Board of Regents, Section 803.07, and furnish a copy of this evaluation to the faculty member.

F. Appoint a faculty member to serve as acting chair on those occasions when the Chair is not available.

G. Appoint an ad hoc committee to consider any specific matter of concern to the department when such a matter arises outside the purview of the standing committees. Ad hoc committees shall report to the Chair, the Executive Committee, or the faculty, depending on their specific charge by the Chair.
H. Hire and apportion duties to the office staff.

I. Serve on committees as specified by the bylaws.

**ARTICLE VI. DIRECTOR OF GRADUATE STUDIES**

A. There will be one Graduate Director for the department. The Director shall be appointed from the departmental Graduate faculty by the Chair after consultation with the Executive Committee and the Dean’s Office (approval required).

B. The term of the Director shall be five years, and this appointment may be renewed.

C. The Director shall perform the following duties:

1) Coordinate with the Chair on matters related to graduate coursework and the development of the graduate program.

2) In consultation with the faculty and Ph.D. area advisors, oversee the promotion of the graduate programs and admission of graduate students.

3) Monitor the academic performance of graduate students.

4) Advise first-term students and guide students in the selection of their advisors.

5) Provide an orientation program, in consultation with the Ph.D. area advisors, for new graduate students.

6) Ensure that the Graduate Student Handbook is up to date on the departmental Website.

7) Communicate with relevant units across campus (e.g., Arts and Sciences Graduate Office).

8) Evaluate the performance of current graduate assistants and upcoming graduate assistant needs and preferences.

9) Oversee updating of program materials and conduct recruiting efforts.

**ARTICLE VII. DIRECTOR OF UNDERGRADUATE STUDIES**

A. There will be a Director of Undergraduate Studies for the department. The Director shall be appointed by the Chair, after consultation with the Executive Committee.
B. The term of the Director shall be five years, and this appointment may be renewed.

C. The Director shall perform the following duties:

1) Oversee the promotion of the undergraduate program.

2) Perform advisement (both programmatic and career) of students, including majors and minors.

3) Coordinate with the Chair on matters related to undergraduate coursework and undergraduate program development. Keep records of ACS exit exam scores and document and report learning outcomes and related assessments.

4) Liase with the Academic Advisement Office.

5) Oversee updating of program changes and descriptions in undergraduate catalogs and other material.

6) Oversee and coordinate departmental efforts in the Freshman Learning Community.

ARTICLE VIII. STANDING COMMITTEES

Section 1: Procedures

A. All meetings of standing committees are open to the faculty except those of the Promotion and Tenure Committee/Contract Renewal Committee and the Executive Committee when it is discussing annual evaluations.

B. All faculty may participate in discussions. Only committee members may vote.

C. Committees are constituted at the departmental faculty meeting in the Spring term effective the beginning of the Fall term. Committee chairs can/may be appointed by the departmental Chair from the members of the standing committee. Should a vacancy occur during the academic year, the Chair shall appoint a temporary replacement, who can not serve as the chair of the committee.

D. New standing committees can be created by a majority vote of the faculty. The faculty shall determine the size of the new committee and the charge to the committee.

E. Minutes shall be kept at all standing committee meetings and distributed to all faculty members in the department electronically by the chair of the committee.
Section 2: Executive Committee

A. The Executive Committee shall consist of three tenured or tenure-track faculty or Senior Lecturers elected to three-year, staggered terms. The Chair of the department shall be the presiding officer at meetings of the Executive Committee. In the absence of the Chair, the Chair shall appoint an executive committee member to preside. The departmental Chair is not a voting member of the committee.

B. Election to the Executive Committee shall be from all those who are nominated from the floor, seconded and agree to stand for election with voting for each position by all members of the faculty by secret ballot. Elections shall be held during the Fall semester, and elected individuals shall commence serving their terms immediately.

C. The Executive Committee shall meet on a regular basis. Regular and special meetings shall be held on dates to be determined by the Chair of the department. A special meeting will be called upon receipt of a petition stating the purpose of the proposed meeting and signed by at least two voting members of the Executive Committee.

D. Minutes of all meetings shall be distributed to the faculty members in the department at the next faculty meeting or electronically via e-mail.

E. A majority (2) of the voting members of the Executive Committee shall constitute a quorum. In cases of split decisions, another meeting will be called.

F. In accord with Article VII, Section 4(d) of the Bylaws of the College of Arts and Sciences, the duties of the Executive Committee shall be to advise and consult with the Chair in Departmental governance including, but not limited to the following:

1) Goals in instruction, research, and service.

2) Policies and procedures.

3) Work loads.

4) Annual budget.

5) Merit raises for faculty.

6) Recruitment of faculty.
7) Committee structure in the department and recommendation of slates of members for standing committees in accordance with departmental bylaws.

Section 3: Departmental Advisory Committee on Promotion and Tenure

The composition and duties of the Departmental Advisory Committee on Promotion and Tenure are described in the departmental P&T Manual (approved by the College P&T Review Board, October 5, 2004). The manual was approved by the faculty after extensive discussions to receive a consensus. Committee duties include but are not limited to:

A. Promotion and/or Tenure processes.

B. Annual review and contract renewal recommendations on non-tenured tenure-track faculty (designated as Contract Renewal Committee by faculty vote).

C. Three-Year and Post-Tenure Review of tenure-track faculty.

D. Graduate Faculty recommendations (designated as Graduate Faculty Committee by faculty vote).

Section 4: Standing Committees

The standing committees of the department are:

A. Curriculum

1) The Curriculum Committee of the Department of Chemistry is elected by the departmental faculty. The departmental Executive Committee will provide a slate of potential candidates to the faculty for consideration which can be modified, etc. by faculty action.

2) The Chair shall serve as an ex officio member.

3) The committee shall annually solicit and organize curriculum changes sought by the faculty in addition, deletion or changes in course offerings.

B. Petitions

1) The Petitions Committee of the Department of Chemistry is elected by the departmental faculty. The departmental Executive Committee will provide a slate of potential candidates to the faculty for consideration which can be modified, etc. by faculty action.
2) The committee shall act as a review board for students to request permission to deviate from standing policy.

3) The committee shall review and make recommendations to the Chair on student petitions, grievances and appeals.

C. M.S. Admissions, Honors and Awards

1) The M.S. Admissions, Honors and Awards Committee of the Department of Chemistry is elected by the departmental faculty. The departmental Executive Committee will provide a slate of potential candidates to the faculty for consideration which can be modified, etc. by faculty action.

2) The committee shall assist the Graduate Director in M.S. admissions.

3) The committee shall review and recommend to faculty on applications for graduation with distinction (B.S.)

4) The committee shall review and recommend faculty awards, Freshman lab awards, and graduate research awards.

D. Advisement Committee

1) The Advisement Committee of the Department of Chemistry is elected by the departmental faculty. The departmental Executive Committee will provide a slate of potential candidates to the faculty for consideration which can be modified, etc. by faculty action.

2) The committee shall assist/advise Nursing, Freshman, and Pre-Med students and undergraduate Chemistry majors in course scheduling and career related matters.

E. New standing committees created by the faculty shall be amended into the bylaws.

ARTICLE IX. AD HOC COMMITTEES

Section 1: Procedures

A. The power to constitute ad hoc committees resides with the Chair in consultation with the Executive Committee. Additionally, a majority of the faculty can ask the Executive Committee to create such a committee.

B. Members will be selected as appropriate to the charge of the committee.

C. The chair of an ad hoc committee will be appointed by the departmental Chair.
D. Such ad hoc committees include applicant screening committees and other committees appointed by the Chair to carry out work that must be completed within a specified timeframe, after which the committee no longer exists.

Section 2: Individual Screening Committees

The department hires tenure-track faculty and lecturers as a committee of the whole. All files are open and available to the faculty. A screening committee is set up to organize the files and provide a preliminary ranking, etc. The faculty can add candidates from the floor (vote required) and rank the candidates for approval of the pool (vote required) and subsequent interviews. After the interviews, the faculty as a committee of the whole rank the candidates and vote to recommend offers.

A. Individual screening committees shall consist of at least three faculty members. The committee is normally set up at the faculty meeting when the search is announced.

B. Screening committees for tenure-track positions shall include tenure-track and tenured faculty.

C. Screening committees for lecturer positions should/may include at least one (1) senior lecturer or lecturer from the department and tenure-track and tenured faculty members.

For visiting lecturers and staff.

A. Search committees for visiting lecturer positions shall include at least two (2) faculty from the program in which the lecturer will be employed and may include faculty from other programs in the department.

B. Search committees for staff positions shall include relevant department members to be determined by the Chair.

C. Chairs of search committees are appointed by the departmental Chair. The chair shall be appointed from the appropriate program area for the search.

In consultation with the departmental Chair and the faculty, the duties and responsibilities of the screening and search committees are the following:

A. To ensure that the position is appropriately publicized.

B. Follow all Affirmative Action procedures and the Arts and Sciences Guidelines on Recruitment of Ethnic and Minority Tenure Track Faculty throughout the search process.
C. Gather, acknowledge and review applicants’ submitted dossiers.

D. Meet as a committee to compare and discuss submitted dossiers.

E. For faculty positions, publicize the interview schedule and solicit feedback about the candidates from faculty when appropriate.

ARTICLE X. GRADUATE FACULTY CRITERIA AND PROCEDURES FOR EVALUATION

The departmental Graduate Faculty Committee has the responsibility to assess and recommend faculty who demonstrate current scholarly competence to the Dean for appointment to Graduate Faculty status. The faculty has designated the departmental Advisory P&T Committee to also serve as the Graduate Faculty Committee. In addition to following the departmental guidelines, College and University policy must be met. Changes to the departmental guidelines must be approved by the Dean’s Office.

Criteria for Selection

In accordance with the College of Arts and Sciences’ Graduate Faculty policy, the Chemistry Department makes recommendations to the Dean for appointment to the Graduate Faculty for tenure-track faculty via recommendations from the departmental Graduate Faculty Committee using the following criteria:

1) An earned doctoral (terminal) degree in the relevant discipline.

2) A strong record of scholarly (refereed) high quality publications and grant support during the last five years.

3) Evidence of effective teaching in graduate courses.

4) Evidence of effective supervision/mentoring of graduate students.

Because of the extensive evaluation during the hiring process, all new tenure-track faculty are automatically appointed to Graduate Faculty status upon hiring. Faculty who hold Graduate Faculty status in the Department of Biology automatically hold that status in the Department of Chemistry and vice versa if they are members of the Center for Biotechnology and Drug Design.

Other faculty (NTT Senior Lecturers, Lecturers, Adjunct Faculty, etc.) whose position and workload allows for involvement in the graduate education program can hold Graduate Faculty status but cannot chair Ph.D. dissertation committees. The chairing of M.S. thesis committees will only be allowed after approval of both the departmental Chair and the departmental Graduate Director. Criteria 1, 2 and 3 above apply except the grant support record in criterion 2 is not required. The graduate status of this group will be reviewed at least every three years.
Procedures

For tenured/tenure-track faculty:

1) All new tenure-track faculty will be appointed to Graduate Faculty status upon hiring. Successful completion of the pre-tenure review will automatically reappoint them to Graduate Faculty status. Newly hired tenured faculty will be appointed to Graduate Faculty status automatically.

2) Tenure-track and tenured faculty members who have Graduate Faculty status will have their status reviewed by the departmental Graduate Faculty Committee, and continuation will be recommended, or denied, as part of the tenure, or post-tenure review process to the Dean. The evidence for “current scholarly competence” beyond that defined in the University policy will be based on the Department of Chemistry’s P&T manual and guidelines regarding Graduate Faculty.

3) Tenure-track and tenured faculty from other departments (except for Biology faculty who have Chemistry Graduate Faculty status as described) may request Graduate Faculty status in Chemistry via a request to the chair at the time of their initial appointment, or at the beginning of Spring Semester. Their continuation in Graduate Faculty status in the Department of Chemistry will also be reviewed at the same time as their tenure, or post-tenure review in their primary department. The evidence for “current scholarly competence” beyond that defined in the University policy will be based on the Department of Chemistry P&T manual and guidelines regarding Graduate Faculty. Graduate Faculty status must be explicitly addressed in the documentation establishing any joint appointments.

4) Tenure-track and tenured faculty members who do not hold Graduate Faculty status may request consideration from the departmental Graduate Faculty Committee at the beginning of Spring Semester each year.

5) Tenured faculty who do not participate in post-tenure review will have their Graduate Faculty status reviewed every five years (or as part of their regular review cycle) by either the Dean’s Office of the College of Arts and Sciences (or the Provost’s Office) using the criteria from the department’s guidelines for Graduate Faculty status.

6) All changes in a faculty member’s Graduate Faculty status must be approved by the Dean’s Office.

For other faculty:

Non-tenure-track and adjunct faculty may be recommended for appointment to Graduate Faculty status by the departmental Graduate Faculty Committee upon nomination by a member of the department’s Graduate Faculty.
1) New NTT faculty and adjunct faculty will be reviewed for faculty status at the time of hire and receive Graduate Faculty status to be in cycle with the rest of the appointments.

2) Other faculty may be nominated for Graduate Faculty status by a member of the Graduate Faculty at the beginning of the Spring Semester each year.

3) Every three years the Graduate Faculty status of other faculty must be reviewed by the departmental Graduate Faculty Committee and the recommendations sent to the Dean.

4) All changes in an “other” faculty member’s Graduate Faculty status must be approved by the Dean’s Office.

Specific Guidelines for Evaluation

For Tenured/Tenure-Track Faculty

The candidate for renewal must submit: (1) an up-to-date resume (C.V.) which lists publications and grant support for the last five years; (2) printouts of (on-line) evaluations for graduate courses taught in the last five years; and (3) evidence of effective supervision/training/mentoring of M.S. and Ph.D. graduate students. The Committee will assess the material to determine if the candidate has demonstrated current scholarly competence based on the criteria in the departmental P&T manual.

For Other Faculty

If nominated by a member of the Graduate Faculty, the candidate must submit: (1) a C.V. that lists publications for the last five years and (2) statements of Teaching Philosophy and evidence of teaching ability/effectiveness. The material will be assessed by the Graduate Faculty Committee to determine current scholarly competence based on the criteria in the departmental P&T manual.

For All Faculty

If the Committee recommends Graduate Faculty status, the name(s) and appropriate materials will be forwarded to the Dean’s Office for approval by the departmental Chair.

Recommendations for removal from Graduate Faculty status must be sent to the Dean’s Office for evaluation. Faculty who have been denied Graduate Faculty status must wait two years to apply for reconsideration.
ARTICLE XI. FACULTY GRIEVANCE PROCEDURES

A. A faculty member who has a grievance regarding an alleged capricious, arbitrary, or discriminatory decision or action shall attempt to resolve the issue informally in a conference with the Chair of the department.

B. Faculty may also consult the faculty ombudsperson and/or the Opportunity Development Office.

C. If the informal conference fails to resolve the issue, the faculty member may initiate a mediation process or a formal written appeal as described in the Faculty Appeals Policy and Procedures of the College of Arts and Sciences.

ARTICLE XII. ADOPTION AND AMENDMENT OF THE BYLAWS

Section 1. Adoption

These bylaws shall become effective using the procedures described in Article III.

Section 2. Amendment

These bylaws may be amended at any regular meeting of the faculty, using the decision-making procedures in Article III, Section 3. Written notice of the proposed change(s) needs to be given to faculty members at least ten (10) working days in advance of the meeting.
## Appendix B-4: Current Faculty Roster
### Chemistry Department
#### Self-Study 2005

<table>
<thead>
<tr>
<th>Faculty names</th>
<th>Current rank</th>
<th>Hiring date</th>
<th>Entry rank</th>
<th>Tenure Status</th>
<th>Full-time Faculty</th>
<th>Part-time Faculty</th>
</tr>
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<tbody>
<tr>
<td>Allison, Stuart A.</td>
<td>Professor</td>
<td>1984</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
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<tr>
<td>Baumstark, A.L.</td>
<td>Professor</td>
<td>1976</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Barrow, Doyle</td>
<td>Lecturer</td>
<td>2003</td>
<td>Visiting Lecturer</td>
<td>NT</td>
<td></td>
<td></td>
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<tr>
<td>Boykin, David W.</td>
<td>Regents’ Professor</td>
<td>1965</td>
<td>Assistant Professor</td>
<td>Emeritus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breyer, Emelita D.</td>
<td>Assistant Professor</td>
<td>1999</td>
<td>Assistant Professor</td>
<td>TT</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Dixon, Dabney W.</td>
<td>Professor</td>
<td>1986</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Franklin, Paul</td>
<td>Senior Lecturer</td>
<td>1995</td>
<td>Visiting Lecturer</td>
<td>NT</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Gadda, Giovanni</td>
<td>Assistant Professor</td>
<td>2000</td>
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<td>TT</td>
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<td></td>
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<tr>
<td>Germann, Markus W.</td>
<td>Associate Professor</td>
<td>2001</td>
<td>Associate Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Grant, Kathryn Betty</td>
<td>Associate Professor</td>
<td>1997</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Huang, Zhen</td>
<td>Associate Professor</td>
<td>2004</td>
<td>Associate Professor</td>
<td>TT</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Kennedy, G. Davon</td>
<td>Associate Professor</td>
<td>1989</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Kibler-Herzog Laura</td>
<td>Senior Lecturer</td>
<td></td>
<td>Visiting Lecturer</td>
<td>NT</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Netzel, Thomas L.</td>
<td>Professor</td>
<td>1989</td>
<td>Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Pascoe, Keith</td>
<td>Senior Lecturer</td>
<td>1997</td>
<td>Visiting Lecturer</td>
<td>NT</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Patonay, Gabor</td>
<td>Professor</td>
<td>1987</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Ray, Gigi</td>
<td>Lecturer</td>
<td>2005</td>
<td>Lecturer</td>
<td>NT</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Shamsi, Shahab</td>
<td>Associate Professor</td>
<td>1998</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Smith, Jerry C.</td>
<td>Associate Professor</td>
<td>1979</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Strekowski, Lucjan</td>
<td>Professor</td>
<td>1984</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Faculty names</td>
<td>Current rank</td>
<td>Hiring date</td>
<td>Entry rank</td>
<td>Tenure Status</td>
<td>Full-time Faculty</td>
<td>Part-time Faculty</td>
</tr>
<tr>
<td>-------------------</td>
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<td>-----------------</td>
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<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Wang, Binghe</td>
<td>Professor, GRA-ES</td>
<td>2003</td>
<td>Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Weber, Irene</td>
<td>Professor</td>
<td>2004</td>
<td>Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Wilson, W. David</td>
<td>Regents' Professor</td>
<td>1970</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Yang, Jenny J.</td>
<td>Associate Professor</td>
<td>1996</td>
<td>Assistant Professor</td>
<td>T</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
The report for the Center of Biotechnology and Drug Design will be appended to the end of this document when received / completed.
## Chemistry Ph.D.'s Awarded by Fiscal Year

### Chemistry Department

**Self Study 2005**

**Appendix B-6**

<table>
<thead>
<tr>
<th>Year</th>
<th>Awarded By Fiscal Year</th>
<th>Chemistry Ph.D.'s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td></td>
<td>Dr. Shaikh Rahman</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Hui Mao</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Robert Pullen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Maryam Hojjat</td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td>Dr. L. Ratmeyer-Fleming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Steve Patterson</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td>Dr. Ted Rigl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Richard Williams</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. David Hamilton</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Elba Michelena-Baez</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Varsha Vaishnav</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Maryam Daneshvar</td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td>Dr. Kishia Towns</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td>Dr. Lawrence Evans</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Tim Baranowski</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Derrick Bennett</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td>Dr. Iris Francesconi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Katherine Hopkins</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Alesia Parker</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Mark Cunningham</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Leila Tarazi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Menno Baars</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. S. Edwards-Bennett</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Ge Xiao</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Anand Swamy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Hyeran Lee</td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td>Dr. Maged Henary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Lei Wang</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Donald Hamelberg</td>
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<tr>
<td></td>
<td></td>
<td>Dr. Hsin-Hung Chen</td>
</tr>
<tr>
<td>2002</td>
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<td>Dr. Christian Mason</td>
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<tr>
<td>2003</td>
<td></td>
<td>Dr. Martial Say</td>
</tr>
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<td></td>
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<td>Dr. Yiming Ye</td>
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<td>Dr. Eilyn Lacy</td>
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<td></td>
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<td>Dr. Binh Nguyen</td>
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<tr>
<td></td>
<td></td>
<td>Dr. Wei Yang (Biology)</td>
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<tr>
<td>2004</td>
<td></td>
<td>Dr. P. Leggett-Robinson</td>
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<tr>
<td>2005</td>
<td></td>
<td>Dr. Nichole Powell</td>
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<tr>
<td></td>
<td></td>
<td>Dr. Ruel McKnight</td>
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<td></td>
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<td>Dr. Jianguo Zhang</td>
</tr>
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<td></td>
<td></td>
<td>Dr. Reem Arafa</td>
</tr>
<tr>
<td>2006 (+projected)</td>
<td></td>
<td>Dr. Alfred Eiser (Geochem.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr. Ekaterina Paliakov</td>
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<td></td>
<td></td>
<td>Dr. Rucks Winkeljohn</td>
</tr>
<tr>
<td>2006 (+projected)</td>
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<td>Dr. Anna Wilkins Maniccia</td>
</tr>
<tr>
<td></td>
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<td>Dr. Brian Crow</td>
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<tr>
<td></td>
<td></td>
<td>Fan Fan (Biology)</td>
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<td></td>
<td></td>
<td>+April Ellis</td>
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<tr>
<td></td>
<td></td>
<td>+Lisa Jones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+Hsiau-Wei Lee</td>
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<td></td>
<td></td>
<td>+Beth White</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+Tanya Myers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+Jie Zheng</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+Mahmoud Ghanem</td>
</tr>
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<td></td>
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<td>+Beth Wilson</td>
</tr>
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</table>
Appendix B-7
Chemistry M.S. Degrees Awarded by Fiscal Year
Chemistry Department
Self Study 2005

1995
Carolyn Pressley
Maria Roberson
Monica Williams
Katherine Hopkins
Jipu Lu
Jung So
M. Giambruno (MAT)

1996
Ann McCartney
Barbara Adam
Wyatt Morgan
Hong Zou
Yiyi Zhong
Dawn Benton
Roberta Howes
Vinci Brooks
Guangmin Pu
Jamie Hsu
Suzann Mazur

1997
Vickie Dobbs
Hsin-Hung Chen
Kai Zhu
Patricia Poor
Madhulika Chaudhary
Tatjana Sklyarevskaya
Shang Song
Martial Say
Thomas Shank
Allyson McFry
Vipul Patel
Bobbi Thorn
Angie Davis

1998
Zhihong Ye
Kari Fowler
Yi Wang

1999
Min Zhai
Binh Nguyen
Nidhi Loomba
Munok Kwang
Jigna Patel
Brian Cartwright
Phalasy Juieng
Denise Mitchell
James Davis
Anna Wilkins
Sonia Singh

2000
Doowon Lee

2001
Victor DeJesus
D. Hamelberg
O. Yepifantseva
Zhijun Kang
Paige Echols
Kelli Jones
Myra Rhaney
Liqin Zhang
Peter Kuklenyik
M. McManus
Juan Turner
Li-Yan Wang
Andrea Neil
S. Vermont
Qi Zhou
M. Josephic
M. Mulkeen

2002
J. Hoffman
Charles Maina
Lucrestha Swain
Amy Carroll
Selvin Edwards
Miki Kassai
Hsiau-Wei Lee

2003
Quentin Nelson
Ying Zhou
Tim Laeger
Peter Nguyen
Bethany Russell
Liz Wilkins
Reginald Lewis
Yubonca Carter
John Szwec
Samuel Fongang
Sheela Logan
Malav Shah
Chuanying Chen
Katina Johnson
Deep Laxmi
Jason Hamilton
Sarah Shealy

2004
Neeta Raje
Dean Norton
Jennifer Marshall
Hetal Patel
Brian Crow
Rucks Winkeljohn
Vashona Dailey
Roy Luo
K. Runsrisuriyachai

2005
Mayra Colombani
Gayatri Desai

Subrata Mishra
Diem-Ngoc Nguyen
Cardra Nixon
Kerry Norton
Alpa Patel
Darshakkumar Patel
Amy Watson
Beth Wilson
Rashid Iqbal
Jason Ponders
C. Boonyakong
Ning Chen
Nebiyou Desalegn

2006 (+Projected for Spring)
Deana Cannon
Clarissa Fields
Phong Truong
Abdur Shareef
+Syed Rizvi
+Hend Mohamed
+Gurpreet Kaur
+Lisa Jones
Chart B-1
Chemistry Department
Self-Study 2005

Chemistry Department
External Grants Support
FY 2001- FY 2005

Fiscal Year

External Grants Support

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>$2,417,013</td>
</tr>
<tr>
<td>2002</td>
<td>$2,887,619</td>
</tr>
<tr>
<td>2003</td>
<td>$3,143,679</td>
</tr>
<tr>
<td>2004</td>
<td>$4,439,307</td>
</tr>
<tr>
<td>2005</td>
<td>$5,260,698</td>
</tr>
</tbody>
</table>

[Bar chart showing the external grants support from FY 2001 to FY 2005]
Chart B-2
Chemistry Department
Self-Study 2005

Chemistry Department Credit Hours 2001-2005

No. of Credit Hours

Years

2001 2002 2003 2004 2005

12,570 13,479 16,683 18,723 20,080

Section B
Chemistry Ugrad Majors
FY 2001- FY 2005

No. Of Ugrad Chem Majors

2001: 132
2002: 151
2003: 189
2004: 217
2005: 261

Fiscal Year

Chart B-3
Chemistry Department
Self-Study 2005
Chart B-5
Chemistry Department
Self-Study 2005

B.S. Degrees Awarded in Chemistry

*2006 includes ~20 projected graduates for Fall and Spring
M.S. Degrees Awarded in Chemistry

*2006 includes ~6 projected graduates for Spring
Ph.D. Degrees Awarded in Chemistry

*2006 includes ~9 projected graduates for Fall and Spring
Graduate Student Support

Chart B-8
Chemistry Department
Self-Study 2005

Graduate Student Support

- RPE
- Projects
- Instruction
- Research/Centers/etc.
- MBD/BB
Chemistry Department Credit Hours by Fiscal Year

*University switched from quarters to semesters in 1998-1999
Appendix C-1
The Strategic Plan and Goals at the Beginning of the
Last Self Study Period

NOTE: All of the following is from the previous Chemistry Department Self Study
Report that was completed in 1997.

From the last self study document: We wish to continue our systematic development
as a first class, internationally-recognized Department with adequate faculty, staff, GLA
positions and operating funds. The development plan described below will allow us to
continue in a leadership role in the University's drive to move from Doctoral I
classification to a Carnegie Class II Research Institution. Our plan is to build on the
strengths of the Department through development of our biochemistry/medicinal and
analytical/environmental areas. A plan with specific recommendations regarding
faculty, staff, students and Departmental operations is described below:

Specific goals:
I. Faculty
  * Continue our strong programs in biophysical and organic/medicinal chemistry.
  * Expand and strengthen the program of application of chemistry to
    biologically/medically related problems;
  * Build on our analytical program to establish an internationally recognized unit in
    Bioanalytical / environmental applications of chemistry;
  * Establish a specific faculty group to develop and publish innovative methods and
    approaches to teaching chemistry and enhance our established program to
    upgrade those teaching chemistry at four-year colleges.

To accomplish the steps required to reach these goals, it is essential that the Chemistry
Department redirect the current composition of its faculty as well as add additional
faculty. The proposed faculty development plan for the next five years is shown in

Table I. This provides a systematic approach for strengthening our very successful
work in biological/medicinal and biophysical applications of chemistry and for building
an equally successful program in the analytical/environmental area.

Table I: Proposed changes in composition of the
Chemistry Department Faculty over the next five years:*
The plan for faculty reorganization in the Chemistry Department over the next five years represents a significant redirection with a significant decrease in the overall percentage of faculty in physical chemistry and elimination of the inorganic division. The significant increase in number of faculty in the biochemical and analytical/environmental divisions reflects enrollment trends and Departmental emphasis in those areas as well as our commitment to interdisciplinary research and training. The core emphasis area consists of faculty who are strongly involved in teaching at the introductory level. Such faculty are essential if the quality of our project-oriented laboratory program is to be maintained as our credit hours grow. The increase in total faculty from 18 (currently 16 tenure track and 2 non-tenured track positions) to 24 is based on use of the Regents' formula with current enrollment figures as well as on predictions of enrollment growth based on trends over the last five year period. It should be emphasized that at least 24 faculty are needed just to teach our courses. A major grant requires at least as much time as teaching a graduate or undergraduate course, and it is essential that the University begin to include research productivity in its formula for allocation of faculty positions and other budget resources.

II. Graduate Students

* Establish twenty University-funded GLA positions in the Chemistry Department.

In addition to the proposed increase in new faculty, it is essential to establish a base of University-funded graduate laboratory assistantship (GLA) positions in the Chemistry Department. This level of support is essential because grant funds cannot be used for first year graduate students who are primarily taking courses. In addition, grant support fluctuates and it is essential to have a financial buffer so that vigorous efforts to recruit and retain outstanding students can be organized. We now have only three continuing GLA positions and they are funded through the Laboratory for Molecular and Biochemical Sciences (LMBS). We propose to add four continuing positions the first two years (1996-1997) and three positions per year for the next three years to give a total of twenty University funded GLAs. Chemistry departments at neighboring Carnegie Research II institutions such as Auburn University and the University of South Carolina have in the neighborhood of fifty University supported graduate assistantships (49 chemistry laboratory assistantships at Auburn and 27 teaching assistantships and 26 research assistantships at USC; a list of the Carnegie Research II and Doctoral I institutions in the Southeast is in Appendix 8). The ability of the Chemistry Department to continue to compete for excellent students in spite of the low level of GLA continuing positions is another example of the strong reputation of the Department. To reach Carnegie Research II status, however, it is essential to establish the minimum twenty GLA positions as rapidly as possible. It must be emphasized that a strong show of support for graduate students is crucial for continued development of the research
program in the Chemistry Department. Our present level of University continuing support is not competitive with chemistry departments at Carnegie Research II Institutions.

III. Staff

* Add four staff positions

Expanding enrollments, instrumentation provided through support from the Georgia Research Alliance, projected increases in the number of faculty, and the opening of chemistry teaching and research laboratories in the Natural Science Center have strained our current staff past a reasonable limit. It is essential to establish the following four new staff positions to ensure the efficient operation of the Department:

a) A research coordinator/grants preparation staff member is currently supported at the 50% level from grant funds and 50% from University funds and this position must be converted completely to University funds at the end of the grant period since NIH is no longer funding this type of staff support. This position is essential if the Chemistry Department is to maintain and expand on its current level of grant funding, an essential feature for attaining Carnegie Research II status for the University;

b) A computer staff member in the Chemistry Department is currently supported entirely by grant funds (the Glactone Project) and this position should be funded by the University when the grant ends in 1998;

c) An instrumentation specialist is needed because of the expansion in the number of instruments and sophistication of instrumentation in the Chemistry Department through Federal and Georgia Research Alliance funds (it is possible that this position could be shared with the Biology Department);

d) A secretary/receptionist is needed since higher enrollment has resulted in a proportional increase in the numbers of students visiting the Chemistry main office and the demand for course materials, etc.

IV. Operation and Infrastructure

* Increase the Departmental supply budget

* Add infrastructure support

In fiscal years 1994-6 the Chemistry Department has added more than $2.5 million in equipment from Georgia Research Alliance supported projects. Equipment from other grant funds raise this to near the $3 million level, and there is currently no University support to maintain this equipment, most of which is or soon will be out of the warranty period. A floor of University support for this research equipment is essential if optimum use of Georgia Research Alliance funds is to be ensured.
In addition, as the credit hours of the Department have undergone large increases (Appendix 8), the Departmental operating budget has been effectively reduced (from $9.65/weighted credit hour in 1991-2 to $7.82/weighted credit hour in 1995-6). Such a reduction is counter-productive for the University and a detriment to one of its most productive and rapidly growing departments. Basic programs that are essential for the learning environment, such as seminars and course development, have been drastically curtailed, and this trend must be quickly reversed if the Department is not to be permanently damaged. A significant increase in state funding for Departmental operations is necessary if the Department is to enhance its international reputation and continue to be a leader in the University's commitment to achieve Carnegie Research II status.

D.4 Space and Facilities

The Chemistry Department recently had a significant increase in research and teaching laboratory space with the opening of the NSC. The new space, however, is not sufficient for all of the Chemistry research and teaching activities, and laboratories in Kell Hall and the Science Annex must be maintained. The space in Kell Hall is badly in need of renovation and this should be a high priority on the University Development Plan.

D.5 Library

The library has a satisfactory collection of Chemistry Journals. The availability of inter-library loan and on-line journals means that teaching and research are not generally limited by the library holdings. Databases provide an enormous benefit to the research program.
Appendix D-1
Learning Outcome Statements and Assessments Plans
Chemistry Department, Self Study 2005

Assessment for Chemistry

The California Chemistry Diagnostic Test was given in each of the area D courses on the first day of class and repeated on the last day of class for each course. The overall score gives the department a guide into how well students are prepared for our courses and how they compare to incoming college students nationally. Four questions were selected from the total of forty-four which will assess critical thinking for these courses. The following data were collected in Summer 2004.

Chemistry 1152 (second semester Survey of Chemistry)

<table>
<thead>
<tr>
<th></th>
<th>Entry Score</th>
<th>Exit Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Average</td>
<td>19.76 (out of 44)</td>
<td>24.10</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>1.24 (out of 4)</td>
<td>1.53</td>
</tr>
</tbody>
</table>

Chemistry 1211 (first semester General Chemistry for Majors)

<table>
<thead>
<tr>
<th></th>
<th>Entry Score</th>
<th>Exit Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Average</td>
<td>16.25</td>
<td>28.55</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>1.19</td>
<td>1.83</td>
</tr>
</tbody>
</table>

Chemistry 1212 (second semester General Chemistry for Majors)

<table>
<thead>
<tr>
<th></th>
<th>Entry Score</th>
<th>Exit Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Average</td>
<td>24.8</td>
<td>31.73</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>1.72</td>
<td>2.31</td>
</tr>
</tbody>
</table>

This data shows an increase in performance for the selected critical thinking questions in each course. The initial critical thinking scores are also consistent with background of the particular student group. If one examines the chemistry 1152 entry score, we see
that the score is similar to the entry scores for chemistry 1211, the first chemistry course for science majors since high school. The 1152 students have just completed chemistry 1151 which is similar in many ways to high school chemistry.

Critical Thinking Assessment for Chemistry

The American Chemical Society provides national-level exit exams for all of the area D courses within the chemistry program. A representative faculty committee was formed and decided on a set of critical thinking questions from each of these exit exams. All students should be able to meet the expected score for each area D course of 2 correct out of the questions selected (the critical thinking “bar.” We found that more than 90% of our students do meet the expected standard in every course. The average number correct in all courses is 4.2, indicating that most of our students exceed the minimum level of critical thinking expected. Data for three semesters are appended.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Description</th>
<th>Number of Students</th>
<th>Number of questions</th>
<th>Average # Correct</th>
<th>Critical Thinking “Bar”</th>
<th>% Over “Bar”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2004</td>
<td>1151</td>
<td>first semester Survey of Chemistry</td>
<td>75</td>
<td>7</td>
<td>2.8</td>
<td>2</td>
<td>98.7</td>
</tr>
<tr>
<td>Fall 2004</td>
<td>1211</td>
<td>first semester General Chemistry for Majors</td>
<td>125</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>95.2</td>
</tr>
<tr>
<td>Fall 2004</td>
<td>1212</td>
<td>second semester General Chemistry for Majors</td>
<td>120</td>
<td>8</td>
<td>3.3</td>
<td>2</td>
<td>97.5</td>
</tr>
<tr>
<td>Spring 2005</td>
<td>1151</td>
<td>first semester Survey of Chemistry</td>
<td>75</td>
<td>7</td>
<td>4.4</td>
<td>2</td>
<td>98.5</td>
</tr>
<tr>
<td>Spring 2005</td>
<td>1152</td>
<td>second semester Survey of Chemistry</td>
<td>65</td>
<td>7</td>
<td>3.4</td>
<td>2</td>
<td>95.4</td>
</tr>
<tr>
<td>Spring 2005</td>
<td>1211</td>
<td>first semester General Chemistry for Majors</td>
<td>125</td>
<td>8</td>
<td>5.1</td>
<td>2</td>
<td>94.4</td>
</tr>
<tr>
<td>Spring 2005</td>
<td>1212</td>
<td>second semester General Chemistry for Majors</td>
<td>99</td>
<td>8</td>
<td>3.9</td>
<td>2</td>
<td>91.9</td>
</tr>
<tr>
<td>Summer 2005</td>
<td>1152</td>
<td>second semester Survey of Chemistry</td>
<td>44</td>
<td>7</td>
<td>4.8</td>
<td>2</td>
<td>93.2</td>
</tr>
<tr>
<td>Summer 2005</td>
<td>1211</td>
<td>first semester General Chemistry for Majors</td>
<td>89</td>
<td>8</td>
<td>5.4</td>
<td>2</td>
<td>96.6</td>
</tr>
<tr>
<td>Summer 2005</td>
<td>1212</td>
<td>second semester General Chemistry for Majors</td>
<td>67</td>
<td>8</td>
<td>5.1</td>
<td>2</td>
<td>94.0</td>
</tr>
</tbody>
</table>
Skills Assessment

<table>
<thead>
<tr>
<th>I</th>
<th>Analytical skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students learn to collect data</td>
</tr>
<tr>
<td></td>
<td>a. Hands-on experience with lab techniques</td>
</tr>
<tr>
<td></td>
<td>b. Theory of lab techniques</td>
</tr>
<tr>
<td>2.</td>
<td>Students learn computer skills</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II</th>
<th>Critical thinking skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students learn how to develop research questions and formulate hypotheses</td>
</tr>
<tr>
<td>2.</td>
<td>Students learn how to analyze and interpret data</td>
</tr>
<tr>
<td>3.</td>
<td>Students learn how to use results of experiments to formulate new research questions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>III</th>
<th>Communication skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students develop oral communication skills</td>
</tr>
<tr>
<td>2.</td>
<td>Students develop written communication skills</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>IV</th>
<th>Collaborative/group skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students develop skills in working on collaborative projects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>V</th>
<th>Acquisition of knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students learn [specific facts]</td>
</tr>
<tr>
<td>2.</td>
<td>Students learn [concepts]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VI</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students acquire professional standards in discipline</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VII</th>
<th>Advancement of knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students learn to apply learned knowledge in a logical manner to solve original problems</td>
</tr>
<tr>
<td>2.</td>
<td>Ability to formulate lab procedures and test chemical hypotheses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemistry Elective Courses</th>
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<tbody>
<tr>
<td>4015</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>I</td>
</tr>
<tr>
<td>----</td>
</tr>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>II</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>III</td>
</tr>
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<td></td>
</tr>
<tr>
<td>IV</td>
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<tr>
<td></td>
</tr>
<tr>
<td>V</td>
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<tr>
<td></td>
</tr>
<tr>
<td>VI</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>VII</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Chemistry Writing Intensive Courses</td>
</tr>
<tr>
<td>------------------------------------</td>
</tr>
<tr>
<td>CHEM 4000 Fundaments of Chemical Analysis</td>
</tr>
<tr>
<td>CHEM 4010 INST Methods I: Chromatography</td>
</tr>
<tr>
<td>CHEM 4160 Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 4170 Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 4190 INSTR Methods III: Spectroscopy</td>
</tr>
<tr>
<td>CHEM 4330 Advanced Synthesis</td>
</tr>
<tr>
<td>Chem 4410 Bioorganic II</td>
</tr>
<tr>
<td>CHEM 4870 Honors Thesis</td>
</tr>
<tr>
<td>CHEM 4950 Chemical Research</td>
</tr>
</tbody>
</table>
Chemistry 4000/6000 Fundamentals of Chemical Analysis  
Georgia State University, Summer Semester 2005

Lecture: Mondays and Wednesdays 10:55 to 12:40 in GCB 323

Instructor: Dr. Doyle Barrow, 519 Science Annex 404 463-9890, chedjb@langate.gsu.edu

Office Hours: Mondays and Wednesdays 2:00 to 3:30 pm. Appointments may also be granted.

Laboratory Instructors: Dr. David Hamilton, 519-A SA, 404-651-3911, cheddh@panther.gsu.edu, Ms. Anilla Gill

Prerequisites: Chem 3410 (Organic Chemistry II) and Math 2212 (Calculus of One Variable II) or equivalent course work and consent of instructor.

Hours: Two lecture and four laboratory hours a week.

Attendance: Punctual attendance for each and every class and laboratory period is expected.

Objective: Chemical equilibria of acid-base systems, metal ion complexes and solubility, and their relationship to chemical analysis; use of manual and semiautomatic methods of data collection.

Assignments and requirements: There will be seven weekly homework assignments. Assignments are due at the beginning of the following Monday class period. Late homework will be penalized 5% per day. If you do not do the homework it is doubtful you will be able to pass the exams. Written midterm and final exams are compulsory. Exams are closed book and closed notes. During exams you will be allowed to have only a pencil, calculator and any other material handed out by the instructor at the start of an exam.

Grading policy:
Percent of course grade:  
Homework 10% (each will have similar weight)  
Midterm Exam 20%  
Final Exam 30%  
Laboratory 40%

Course grades will be assigned by the following scheme: 100%-90% = A, 89%-80% = B, 79%-70% = C, 69%-60% = D, < 60% = F.

Additional materials in the form of handouts will be provided to the student during the course. A calculator is required.

**Make-Up Examination Policy:** Make-up exams will be scheduled by agreement between the student and instructor.

**Policy on Academic Honesty:** The following are from the University's Policy on Academic Honesty and will be adhered to. “As members of the academic community, students are expected to recognize and uphold standards of intellectual and academic integrity. The university assumes as a basic and minimum standard of conduct in academic matters that students be honest and that they submit for credit only the products of their own efforts. Both the ideals of scholarship and the need for fairness require that all dishonest work be rejected as a basis for academic credit. They also require that students refrain from any and all forms of dishonorable or unethical conduct related to their academic work. ... Plagiarism is presenting another person's work as one's own. Plagiarism includes any paraphrasing or summarizing of the works of another person without acknowledgment, including the submitting of another student's work as one's own.” Dishonest work, including plagiarism, will not be tolerated and will be grounds for rejection of submitted work for academic credit. The University's Policy on Academic Honesty is published in the On Campus: The Undergraduate Co-Curricular Affairs Handbook and is available to all members of the university community. The Policy on Academic Honesty may also be found on the web at: http://www.gsu.edu/%7Ewwwfhb/sec400.html#409

**Tentative Schedule:**

Material for lecture in Times New Roman

Material for lab in Arial.

<table>
<thead>
<tr>
<th>Dates</th>
<th>Topic</th>
<th>Homework Due on Mondays</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 13, 15</td>
<td>Chapter 3 <em>Error</em> and Chapter 4 <em>Statistics</em></td>
<td></td>
</tr>
<tr>
<td>June 14-17</td>
<td>You should know Chapters 1-3 for the lab. There may be a lab quiz on these chapters at the beginning of the third lab period</td>
<td>Problem set 1</td>
</tr>
<tr>
<td>June 20, 22</td>
<td>Chapter 4 <em>Statistics</em> and Chapter 5 <em>Calibration Methods</em></td>
<td></td>
</tr>
<tr>
<td>June 27, 29</td>
<td>Chapters 6-9 <em>Chemical Equilibria</em></td>
<td>Problem set 2</td>
</tr>
<tr>
<td></td>
<td>Chapters 7 and 12 for the lab.</td>
<td></td>
</tr>
<tr>
<td><strong>July 4</strong></td>
<td>Independence Day Holiday, University Closed, No Classes</td>
<td></td>
</tr>
<tr>
<td><strong>July 6</strong></td>
<td>Mid Term Exam 323 GCB 10:55</td>
<td>Problem set 3</td>
</tr>
<tr>
<td><strong>July 8</strong></td>
<td><em>MIDPOINT</em> for 7-week session. Last day to withdraw and possibly receive a W*</td>
<td></td>
</tr>
<tr>
<td>July 11, 13</td>
<td>Chapters 10-12 <em>Acid - Base Equilibria</em></td>
<td>Problem set 4</td>
</tr>
<tr>
<td>July 18, 20</td>
<td>Chapters 10-12 <em>Acid - Base Equilibria</em></td>
<td>Problem set 5</td>
</tr>
<tr>
<td>July 25, 27</td>
<td>Chapter 13 <em>EDTA Titrations</em></td>
<td>Problem set 6</td>
</tr>
<tr>
<td></td>
<td>Chapters 7 and 13 for the lab</td>
<td></td>
</tr>
<tr>
<td>August 1</td>
<td>Chapter 17 <em>Gravimetric and Combustion Analysis</em></td>
<td>Problem set 7</td>
</tr>
<tr>
<td><strong>August 3</strong></td>
<td>Final Exam 323 GCB Kell Hall 10:15 duration is 2 hours</td>
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</tbody>
</table>

*The course syllabus provides a general plan for the course; deviations may be necessary*
Important Due Dates

Paper 1 Due June 20 for MW labs, June 21 for T, Th labs

Paper 2 Due July 8 For all labs

Paper 3 Due July 25 for M,W labs, July 27 for T, Th labs

July 8 is the last day to resubmit report 1

July 25 is the last day to resubmit report 2

Note: If you would like the opportunity to resubmit report 3 then you should turn this report in no later than July 20
Chemistry 4010/6010  
Chromatography Fall 2005  
S 328, 5:30-6:20 P.M. (T, Th)  
Instructor: Shahab A. Shamsi, Room 573 Natural Science Center (NSC)  
Phone (404)651-1297; e-mail address: chesas@panther.gsu.edu  
Tuesday and Thursday 6:30-7:30 (immediately after the class),  
or TBA by appointment  

Reference text and resources: (1) “Chromatographic Methods” written by A. Braithwaite and F. J. Smith (available in the GSU bookstore); (2) Lecture notes (available in library reserve); Lab manual  

Course Objective:  
*To learn basic principles governing separation techniques  
*To learn fundamentals of chromatographic techniques  
*To develop basic skills in operating chromatographic instruments  
*To improve skills in observation, keeping records, and interpreting data  
*To learn to apply basic principles in order to develop a chromatographic method to achieve a particular separation/analysis of compounds or mixtures of compounds  

Tentative Lecture Content: (This schedule is a general guide and may be modified as needed)  

<table>
<thead>
<tr>
<th>Topic 1- The Basics of Separations/Theories of Chromatography (Total 6 lectures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
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<tr>
<td>Aug 23-25</td>
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<tr>
<td>Aug 30-Sep1</td>
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<tr>
<td>Sep 6-8</td>
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</table>

Exam 1: Tuesday Sep 13, 5:30 P.M. (100 pts)  

<table>
<thead>
<tr>
<th>Topic 2- Qualitative and Quantitative analysis in chromatography (Total 3 lectures)</th>
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</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Sep 13-15</td>
</tr>
</tbody>
</table>
**Lecture Notes**

**Sep 20-22**
Chapter 2  
Quantification-External Standard, Internal Standard  
Standard Addition Method  
Effect of Temperature in Gas Chromatography

**Topic 3-**  
**Gas Chromatography (GC)**  
(Total 5 lectures)

**Date**
Sep 27-29
Oct 4-6
Oct 11-13

**Reading**
Chapter 5
Chapter 5
Chapter 5

**Sub-Topic**
Principles and Instrumental Aspects in GC  
Carrier Gas, Injection Modes in GC  
Choice of Stationary Phases (Packed and Open Tubular Columns), Detector Specifications and Properties  
Major Types of GC Detectors

**Exam 2:**  
Tuesday Oct 18, 5:30 P.M. (100 pts)

**Topic 4-**  
**Thin Layer Chromatography (TLC)**  
(Total 1 lecture)

**Date**
Oct 20

**Reading**
Chapter 3/Lecture Notes

**Sub-Topic**
Principle, Working and Advantages of TLC  
Two-dimensional TLC

**Topic 5-**  
**High Performance Liquid Chromatography (HPLC)**  
(Total 5 lectures)

**Date**
Oct 25-27
Nov 1-3
Nov 8-10

**Reading**
Chapter 6/Lecture Notes
Chapter 6/Lecture Notes
Chapter 6/Lecture Notes

**Sub-Topic**
Instrumental Aspects in HPLC  
Pumps, Injectors, Columns  
HPLC Detectors

**Exam 3:**  
Tuesday November 15, 5:30 P.M. (100 pts)

**Topic 6-**  
**Methods in HPLC**  
(Total 5 lectures)

**Date**
Nov 17
Nov 29
Dec 1
Dec 6

**Reading**
Chapter 6/Lecture Notes
Chapter 6/Lecture Notes
Chapter 6/Lecture Notes
Chapter 6/Lecture Notes

**Sub-Topic**
Normal Phase HPLC  
Reversed-Phase HPLC  
Gel Permeation Chromatography  
Ion Exchange Chromatography  
Ion-Chromatography with Conductivity Detection  
Ion-Chromatography with Indirect UV-Detection

**Topic 7-**  
**Analysis of Real Samples in Chromatography and Review**  
(Total 2 lectures)
Final Exam: Tuesday December 13, 5:00 P.M.

*Homework Problems:
Assigned problems will also be given during the course of the semester. These will not be graded nor turned in. It will be up to the students to complete these homework assignments. However, it should be noted that the some of questions appearing on exams will be based on questions taken from homework.

GRADING CRITERIA

<table>
<thead>
<tr>
<th>UNDERGRADUATE (4010)</th>
<th>*GRADUATE (6010)</th>
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<tbody>
<tr>
<td>Lab reports 40%</td>
<td>Lab reports 30%</td>
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<tr>
<td>Short exams 30% (100, 100, 100) points</td>
<td>Short exams 30%</td>
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<tr>
<td>*Final exam 28%</td>
<td>*Final exam 30%</td>
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<tr>
<td>Pop Quizzes 2%</td>
<td>Literature report 8%</td>
</tr>
<tr>
<td></td>
<td>Pop Quizzes 2%</td>
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</tbody>
</table>

*Final exam will be 50% comprehensive and will cover 50% of the material after Exam III

*Extra assignments will be given to graduate students

* There will be extra questions in both short and final exams for graduate student

*Student can take at least two final exams within 24 hours. However, if a student has more than two exams please let me know in writing at least 14 days before the final to reschedule.

GRADING SCALE: The grading scale may be curved, but the most probable breakdown will be:

85-100 A
70-84 B
60-69 C
50-59 D
below 49 F

PLEASE READ THE IMPORTANT POLICIES AND PROCEDURES:
1. No makeup exams will be given (unless the situation is such that the whole class did poorly in the exam).

2. If a student misses one exam without a legitimate excuse, s(he) will receive a grade zero for that exam.
3. If a student misses one exam with a legitimate excuse, s(he) can either choose to receive a grade of zero for that exam or apply the grade of the following exam to the missed exam.

*Legitimate reasons for excuse are the following:

<table>
<thead>
<tr>
<th>Cause</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due to illness</td>
<td>illness note from the doctor</td>
</tr>
<tr>
<td>Due to business</td>
<td>business note from the supervisor</td>
</tr>
<tr>
<td>Death in family</td>
<td>note of death from a family member</td>
</tr>
<tr>
<td>Other</td>
<td>On a case by case basis</td>
</tr>
</tbody>
</table>

* I must be informed **before the exam** to count as an excused absence. If you cannot reach me, leave a message on my answering machine at my office (indicate the time and the day), or notify the departmental receptionist (Indicate the time and the day).

Please note that notifying me after the exam will result in a grade of zero for that exam.

4. Although I do not expect cheating in my classroom, the penalty is an F for the course. Plagiarism is also considered cheating, therefore, copying large sections of another author’s material without paraphrasing and referencing it will result in grade F.

5. Attendance will be taken regularly. I strongly urge you to attend class. Otherwise you may miss the pop quizzes and lecture part (that may not be there in your textbook).

6. Although I will try to maintain the class schedule and objectives, I may need to make adjustments.

**Course Withdrawal Date**

The last day to withdraw from the course and possibly receive a “W” is **October 14 (Friday)**

**Professional Behavior Guidelines:**

1. **Tardiness:** Please arrive on time. If you are late please enter the class without disturbing your class mates and my concentration.

2. **Side Conversation:** Side conversations make it difficult for your class mates to actively listen and learn. If you have trouble reading the board please ask me without any hesitation.

3. **Sleeping:** Falling asleep in class (unless the course focuses on dysfunctional sleep behaviors) is not considered professional attitude.
4. **Lack of attention/Boredom:** Please do not read other books or newspapers or study for other courses during my class. It is not polite. If the material that you are taught is familiar to you please write down some specific questions in your notebook and discuss with me about the advances in this topic *only after the class*.

5. If you cannot see me during my office hours please send me an e-mail (chesas@langate.gsu.edu) for help any day.

6. You may audio tape my lectures.
Fall Semester 2005

Chemistry 4190/6190 Spectroscopy Syllabus

Instructors: Dr. Stuart Allison, Lecture and Laboratory; Dr. Thomas L. Netzel, Laboratory
Offices: 520A SC-Annex (SA), 515 SC-Annex (TLN)
Phones: 404-651-1986 (SA), 404-651-3129 (TLN)
Emails: chesaa@panther.gsu.edu (SA), tnetzel@gsu.edu
Faxes: 404-651-1416 (SA), 404-651-3129 (TLN)
Office hours: 4:30-5:20 on M & W (SA), 4:30-5:20 on Tu & Th (TLN)
Also, please phone or email for an appointment.

Lecture Times and Location:
MW 5:30-6:20, Rm. 216 Arts and Humanities

Laboratory Times and Location:
M 6:30-9:30, Room 698 Kell Hall
Th 12:00-2:45, Room 698 Kell Hall
A pre-lab lecture (30 min.) will begin promptly at 6:30 or 12:00*

Authors: Douglas Skoog and James Leary
Publisher: Harcourt Brace Javonovich College Publisher
Phone: 1-800-782-4479

Course Prerequisites: Chem 4000/6000 and Chem 4120/6120 or their equivalents.
[Note: It is absolutely necessary to satisfy the course prerequisites!]

*Attendance Policy at Laboratory: If you miss a prelab lecture without obtaining prior permission, you could lose 10% of your lab report grade and perhaps not be allowed to work in the lab that day.

Supply Card for Consumables: You are required to purchase a Green Supply Card ($30), which covers the costs of consumable laboratory supplies, at the GSU bookstore prior to the second laboratory period. Students are responsible for replacing lost cards. Receipts will not be accepted in lieu of lost cards. Note that if you do not present the appropriate type of Supply Card by the time of the second laboratory period, you will still be permitted to check-in and work in the laboratory. However, a charge for the amount of the Supply Card will be added to your breakage account in the Chemistry Department. According to the usual procedures at GSU, you have to pay all of your breakage account charges at the end of the semester to receive your grades and transcripts from the university.

Laboratory Notebooks:
A bound (not a spiral binding) notebook is required for each laboratory session. If
you forget it, you will have to buy another from the bookstore before you can attend a laboratory session. Include in the notebook all of your own and your groups data. If someone else in your group prepared the sample, ran the spectrum, or made the measurement, simply state this fact by the corresponding entry. In your notebook include all spectra (or copies of them) that you include, discuss, or report as results in your laboratory reports.

You must turn in a complete laboratory notebook with your final laboratory report. Additionally, whenever you turn in a laboratory report the corresponding section of your notebook must be complete. Instructors will on occasion spot check your notebook. If it is not complete (with all spectra for example), your grade for the corresponding report will be reduced up to 15% (approximately one grade level). Graded notebooks must be picked up at the Chemistry Department office (540 GCB) within one week after final semester grades are due at the registrar. After this time they will be discarded.

Safety Glasses:
State law requires that you wear regular glasses or laboratory safety glasses at all times in all laboratories. Contact lenses are not safe and should not be worn. However, you can fill out a waiver of your right to sue GSU and then wear them with laboratory safety glasses at your own risk.

Pre-Laboratory Quizzes:
In general there will usually be a pre-laboratory quiz at the start of each laboratory. It will cover material both from previous laboratories and from the current laboratory. If your section consistently scores well on its quizzes, your instructor may decide to reduce their frequency later in the course. If you come late to a laboratory period, you will not be given extra time to complete the pre-laboratory quiz. If you arrive after the quiz has been given, you will receive an automatic score of zero for that quiz. Quiz scores will be taken into consideration as part of the laboratory report grade.

Sign-in & Sign-out For Each Laboratory:
State law also requires that you sign-in and sign-out for each laboratory session that you attend. It is your responsibility to see that you observe this law.

Grading:
Lab Reports (4), Quizzes and Notebook 60%
Midterm Exam 16%
Final Exam 24%

The midterm and final examinations will be almost exclusively on material covered in the lectures, including especially the recommended problems.

Criteria used in grading the LABORATORY REPORTS are:
1. Your understanding of the experiment as judged by your comments and answers to questions. (Focus especially on your Introduction, Discussion and Conclusions sections)
to demonstrate your understanding.)
2. The quality of your data.
3. The completeness and accuracy of your data analysis (including error analysis).
4. The report's clarity, organization, and quality of presentation.

Lab Reports: There are four (4) required laboratory reports (each of equal credit) and one (1) optional report for extra credit (one-half the credit of a required report). The UV-visible spectroscopy section consists of two parts. Part A involves familiarizing yourself with computer controlled UV-visible spectrophotometers (3 lab periods), and Part B uses UV-visible absorbance spectroscopy to determine an equilibrium constant for Mg$^{2+}$ binding by an organic acid (3 lab periods). Individual lab reports must be turned in on each part. One lab report shall also be required on the fluorescence (3 lab periods) and FT-NMR (2 lab periods) spectroscopy sections. See the Lab Schedule below for more details. Lab reports must be turned in on the due dates (see the Lab Schedule). They cannot be resubmitted with corrections for re-grading at a later date. However, report outlines, tables and figures can be submitted to your lecturer or laboratory instructor one week in advance of the due date for helpful comments. For most students doing this will improve your report grades substantially. A laboratory report on the IR spectrum of HCl (1 lab period) is required of 6190 students (full format) and 4190 students (basic or full format). The IR report is worth, at most, half what one of the other reports is worth. See the Lab Manual for a discussion of the basic and full formats. The lab instructor can give you a specific point breakdown.

Laboratory Manual: To be supplied at the first lecture.

Examinations: 1.) October 5, 2005; 5:30-6:20 pm; Rm. 216 Arts & Humanities
               2.) December 12, 2005; 5:00-7:00 pm; Rm. 216 Arts & Humanities


Overall Objectives: The two primary objectives of this course are to give students "hands on" experience in operating a variety of different spectrometers and an understanding of the power, versatility, and limitations of each type of instrument.

As either seniors or graduate students, you are expected to have sufficient maturity that your instructor does not need to direct you moment by moment. Preparation and forethought prior to the scheduled lab period are essential. The laboratory handouts you receive will undoubtedly appear vague. This is deliberate on the part of the instructor since at this stage in your education, it is important to be able to participate in the design of an experiment and not just follow the line by line instructions of a "cookbook" style recipe. In the near future (or perhaps even now), you will probably find yourself in situations (as a graduate student, instructor, or industrial scientist) which require thoughtful decisions on your part. Consequently this course is designed, at least partially, to help prepare you for such a research or work environment.

The following outline lists the general objectives of this course:
1. To learn the principles on which modern instrumentation are based.
2. To develop a research orientation (i.e., to increase your independent problem solving skills). Thus use your initiative to:
   a. Perform initial operations.
   b. Scan instrument manuals (especially layout diagrams).
   c. Evaluate your measurement results for reasonableness.
   d. Extend indicated procedures to reasonable completeness.
   e. Report the limitations imposed by time, instruments, and facilities.
   f. Recommend further work. You are encouraged to ask questions and do literature research concerning the instrumentation and chemical phenomena with what you're working on.
3. Learn to analyze laboratory data in terms of theoretical models.
4. Develop some skill in obtaining optimal precision from laboratory instruments.
5. Provide opportunities to acquire skills within the limits of our facilities.
6. Use literature and library resources.
7. Learn to present your results in clearly written reports that are supported by a well documented notebook.

Requirements in Addition to Examinations

A. Study. Weekly reading assignments and recommended problems will be posted during the lecture periods.

B. Required Experiments. Each student is required to keep a bound research notebook for the sake of making procedural notes, writing down data, and analysis of data.

C. Laboratory Reports. Content has been discussed previously. Due dates are discussed below. See pp 4-5 of the LABORATORY MANUAL for guidance in organizing these reports. Simply put, the laboratory reports must follow the same format as in Chem 4000/6000. That is, they are to be in the form of a scientific paper (see *J. Amer. Chem. Soc.* or *J. Phys. Chem.* articles). **Reports must be typed.** Since the LABORATORY REPORTS constitute 60% of the grade for this course, you are expected to put considerable effort into their preparation. Your notebook and reports must meet professional standards.

Additional comment on the report format. The laboratory manual suggests separate Results and Discussion and Conclusions sections. This format can work well for a full research paper, but might be artificially rigid for the reports in this course. Another format that you could use would have separate Results and Discussion and Conclusions sections. It is convenient to discuss individual spectra and other particular results at the time that you first present them in the paper. Otherwise you have to present them twice. In the Conclusions section, you can then summarize the important findings that you have previously discussed in the Results and Discussion section and very importantly compare
and contrast the results of different particular experiments to show how they either support or contradict one another. Basically the Conclusions section should examine the results of a laboratory project from an overall perspective and give the overall conclusions that can be drawn from a consideration of all of the different experimental results.

**General Comments on the Experiments.** A tentative schedule is given on subsequent pages. **Warning:** Laboratory time is limited. In order to finish the experiments in the allotted time, read the appropriate sections in the manual and do any necessary calculations before coming to the laboratory. On the basis of past experience, you should have more than enough scheduled laboratory time to finish all of the experiments, if you prepare thoroughly ahead of time.

**Department of Chemistry Student Integrity Policy.** All tests taken must represent your individual, unaided efforts. To receive unauthorized outside information or to offer unauthorized information to another student during an examination is cheating. To rephrase, the use of unauthorized supplementary materials during tests is cheating.

All laboratory work performed during this course must reflect your individual effort. Only original data obtained by your own (or your assigned group's) laboratory experiments are permitted to be used, except when specifically authorized by your laboratory professor. **Data from supplementary sources** (handbooks, reference literature, etc.) must be clearly referenced [title, author, volume, page(s), year, etc.; see *J. Amer. Chem. Soc.* format]. **Falsification or destruction of data constitutes cheating.**

Any suspected offenses may be referred to the Chairman of the Department of Chemistry for appropriate action and may be further referred to the Office of the Dean of the College of Arts and Sciences.

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<thead>
<tr>
<th>DATE</th>
<th>LECTURE NO.</th>
<th>LECTURER</th>
<th>SUBJECT</th>
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<tbody>
<tr>
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<td>1</td>
<td>SA</td>
<td>UV-visible</td>
<td>Chapter 6</td>
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<td>Chapter 7</td>
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<td>5-7 p.m.</td>
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<td>Rm. 216 AH</td>
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Section D 18
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<th>Group #2</th>
<th>Group #3</th>
<th>Group #4</th>
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<td>UV-vis Part B</td>
<td>UV-vis Part B</td>
<td>UV-vis Part B</td>
</tr>
<tr>
<td>10/13 or 10/17</td>
<td>8 [Rpt. #2]</td>
<td>UV-vis Part B</td>
<td>UV-vis Part B</td>
<td>UV-vis Part B</td>
<td>UV-vis Part B</td>
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<tr>
<td>10/20 or 10/24</td>
<td>9</td>
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<td>UV-vis Part B</td>
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<tr>
<td>10/27 or 10/31</td>
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<td>IR</td>
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<td>11/3 or 11/7</td>
<td>11 [Rpt. #3]</td>
<td>Fluorescence</td>
<td>IR</td>
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<td>11/10 or 11/14</td>
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<td>11/17 or 11/21</td>
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<tr>
<td>11/28 or 12/1</td>
<td>14 [Rpt. #4]</td>
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<td>Check-out</td>
<td>Check-out</td>
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<tr>
<td>12/6 or 12/9</td>
<td>15 [Rpt. #5]</td>
<td>Due at 5 pm</td>
<td>Due at 5 pm</td>
<td>Due at 5 pm</td>
<td>Due at 5 pm</td>
</tr>
</tbody>
</table>

1 One Shimadzu UV-vis has variable slits and the other has slits fixed at 2-nm SBW. Thus, Groups 3 and 4 will have to switch machines so that each group can do the required variable slit width experiments. Scan speed effects on noise and spectral measurements of ethylbenzene can be made on either machine. Groups 3 and 4 should arrange machine switches with each other so that each group has 1.5 laboratory periods on the machine with variable slits.

2 All laboratory notebooks are also due with this last report.
Course Title: Advanced Synthesis

Professor: L. Strekowski, 689 Kell Hall, 651-0999

Lab Assistant: Reham Abou-Elkhair

Objectives: To learn modern synthesis, separation techniques and compounds characterization in organic and inorganic chemistry.


Course Requirements: Bound laboratory notebook, written report from each experiment with full characterization of synthesized compounds, and submission of the samples. The report and the product should be submitted within two weeks after completion of the experiment. Points will be subtracted for late submissions.

Grading Scheme: Three classroom tests, 3 x 100 300 (Dates: TBA in class) Three lab quizzes, 3 x 20 60 Six lab reports 600 Final Exam 400 Total 1360

≥ 1224 A
≥ 1088 B
≥ 952 C
≥ 816 D
< 866 F

Attendance Policy: Lectures and labs must be attended; lab make-ups are possible at the discretion of the lab assistants.

It is absolutely forbidden to work in the lab without supervision.

The course syllabus provides a general plan for the course, deviations may be necessary.
List of Preparations:

1. **7,7-Dichloronorcarane**
   
   
   **Chemistry**: Generation of a carbene, phase-transfer catalysis
   **Techniques**: Distillation, IR, GC-MS, \(^1\)H-NMR

2. **Ferrocene**
   
   
   **Chemistry**: Inorganic synthesis, generation of cyclopentadiene
   **Techniques**: Distillation, sublimation, use of a dry box, mp, IR, \(^1\)H-NMR

3. **(-)- and (+)-Tris(\(\alpha\)-phenanthroline)iron(II) perchlorate trihydrate**
   
   
   **Chemistry**: Inorganic synthesis of optically active compounds
   **Techniques**: Crystallization of diastereomers, polarimetry, half-life of racemization

4. **Tetraphenyltin**
   
   
   **Chemistry**: Inorganic synthesis
   **Techniques**: Handling of sodium and phenylsodium, crystallization, mp, IR, \(^1\)H-NMR.

5. **2-Chloro-4-(2-thienyl)pyrimidine**
   
   
   **Chemistry**: Nucleophilic addition, DDQ oxidation
   **Techniques**: Handling of organometallic reagents, chromatography, mp, \(^1\)H-NMR, GC-MS.

6. **A near-infrared cyanine dye**
   
   
   **Chemistry**: Cyanine dyes, \(S_{RN}1\) mechanism.
   **Techniques**: Crystallization, NIR spectroscopy
Schedule of Experiments:

Each experiment will be conducted individually by each student. Each experiment, time table and the chemistry involved will be discussed in class.

FINAL EXAM: DECEMBER 16, 2005, (THURSDAY) 1:00 P.M., (LAST DAY OF CLASS)

Laboratory Syllabus
242 Natural Science Center
Monday 1:50-5:35 p.m.
Dr. Lucjan Strekowski (Office Hours, see class syllabus)
Kate Paliakov (688 Kell Hall)

<table>
<thead>
<tr>
<th>Month</th>
<th>Aug</th>
<th>Sept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>23</td>
<td>13</td>
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<td></td>
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<td>27</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Grp A</td>
<td>Intro</td>
<td>Ferro</td>
</tr>
<tr>
<td>Grp B</td>
<td>Intro</td>
<td>Ferro</td>
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</table>

<table>
<thead>
<tr>
<th>Month</th>
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<td>22</td>
</tr>
<tr>
<td></td>
<td>29</td>
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</tr>
<tr>
<td>Grp A</td>
<td>Phen</td>
<td>Su</td>
</tr>
<tr>
<td>Grp B</td>
<td>Sn</td>
<td>PCA</td>
</tr>
</tbody>
</table>

ANB - 1-amino-3-nitrobenzene
Ferro = Ferrocene
PCA = trans-4'-phenylcinnamic acid
Phen = Phenanthroline
Sn = Tetraphenyltin
Su = Biphenylcarboxaldehyde

Notes: There will be three laboratory quizzes covering practical concepts covered in the laboratory sessions. They will be included as part of your laboratory grade. A portion of the laboratory grade will include general laboratory technique (prelab, waste disposal, apparatus cleaning, technique, attendance).
**Prerequisites:** Undergraduate organic chemistry plus at least one more course. Useful courses are Chem 4600/6600 or Chem 4610/6610 or Chem 4400/6400. The course is at the advanced undergraduate/graduate level and is appropriate for both chemistry and biology students. For undergraduate students, this course is appropriate for those planning a professional career in science or medically-related fields.

**Content:** This course will emphasize structure-activity relationships in proteins and molecules which bind to proteins. We will look at the active sites of proteins with emphasis on proteins carrying prosthetic groups. Design of inhibitors of various enzymatic functions will be discussed. Quantitative assessment of binding and rate constants will be emphasized.

**Written work:** The major goal of this course is to help students learn to write scientific papers with ease. To this end, there will be only a short mid-term and final. These are open-book, open-note exams. There is no homework. During the course, the student will write a series of papers on the current literature.

1. The paper should discuss at least one up-to-date (2000 - present) reference.
   1.1. These are most easily obtained from PubMed or Web of Science
   1.2. All papers must be available in HTML or PDF file format for Dr. Dixon so that she can check for plagiarism. If a PDF, please email the file.
   1.3. If you want to use an earlier reference, check with Dr. Dixon.

2. The goal is to learn to write in review style. Please see examples in Chemical Reviews to understand the style (two are given in the handouts). Please envision yourself as writing only a portion of a much longer review. There is no introduction and no conclusion. Just start writing your section of the review, and write for three pages.

3. There are seven topics listed on the accompanying sheet. At the discretion of the instructor (always check with Dr. Dixon first), students may:
   3.1. write two (unrelated) papers on a given topic and skip another topic
   3.2. write a paper on results of their experiments
   3.3. write paper appropriate for the background of their thesis/dissertation/honors paper
   3.4. write parts of a grant proposal

4. Each time you turn in the paper, it will be regraded. Your final grade on the paper is the highest grade that you receive on the paper.

5. Each student will have a scheduled 30 minute meeting with Dr. Dixon each week. These will be in two blocks of time to be arranged the first week of class. If you need to change the appointment, please arrange to switch with another student.

6. Email
   6.1. To save time for all concerned, communication regarding the status of paper grading will be via email. Please do not phone unless it is necessary.
   6.2. Students should email ddixon@gsu.edu asking to be added to the 4410/6410 email list as soon as possible after the course begins if you are not already on the list.
   6.3. Any changes in class schedule, etc. will be announced via email.

7. Spelling and grammar count.
   7.1. Spell check and grammar check programs must be used.
   7.2. On the THIRD spelling error that should have been picked up by the spelling program (not "that" for "than" etc.) I will stop reading the paper and return it to you ungraded.

8. Careful referencing counts. On the FIRST error in the references I will stop reading the paper and return it to you ungraded. I will check the references before reading the paper.
   8.1. We will use Virology style.
   8.2. References in a series have to be in chronological order from oldest to newest.
9.1. Papers will be a minimum of three double-spaced pages long (not including figures or tables).
9.2. Margins will be a maximum of one inch.
9.3. The type font should be 12 if Times Roman and 11 if Arial.
9.4. Be sure and staple your papers in the upper left hand corner.
9.5. Do not put papers in covers or folders.
9.6. Put your name on the papers.
9.7. Save paper, do not put on a cover sheet.
9.8. Title each paper and keep the title consistent throughout the course.
9.9. All figures, tables and schemes will be at the end of the paper. This really saves time on rewrites. Figures should have a figure caption which you write (do not use that from the journal). At the end of the figure legend, write "reprinted from xxxx" or "adapted from xxxx" where xxxx is the reference that you used.

10. Turning in papers
10.1. Each paper can be turned in as many times as you wish but not more often than once a week.
10.2. Papers are due on Tuesdays.
10.3. Papers will be returned in one week (in class on Tuesday).
10.4. I will make an effort to have papers available on Friday of each week (i.e., four days early) so that papers can be rewritten over the weekend, but this cannot be guaranteed. This will be especially difficult as the semester progresses and there are more rewrites.
10.5. I will make an effort to grade late papers but do not commit to this. If your paper is late, it will by default go into the next Tuesday's deadline. If I have time, I will grade it but in many cases I will not have time.
10.6. When the paper is ready, I will put it on the bulletin board outside my office and notify you by email.
10.7. The content of a number of papers does not depend heavily on the lectures. In these cases, it is to your advantage to turn the paper in early. This gives you more time for rewrites and also gives you a buffer zone in case of illness, travel, etc.

11. Other suggestions
11.1. Do not write anything that you are not willing to defend. If you do not understand the issue, do not write on it. Be especially careful of calling something "novel" or "unique" - this is exceptionally difficult to defend.
11.2. Be as quantitative as possible. It is better to call something 3-fold larger or 1000-fold larger than "much larger".
11.3. Never cite a paper that you did not read. Suppose that you have a sentence from a paper by Li and Yang: "Smith and Jones report that the molecular weight of the protein indicates that it is a tetramer." You want to report that the protein is a tetramer, but are not going to read Smith and Jones (article not in library, you are too busy, etc.) The reference that goes at the end of this sentence in your writing is Li and Yang. For published writing, you will have to get a copy of Smith and Jones and read it or else leave it out.

12. Plagiarism is totally unacceptable.
12.1. Papers which contain even a single sentence copied will be returned ungraded.
12.2. Papers which have more than 15% similarity over 2 or more sentences will be returned ungraded.
12.3. Papers with two or more consecutive sentences copied will result in an F for that paper with no opportunity for rewrite.

13. One of the goals of the course is to encourage timely scheduling of work. To this end, incompletes are not given except in cases of serious illness or emergency. In general, it is to your advantage to turn in papers early and finish the course early. Students finishing all papers before the final do not have to take the final exam.

14. Required Departmental Statement: Students who are withdrawn may petition the Department Chair for reinstatement into their class(es). Students who withdraw themselves by the mid-point will receive a W under this policy.
## Degree Requirements per program
### Department of Chemistry Department GSU

### Graduate program

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Master of Science (Thesis option)</th>
<th>Non-thesis option</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>26 hours of approved course work to be selected from 6000 and 8000 level courses.</td>
<td>1. 36 hours of approved course work to be selected from 6000 and 8000 level courses</td>
</tr>
<tr>
<td></td>
<td>Eight of the 26 hours may be taken in a related field or fields (upon approval). Two hours of Chem 8800, Seminar in Chemistry.</td>
<td>a. Eight hours of graduate-level biology or related field coursework may be applied toward the degree.</td>
</tr>
<tr>
<td>2.</td>
<td>Proficiency in a foreign language or in an approved research skill.</td>
<td>b. One hour of Chem 8800, Seminar in Chemistry.</td>
</tr>
<tr>
<td>4.</td>
<td>A general examination.</td>
<td>d. The coursework must be approved by the Director of Graduate Studies in the Department of Chemistry.</td>
</tr>
<tr>
<td>5.</td>
<td>A thesis</td>
<td>2. Proficiency in a foreign language or in an approved research skill.</td>
</tr>
<tr>
<td>Requirements</td>
<td>Degree</td>
<td>Majors and their requirements</td>
</tr>
<tr>
<td>--------------</td>
<td>--------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>6. A thesis defense</td>
<td>3. The successful completion of an approved laboratory or literature research paper under the direction of a faculty adviser.</td>
<td></td>
</tr>
<tr>
<td><strong>Degree</strong></td>
<td><strong>Doctor of Philosophy</strong></td>
<td></td>
</tr>
<tr>
<td>1. Thirty hours of approved graduate core coursework.</td>
<td>2. Forty hours of research minimum, at least 20 hours of which must be Dissertation Research.</td>
<td></td>
</tr>
<tr>
<td>3. Ten additional hours of graduate course electives or research.</td>
<td>4. Satisfaction of the foreign language (research skill) requirement.</td>
<td></td>
</tr>
<tr>
<td><strong>Majors and their requirements</strong></td>
<td><strong>Ph.D. in Biochemistry</strong></td>
<td><strong>Ph.D. in Biophysical Chemistry</strong></td>
</tr>
<tr>
<td>A. Core courses (9 hours) - To be selected from Chem 6600, 6610, 6840, 8360, 8370, or approved substitutes;</td>
<td>A. Core courses: (9 hours). Chem 6110, 6120, and/or 8510 and choice of Chem 6190, 6370, 6740, 6792, 8360, 8370, or approved substitutes;</td>
<td></td>
</tr>
<tr>
<td>B. Area Electives (6 hours) - To be selected from Chem 6400, 6410, 8510, or approved substitutes;</td>
<td>B. Area Electives: (6 hours) To be selected from Chem 6600, 6610 and/or Chem 6400, 6410 and/or Biol 6890, 8500, 8750 or approved substitutes;</td>
<td></td>
</tr>
<tr>
<td>C. Interdisciplinary Electives in Biology (6 hours) or approved substitutes;</td>
<td>C. Interdisciplinary Electives in Biology (6 hours) or approved substitutes;</td>
<td></td>
</tr>
<tr>
<td>D. Topics, Electives and Seminar (6-19 hours) - To be selected from Chem 6050, 6450, 8800, 8900, 8910, 8970, or approved substitutes;</td>
<td>D. Topics, Electives and Seminar (6-19 hours) - To be selected from Biol/Chem 8970, Biol 8700; Chem 6050, 6450, 8800 and other approved electives;</td>
<td></td>
</tr>
</tbody>
</table>
### Ph.D. in Organic Chemistry

**A.** Core courses (9 hours) Chem 6400, 6410, and 6330, 8400, or approved substitutes;

**B.** Area Electives (6 hours) - To be selected from Chem 6600, 6610, 6370, 8510, or approved substitutes;

**C.** Interdisciplinary Electives in Biology (6 hours) or approved substitutes;

**D.** Topics, Electives and Seminar (6-19 hours) To be selected from Bio/Chem 8970, Bio 8700, Chem 6050, 6450, 8800, 8900, 8910, 8970, or approved substitutes;

**E.** Research (40 hours) Chem 8900, 8910, 9999 (minimum of 20 hours must be 9999).

### Ph.D. in Analytical

**A.** Core courses (9 hours) Chem 6015, 6850, and 6870 (Chem 6860) or approved substitutes;

**B.** Area Electives (6 hours) to be selected from Chem 6370, 6400, 6410, 8510, or approved substitutes;

**C.** Interdisciplinary Electives in Biology (6 hours) or approved substitutes;

**D.** Topics, Electives and Seminar (6-19 hours) to be selected from Bio/Chem 8970, Bio 8700, Chem 6050, 6450, 8800, 8900, 8910, 8970, or approved substitutes;

**E.** Research (40 hours) Chem 8900, 8910, 9999 (minimum of 20 hours must be 9999).

### Undergraduate program

#### Bachelor of Science Major in Chemistry

**Area A: Essential Skills (9)** Required course: Math 1113 Precalculus (or a higher level mathematics course) (3)

**Area B: Institutional Options (4)**

**Area C: Humanities and Fine Arts (6)**

**Area D: Science, Mathematics, and Technology (11)**

**Recommended courses:** Chem 1211K Principles of Chemistry I (4) Chem 1212K Principles of Chemistry II (4). **Required course:** Math 2211 Calculus of One Variable I (or a higher level mathematics course) (4)

*One credit hour will count in the second 60 hours beyond the core curriculum.*
### Area F: Courses Appropriate to the Major Field (18)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Chem 1211K</td>
<td>Principles of Chemistry I (4)+</td>
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</tr>
<tr>
<td>Chem 1212K</td>
<td>Principles of Chemistry II (4)+</td>
<td></td>
</tr>
<tr>
<td>Phys 2211K</td>
<td>Principles of Physics I (4)*</td>
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</tr>
<tr>
<td>Phys 2212K</td>
<td>Principles of Physics II (4)*</td>
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<tr>
<td>Chem 2010</td>
<td>Quantitative Analysis (2)</td>
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<tr>
<td>Chem 2400</td>
<td>Organic Chemistry I (4)</td>
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</tr>
<tr>
<td>Math 2212</td>
<td>Calculus of One Variable II (4)</td>
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</table>
*Physics 1111K and 1112K can be substituted if approved by the Department of Chemistry.
+Chem 1211K and 1212K must be taken here unless already taken in Area D. If already taken in Area D, then take Phys 2211K and 2212K. Both Chem 1211K/1212K and Phys 2211K/2212K are required for graduation.

### Area G: Major Courses (30)

**A grade of C or higher is required in all major courses.**

1. **Major Requirements (25)**

<table>
<thead>
<tr>
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<th>Course Title</th>
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</tr>
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<tr>
<td>Chem 3410</td>
<td>Organic Chemistry II (4)</td>
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<tr>
<td>Chem 3100</td>
<td>Organic Chemistry Laboratory I (2)</td>
<td></td>
</tr>
<tr>
<td>Chem 3110</td>
<td>Organic Chemistry Laboratory II (2)</td>
<td></td>
</tr>
<tr>
<td>Chem 4110</td>
<td>Physical Chemistry I (3)</td>
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<tr>
<td>Chem 4120</td>
<td>Physical Chemistry II (3)</td>
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<tr>
<td>Chem 4160</td>
<td>Chemistry Laboratory IV A (2)</td>
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<tr>
<td>Chem 4000</td>
<td>Fundamentals of Chemical Analysis (3)</td>
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<tr>
<td>Chem 4010</td>
<td>Instrumental Methods I: Chromatography (3)</td>
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</tr>
<tr>
<td>Chem 4190</td>
<td>Instrumental Methods III: Spectroscopy (3)</td>
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</table>

2. **Major Electives (5)**

**Recommended course:**

<table>
<thead>
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<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem 4600</td>
<td>Biochemistry I (5) (required for ACS certification)</td>
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</tr>
<tr>
<td>B.S. of Science in Chemistry</td>
<td>American Chemical Society Certification</td>
<td>Concentration in Premedicine</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>1. <strong>Required Courses (6)</strong></td>
<td>Chem 4330 Advanced Synthesis (3)</td>
<td>A premedicine concentration is available for chemistry majors. The premedical or predental student who completes Chem 1211K, 1212K, 2010, 2400, 3410, 3100, and 3110 will have earned the equivalent of 10 credit hours in general and quantitative analytical chemistry and 12 credit hours in organic chemistry. Please contact the Department of Chemistry for further information.</td>
</tr>
<tr>
<td></td>
<td>Chem 4210 Inorganic Chemistry (3)</td>
<td></td>
</tr>
<tr>
<td>2. <strong>Select additional elective courses (4)</strong></td>
<td>Chem 4050, 4170, 4370, 4400, 4410, 4450, 4490, 4590, 4610, 4620, 4840, or other approved courses (must be different from major elective choices)</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Area H: Minor and Additional Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Students majoring in chemistry are not required to take a minor. Consult the department for assistance in selecting a minor in biology, business, or related areas</td>
</tr>
<tr>
<td>2. Students majoring in chemistry must take additional courses as electives to complete a minimum of 120 hours, exclusive of 1000/2000 physical education or military science courses. The department recommends that majors take computer and/or foreign language courses.</td>
</tr>
</tbody>
</table>

**Minor Offerings:** Students who wish to minor in chemistry must take 15-18 hours in courses in chemistry, including at least nine hours at the 3000-level or above. Students taking more than 15 hours in courses in chemistry may count the additional hours toward their electives or may consider completing a double major. A grade of C or higher is required in all courses counting toward the minor.
## Appendix D-4
### Departmental Course Offerings by Fiscal Year
#### Course Level, # of Sections, # of Students
And Average # of Students
Chemistry Department
Self Study 2005

<table>
<thead>
<tr>
<th>FY</th>
<th>LEVEL</th>
<th>COURSE</th>
<th># OF SECTIONS</th>
<th># OF STUDENTS</th>
<th>AVG. # OF STUDENTS</th>
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</thead>
<tbody>
<tr>
<td>FY03</td>
<td>LOWER</td>
<td>CHEM 1101K*</td>
<td>1</td>
<td>34</td>
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<tr>
<td>FY03</td>
<td>LOWER</td>
<td>CHEM 1102K*</td>
<td>1</td>
<td>135</td>
<td>135.0</td>
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<td>FY03</td>
<td>LOWER</td>
<td>CHEM 1151K</td>
<td>2</td>
<td>190</td>
<td>95.0</td>
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<td>FY03</td>
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<td>CHEM 1151K*</td>
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<td>83</td>
<td>83.0</td>
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<tr>
<td>FY03</td>
<td>LOWER</td>
<td>CHEM 1152</td>
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<td>42</td>
<td>42.0</td>
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<tr>
<td>FY03</td>
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<td>CHEM 1152K</td>
<td>1</td>
<td>88</td>
<td>88.0</td>
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<tr>
<td>FY03</td>
<td>LOWER</td>
<td>CHEM 1201</td>
<td>10</td>
<td>270</td>
<td>27.0</td>
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<tr>
<td>FY03</td>
<td>LOWER</td>
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*Cross listed course
Analysis of faculty and student survey responses is presented in the text of Section D and all survey results are collected in Appendix D-5(2).

(i) Undergraduate and Graduate Alumni Surveys: The Department was very highly rated by undergraduate alumni. Essentially all questions had scores of 3.5 (out of 5) or better. The only score below 3 was related to whether there is career advisement in the Department. This is correct because at GSU we carry our career advisement, interviews, and CV assistance in the University Career Center. We received scores above 4.2 for two points: "Faculty in the Department were appropriately prepared for their course", and "Class size was appropriate for effective learning." Both of these responses are significantly better than the University average. Scores for graduate alumni were lower and this may reflect the large number of M.S. graduates in recent years. The M.S. students get less attention in the graduate program than Ph.D. students and are in the Department for a shorter time.

(ii) Current Graduate and Undergraduate Surveys: Current graduate and undergraduate students rated the Department equally highly with essentially all responses being 3.5 or better. The only response near 3.0 for the undergraduate survey related to the frequency of undergraduate major course offerings. It is impossible for us, however, to offer these courses more frequently with the limited number of faculty that we have. As our faculty and student majors numbers increase in the next five year period, we will be able to increase the frequency of course offerings. The highest agreement on the undergraduate survey was for "The undergraduate program of study is academically challenging." We are very please with the high rating in this area.

Although survey results should not be used in a detailed quantitative manner, it is encouraging that the Department is very highly rated by both current and former student majors. The results mirror those of the Chemistry Faculty that are presented in Section D text.
Full survey results of the Academic Program Review Department of Chemistry Surveys.

1. Academic Program Review Department of Chemistry Undergraduate Alumni Survey University Comparisons report

2. Academic Program Review Department of Chemistry Graduate Alumni Survey University Comparisons report

3. Academic Program Review Department of Chemistry Faculty Survey University Comparisons report

4. Academic Program Review Department of Chemistry Undergraduate Survey University Comparisons report

5. Academic Program Review Department of Chemistry Graduate Survey University Comparisons report
**Table 1**

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<th>Faculty members in the department were interested in the academic development of undergraduate majors.</th>
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*Mean range: 1=strongly disagree to 5=strongly agree
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*Mean range: 1=poor to 5=excellent
Table 3

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ACADEMIC PROGRAM REVIEW
DEPARTMENT OF CHEMISTRY
GRADUATE ALUMNI SURVEY
UNIVERSITY COMPARISONS REPORT

December 2004

Department of Chemistry N = 21 (response rate = 42.0 percent)
University (17 departments) N = 803 (response rate = 48.4 percent)

Table 1

<table>
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<th>Department</th>
<th>University</th>
<th>Department</th>
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Mean range: 1=strongly disagree to 5=strongly agree

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<th>University</th>
<th>Department</th>
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<td>39.0</td>
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<td>40.0</td>
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<tr>
<td>Excellent</td>
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<th>University</th>
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### Table 3

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### ACADEMIC PROGRAM REVIEW

**DEPARTMENT OF CHEMISTRY FACULTY SURVEY**

**UNIVERSITY COMPARISONS REPORT**

**November 2004**

- **Department of Chemistry N = 24**
- **Department of Chemistry Response Rate = 92.3 percent**
- **University (18 Departments) N = 416**
- **University Response Rate = 86.2 percent**

### Table 1

<table>
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<th>Variety of advanced course offerings</th>
<th>Level of clerical staff support</th>
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Mean range: 1=poor to 5=excellent

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<th>N</th>
<th>%</th>
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<td>30.9</td>
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<tr>
<td>Mean</td>
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<td>3.54</td>
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<tr>
<td>SD</td>
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<td>1.285</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
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<td>8.2</td>
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<td>0.0</td>
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<td>105</td>
<td>27.1</td>
<td>6</td>
<td>25.0</td>
</tr>
<tr>
<td>Excellent</td>
<td>117</td>
<td>30.2</td>
<td>13</td>
<td>54.2</td>
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<tr>
<td>Mean</td>
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<td>4.29</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>1.244</td>
<td>.908</td>
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</tbody>
</table>

<table>
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<tr>
<th>Availability of computer/data base software relevant to your work</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
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<td>0.0</td>
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<td>14.5</td>
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<td>8.7</td>
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<td>4</td>
<td>121</td>
<td>34.4</td>
<td>7</td>
<td>30.4</td>
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<tr>
<td>Excellent</td>
<td>148</td>
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<td>13</td>
<td>56.5</td>
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<tr>
<td>Mean</td>
<td>4.06</td>
<td>4.39</td>
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<td>.839</td>
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<td></td>
</tr>
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</table>

Table 2

<table>
<thead>
<tr>
<th>The department's program of study is academically challenging.</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>8</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>4.3</td>
</tr>
<tr>
<td>3</td>
<td>59</td>
<td>14.8</td>
</tr>
<tr>
<td>4</td>
<td>166</td>
<td>41.5</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>150</td>
<td>37.5</td>
</tr>
<tr>
<td>Mean</td>
<td>4.08</td>
<td>4.29</td>
</tr>
<tr>
<td>SD</td>
<td>.932</td>
<td>1.042</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Faculty in the department work together toward program goals.</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>27</td>
<td>6.7</td>
</tr>
<tr>
<td>2</td>
<td>26</td>
<td>6.5</td>
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<td>4</td>
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<td>Strongly agree</td>
<td>137</td>
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<tr>
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<td>3.96</td>
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<tr>
<td>SD</td>
<td>1.174</td>
<td>.955</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In our department, faculty feel comfortable expressing different views and opinions.</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>32</td>
<td>8.0</td>
</tr>
<tr>
<td>2</td>
<td>29</td>
<td>7.2</td>
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<tr>
<td>3</td>
<td>62</td>
<td>15.5</td>
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<td>4</td>
<td>118</td>
<td>29.4</td>
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<tr>
<td>Strongly agree</td>
<td>160</td>
<td>39.9</td>
</tr>
<tr>
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<td>3.86</td>
<td>4.00</td>
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<td>SD</td>
<td>1.243</td>
<td>1.142</td>
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<table>
<thead>
<tr>
<th>I have adequate opportunities to influence decisions made in the department about our programs.</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>23</td>
<td>5.8</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
<td>12.1</td>
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<tr>
<td>3</td>
<td>61</td>
<td>15.4</td>
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<td>28.0</td>
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<tr>
<td>Strongly agree</td>
<td>154</td>
<td>38.8</td>
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<tr>
<td>Mean</td>
<td>3.82</td>
<td>3.75</td>
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<tr>
<td>SD</td>
<td>1.232</td>
<td>1.260</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Guidelines regarding job performance are clear to faculty in the department.</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>25</td>
<td>6.6</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>7.9</td>
</tr>
<tr>
<td>3</td>
<td>57</td>
<td>15.0</td>
</tr>
<tr>
<td>4</td>
<td>130</td>
<td>34.2</td>
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<tr>
<td>Strongly agree</td>
<td>138</td>
<td>36.3</td>
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<tr>
<td>Mean</td>
<td>3.62</td>
<td>4.78</td>
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<tr>
<td>SD</td>
<td>1.232</td>
<td>1.260</td>
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### Table 3

<table>
<thead>
<tr>
<th>Research tasks</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Significantly too little emphasis</td>
<td>11</td>
<td>2.8</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>5.7</td>
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<tr>
<td>3</td>
<td>225</td>
<td>58.1</td>
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<tr>
<td>4</td>
<td>86</td>
<td>22.2</td>
</tr>
<tr>
<td>Significantly too much emphasis</td>
<td>43</td>
<td>11.1</td>
</tr>
<tr>
<td>Mean</td>
<td>3.33</td>
<td>3.41</td>
</tr>
<tr>
<td>SD</td>
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<td>.734</td>
</tr>
<tr>
<td>Service to department</td>
<td>University</td>
<td>Department</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Significantly too little emphasis</td>
<td>8</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>29</td>
<td>7.4</td>
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<td>4</td>
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<td>23.4</td>
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<td>16.5</td>
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<tr>
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<td>.702</td>
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<td>Publishing in certain journals</td>
<td>University</td>
<td>Department</td>
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<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Significantly too little emphasis</td>
<td>11</td>
<td>3.0</td>
</tr>
<tr>
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<td>3.23</td>
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<td>Teaching</td>
<td>University</td>
<td>Department</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Significantly too little emphasis</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>14.0</td>
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<tr>
<td>4</td>
<td>83</td>
<td>21.1</td>
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<tr>
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<td>3.33</td>
</tr>
<tr>
<td>SD</td>
<td>.932</td>
<td>.702</td>
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</table>

*Mean range: 1=significantly too little emphasis to 5=significantly too much emphasis

### Table 4

<table>
<thead>
<tr>
<th>Have you ever been the editor of any journals or served on any editorial boards in your field?</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>192</td>
<td>48.4</td>
</tr>
<tr>
<td>No</td>
<td>205</td>
<td>51.6</td>
</tr>
<tr>
<td>Have you been awarded any grants from Georgia State University to support research in your field?</td>
<td>University</td>
<td>Department</td>
</tr>
<tr>
<td>Yes</td>
<td>253</td>
<td>63.9</td>
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<tr>
<td>No</td>
<td>143</td>
<td>36.1</td>
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<tr>
<td>Have you been awarded any grants from a source other than Georgia State University to support research in your field?</td>
<td>University</td>
<td>Department</td>
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<td>Yes</td>
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<tr>
<td>No</td>
<td>146</td>
<td>36.3</td>
</tr>
<tr>
<td>During the last two years, have you refereed or served as a reviewer of one or more articles submitted to journal(s) in your field?</td>
<td>University</td>
<td>Department</td>
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<tr>
<td>Yes</td>
<td>296</td>
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<td>No</td>
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### Table 5

<table>
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<th>How many professional articles or chapters in books have you published in the last five years?</th>
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<th>Department</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
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<tr>
<td>0</td>
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<td>14.2</td>
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<td>3-4</td>
<td>48</td>
<td>12.8</td>
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<td>5-6</td>
<td>66</td>
<td>17.6</td>
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<td>7 or more</td>
<td>172</td>
<td>46.0</td>
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<table>
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<th>How many authored books or edited books have you published in the last five years?</th>
<th>University</th>
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<tr>
<td></td>
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<tr>
<td>5-6</td>
<td>1</td>
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<td>7 or more</td>
<td>5</td>
<td>1.3</td>
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<table>
<thead>
<tr>
<th>How many monographs, manuals, or reviews have you published in the last five years?</th>
<th>University</th>
<th>Department</th>
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<tr>
<td></td>
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<td>5-6</td>
<td>19</td>
<td>5.1</td>
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<tr>
<td>7 or more</td>
<td>21</td>
<td>5.6</td>
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<table>
<thead>
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<th>How many formal presentations have you given at professional meetings over the last five years?</th>
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<th>Department</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
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<td>1-2</td>
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<tr>
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<td>53.4</td>
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<table>
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<tr>
<th>How many formal presentations have you given at other colleges or institutions over the last five years?</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>5-6</td>
<td>37</td>
<td>9.3</td>
</tr>
<tr>
<td>7 or more</td>
<td>75</td>
<td>18.8</td>
</tr>
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---

**ACADEMIC PROGRAM REVIEW**  
**DEPARTMENT OF CHEMISTRY UNDERGRADUATE STUDENT SURVEY**  
**UNIVERSITY COMPARISONS REPORT**  
December 2004

**Department of Chemistry N = 78**  
**Department of Chemistry response rate = 32.4 percent**  
**University (16 departments) N = 1936**  
**University response rate = 41.4 percent**

**Table 1**

<table>
<thead>
<tr>
<th>Faculty members in the department are interested in the academic development of undergraduate majors.</th>
<th>University</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>56</td>
<td>3.2</td>
</tr>
<tr>
<td>2</td>
<td>137</td>
<td>7.7</td>
</tr>
<tr>
<td>3</td>
<td>358</td>
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<tr>
<td>4</td>
<td>611</td>
<td>34.5</td>
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<tr>
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<td>609</td>
<td>34.4</td>
</tr>
<tr>
<td>Mean</td>
<td>3.89</td>
<td>3.83</td>
</tr>
<tr>
<td>The undergraduate program of study is academically challenging.</td>
<td>SD</td>
<td>1.063</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>----</td>
<td>-------</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>59</td>
<td>3.2</td>
</tr>
<tr>
<td>2</td>
<td>96</td>
<td>5.3</td>
</tr>
<tr>
<td>3</td>
<td>228</td>
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<td>4</td>
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<tr>
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<td>1.028</td>
<td>.925</td>
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<tr>
<td>Faculty in the department are appropriately prepared for their courses.</td>
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<td>1.011</td>
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<tr>
<td>Strongly disagree</td>
<td>53</td>
<td>2.9</td>
</tr>
<tr>
<td>2</td>
<td>98</td>
<td>5.5</td>
</tr>
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<td>3</td>
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<td>4</td>
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<tr>
<td>Strongly agree</td>
<td>732</td>
<td>40.7</td>
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<tr>
<td>Mean</td>
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<td>3.95</td>
</tr>
<tr>
<td>SD</td>
<td>1.011</td>
<td>1.039</td>
</tr>
<tr>
<td>I feel the undergraduate program is preparing me for my professional career and/or further study.</td>
<td>SD</td>
<td>1.122</td>
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<tr>
<td>Strongly disagree</td>
<td>89</td>
<td>4.9</td>
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<td>2</td>
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<td>7.6</td>
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<td>4</td>
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<tr>
<td>Strongly agree</td>
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<tr>
<td>Mean</td>
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<td>3.99</td>
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<td>.973</td>
</tr>
<tr>
<td>There is open communication between faculty and undergraduate students about student concerns.</td>
<td>SD</td>
<td>1.192</td>
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<tr>
<td>Strongly disagree</td>
<td>108</td>
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<tr>
<td>2</td>
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<td>10.8</td>
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*Mean range: 1=poor to 5=excellent*
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*Mean range: 1=strongly disagree to 5=strongly agree*
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*Mean range: 1=poor to 5=excellent*
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Appendix D-6

Undergraduate and Graduate Advisement Procedures

Chemistry Self Study 2005

Undergraduate Advisement: All undergraduate chemistry majors are advised by a Departmental faculty member who is a member of the Undergraduate Advisement Committee (elected). The Committee is chaired by the Director of Undergraduate Studies, Dr. Paul Franklin. When the students enroll as freshmen, they are initially sent to the Office of Academic Advisement of the College of Arts and Sciences. The Chemistry Department Advisement Committee feels that it is essential to contact these students as soon as possible. The Committee notifies students that it is critical for all majors to see an advisor in the Chemistry Department in their first semester. The adviser assigned to a student major works through a degree program with the student. Students can then make appointments to review the plan as necessary through their time at GSU but there is a mandatory senior advisement and career counseling three semesters prior to graduation. The focus of our efforts is on individual contact and advisement of all of our undergraduate chemistry majors so that they can move forward in the optimum manner with their educational program.

The Department recognizes that a very large number of our undergraduates plan to pursue careers in Pharmacy, Dentistry, Medicine (human and veterinary) or other medically related fields. The Departmental advisement program for these students is interfaced with that of the advisement office of the College of Arts and Sciences, which has a special group devoted to premedical advisement. In this office of the college students initiate their "premed file" which is a compilation of required material: CV, application forms, test scores, essays, letters of recommendation, etc. These materials cover the requirements to apply to most professional schools. The file is monitored by the College office and students are informed of deadlines for submission of the required documents, getting standardized test scores and final submission of their application. The College's Premed Advisory Committee (on which the Chemistry Department is represented) monitors the file for completeness and writes the composite recommendation required for each student.

At the Departmental level advisers meet with students to inform them of the core chemistry and other requirements for most medically related professional schools. The adviser emphasizes that it is important to have strong performances in these subjects. Students are also advised to pay particular attention to the sequencing of their courses to allow for optimum preparation in time to take the standardized test required by most of these schools; (MCAT, DAT, PCAT, VCAT, etc.).
At the Department level, students are advised to participate in class discussions, tutorials and practical sessions and become known by the instructor since a recommendation from a chemistry professor is needed for the premed file. Students are also advised to explore other career paths in science and technology and to make sure they are taking a wide offering of courses to allow for changes in career directions that may become necessary or desirable.

**Graduate Advisement Procedure:** The Department of Chemistry has a Director of Graduate Studies, Dr. Markus Germann who is assisted by a staff member who is the Graduate Coordinator. The Graduate Coordinator is a full time position in recognition of the importance of graduate student recruitment and advisement. The Graduate Director and Coordinator are the primary contacts for prospective students. During the application process, the Coordinator serves as the main contact between students and GSU and ensures that forms are complete and filed in a timely manner. The Graduate Director also does the initial screen of the applications and provides a link between faculty and students. If a suitable match for area or potential supervisor is found the Graduate Director issues a recommendation for acceptance.

New graduate students are advised on course selection based on programmatic need that takes their background and preparation in consideration. The Graduate Director makes decisions on transfer credits and on substitutions of core and elective classes. In the case of Ph.D. and thesis MS students, this also includes consultation/participation of the advisor. Compliance with College and Chemistry Department guidelines and requirements is monitored on a regular basis. Students with lower GPA’s are identified and a meeting with the Director of Graduate Studies is scheduled to discuss ways to improve performance. Both the Director of Graduate Studies and the Graduate Coordinator are available for consultation and advisement on graduate student issues and concerns.
Appendix D-7
Reports from Undergraduate Research
Chemistry Department
Self-Study 2005

One example report from each of the three focus areas of research in the Chemistry Department is included in this appendix.

**Biosensors and Diagnostics - Separations Theory and Practice:**

Title: “Polymeric Sulfated and Glycinated Surfactants for Electrokinetic Chromatography: Separation of 16 Priority Polycyclic Aromatic Hydrocarbon Pollutants”.

Author: Quynh Giao Tran

**Biomolecular Structure and Interactions - Function, Mechanisms, Design and Recognition:**

Title: “Inhibition Studies of Flavin-Dependent Choline Oxidase Part II: Tetrinitromethane”.

Author: Thuy-Trang Hoang

**New Therapeutic Agents and Approaches - Drug Design, Discovery and Development:**

Title: Synthesis of Guanidines, Reversed Amidines, Amidines in the 2,5-Diaryluran Series As Antimicrobial Agents”.

Author: Phanneth Som
Polymeric Sulfated and Glycinated Surfactants for Electrokinetic Chromatography: Separation of 16 Priority Polycyclic Aromatic Hydrocarbon Pollutants

Quynh Giao Tran
Chemistry 4160
Spring-Summer 2004
Dr. Shahab A. Shamsi
Dr. Paul J. Franklin
07/30/2004
Georgia State University
ABSTRACT

Electrokinetic chromatography (EKC) with poly(sodium N-undecenoyl glycinate) (poly-SUG), poly(sodium N-undecenoxy carbonyl glycinate) (poly-SUCG) and four anionic sulfated surfactants with 8-, 9-, 10-, and 11- carbon chains (poly-SOcS, poly-SNoS, poly-SDeS and poly-SUS, respectively)\(^1\) are utilized to separate environmental pollutants such as polycyclic aromatic hydrocarbons (PAHs). Parameters such as retention time (\(t_R\)) and peak resolution (Rs) were investigated under the effect of hydrocarbon chain length of each of the four anionic sulfated surfactants. Also, capacity factor (\(k'\)) and selectivity factor (\(\alpha\)) of separated PAHs that were separated using poly-SUS, poly-SUG and poly-SUCG were compared.

1. INTRODUCTION

Micellar electrokinetic chromatography (MEKC) using conventional micelles such as sodium dodecyl sulfate (SDS) have been reported on many occasions to be well suited for the separation of relatively hydrophilic and polar compounds [1, 2]. However, separation of highly hydrophobic polycyclic aromatic hydrocarbons (PAHs) using SDS alone as a single pseudostationary phase is very difficult due to the strong hydrophobic interaction between PAHs and SDS [3]. Thus, polymeric surfactants are employed for the separation because they provide several potential advantages over the use of conventional micelles. First, they have no critical micelle concentrations (CMC), thus they can be effective as pseudostationary phases at low concentrations below the normal CMC of the monomer in order to prevent Joule heating, which is caused by the rising of temperature inside the capillary [4]. Second, polymers are covalently bonded together, which allow them to remain stable in the presence of high content of organic solvents such as acetonitrile (ACN) [5]. Third, several studies have shown that EKC with polymeric surfactants offers a wider elution window (\(t_{MC}/t_0\)), resulting in higher peak capacity

\(^{1}\) Abbreviations: poly-SOcS, poly(sodium 7-octenyl sulfate); poly-SNoS, poly(sodium 8-noneny1 sulfate); poly-SDeS, poly(sodium 9-decenyl sulfate); poly-SUS, poly(sodium 10-undecenyl sulfate).
[4]. Therefore, polymeric surfactants, such as poly-SUG, poly-SUCG, poly-SOcS, poly-SNoS, poly-SDeS and poly-SUS, have been investigated as alternative pseudostationary phases over SDS in MEKC for separations of highly hydrophobic PAHs.

The present studies compare the separation capability of poly-SUG, poly-SUCG, poly-SOcS, poly-SNoS, poly-SDeS and poly-SUS for EKC separation of 16 PAHs categorized by the U.S. Environmental Protection Agency as priority pollutants. The effect of hydrocarbon chain length of anionic sulfated surfactants (poly-SOcS, poly-SNoS, poly-SDeS and poly-SUS) on retention behavior and peak resolution in EKC was investigated. Also, the retention time ($t_R$), capacity factor ($k'$) and selectivity ($\alpha$) of 16 PAHs that were separated using poly-SUS, poly-SUG and poly-SUCG were calculated for comparison. Migration times of 16 PAHs using poly-SUG were measured at various percentages (30-45% v/v) of ACN so that an optimized ACN concentration could be determined for separation of PAHs using polymeric glycinated surfactants. In addition, application of poly- SUG, poly-SUCG, poly(sodium N-undecenoyl glycyl glycinate) (poly-SUG$_2$) and poly(sodium N-undecenoxy carbonyl glycyl glycinate) (poly-SUCG$_2$) for EKC separation of a test mixture of a series of alkyl aryl ketones (C$_1$-C$_4$, C$_6$-C$_7$, C$_9$, C$_{13}$, C$_{15}$ and C$_{17}$) was investigated in order to determine the migration time of micelles ($t_{MC}$), which was later used for calculations of $k'$ and $\alpha$ of 16 PAHs.

2. EXPERIMENTAL

2.1 Chemicals and reagents

A mixture of 16 polycyclic aromatic hydrocarbons (PAHs), whose structures are shown in the Appendix, was obtained from Aldrich Chemical Co. (Milwaukee, WI). These polycyclic aromatic hydrocarbons include: (1)naphthalene, (2)acenaphthylene, (3)acenaphthene, (4)fluorene, (5)phenanthrene, (6)anthracene, (7)fluoranthenone, (8)pyrene, (9)benz[a]-anthracene, (10)chrysene, (11)benzo [b]fluoranthene, (12)benzo[k]fluoranthene, (13)benzo-[a]pyrene,
(14)dibenz-\([a,h]\)anthracene, (15)benzo\([ghi]\)perylene, and (16)indenol\([1,2,3-cd]\)pyrene. The
detailed synthesis and polymerization of polymeric glycinated surfactants (poly- SUG, poly-
SUCG, poly-SUG\(_2\) and poly-SUCG\(_2\)) and sulfated surfactants (poly-SOcS, poly-SNoS, poly-
SDeS and poly-SUS) were reported elsewhere [5, 6]. Schematics of the synthesis of the four
anionic sulfated surfactants and the polymeric glycinated surfactants are shown in Figure 1 and
Figure 2, respectively. A series of 11 ketones that was used as a test mixture was also obtained
from Aldrich Chemical Co. (Milwaukee, WI). These ketones are (1) C\(_1\)-acetophenone, (2) C\(_2-
propiophenone, (3) C\(_3\)-butyrophenone, (4) C\(_4\)-valerophenone, (5) C\(_5\)-heptanophenone, (6) C\(_7-
octanophenone, (7) C\(_9\)-decanophenone, (8) C\(_{11}\)-dodecanophenone, (9) C\(_{13}\)-tetradecanophenone,
(10) C\(_{15}\)-hexanophenone, and (11) C\(_{17}\)-octadecanophenone. HPLC grade acetonitrile (ACN) was
obtained from Burdick and Jackson (Muskegon, MI). Disodium tetraborate (Na\(_2\)B\(_4\)O\(_7\)) and
disodium hydrogen phosphate (Na\(_2\)HPO\(_4\)) were of analytical grade and were purchased from EM
Science (Gibbstown, NJ).

2.2 Instrumentation [4]

A Beckman (Fullerton, CA) P/ACE model 5510 capillary electrophoresis (CE)
instrument was employed in EKC separation of PAHs. This CE instrument was equipped with
(1) a 21-position inlet and 10-position outlet sample carousels for automatic sample/buffer change, (2) a 0-30-kV high-voltage built-in power supply, (3) 200-, 214-, 254-, and 280-nm
selectable wavelength filters for UV detection, (4) a liquid thermostated capillary cartridge
(capillary 50 \(\mu\)m i.d. \(\times\) 375 \(\mu\)m o.d. \(\times\) 47 cm total length, 40 cm to the detector), and (5) software
System Gold for system control and data handling. The capillary in the Beckman instrument was
thermostated by use of a fluoroorganic fluid. The detector time constant was 0.2 s.
2.3 Capillary Electrophoresis Procedure [4]

All new capillaries were prepared by use of a standard wash cycle of 1 M NaOH for 1 h before use. Each day, operation was started by purging the capillary with 1 M NaOH (15 min), triply deionized water (2 min), and the running EKC buffer (10 min). Prerun rinsing consisted of 3.0 min of the EKC buffer. Unless otherwise noted, the time for pressure injection was 3 s for most separations. Postrun rinse consisted of a 2.0-min flush with 0.5 M NaOH. These procedures resulted in improved peak shapes, minimized analyte adsorption on the capillary wall, and a good migration time reproducibility range of 2.0-2.5% RSD, n = 3.

2.4 Preparation of EKC Buffers and Standard Solutions

For all EKC experiments, the final background electrolyte (BGE) consisted of 12.5 mM each of Na₂HPO₄ and Na₂B₄O₇ in a solution mixture buffered at pH 9.2, 0.5% (w/v) of each polymeric surfactant and 40% ACN (v/v) [4] (one exception to this was when poly-SUG was used at various percentages (30-45% v/v) of ACN so that an optimized ACN percentage could be determined for separation of PAHs in polymeric glycinated surfactants). The final volume of BGE was then adjusted with triply deionized water. After a thorough mixing in a sonicator for about 5 min, BGE was filtered through a 0.45-μm syringe filter (Nalgene, Rochester, NY) by creating a vacuum inside the syringe. It was then degassed for 2 min using the same sonicator. Exactly 200μL of the PAHs mixture were diluted in 80/20 (v/v) ACN/H₂O before injection.

2.5 Safety Precautions [4]

Transfer of PAHs mixture from the reagent bottle into a small vial and dilution of the stock mixture were performed in a ventilated hood. The PAHs mixture was stored in a closed container in a refrigerator. Disposable latex gloves were worn and care was taken to dispose of PAH waste solutions appropriately.
2.6 Calculations [4]

The capacity factor, $k'$, of a neutral solute was calculated according to the formula

$$k' = (t_r - t_0)/t_0(1 - t_{mc}/t_{mc}),$$

where $t_R$ is the migration time of a neutral retained analyte, $t_0$ is the migration time of a neutral unretained analyte, and $t_{MC}$ is the migration time of the micelles. The void time, $t_0$, was determined by a first solvent disturbance due to a refractive index change, which was also known as electroosmotic flow (EOF) in capillary electrophoresis (CE). The value of $t_{MC}$ was determined by using the procedure proposed for a series of homologous compounds by Bushey and Jorgenson [7]. This procedure consists of five steps: (1) migration times of a homologous series of alkyl aryl ketones ($C_1$-$C_4$, $C_6$-$C_7$, $C_9$, $C_{13}$, $C_{15}$ and $C_{17}$) were measured at 40% (v/v) of ACN; (2) using the longest migration time of $C_{17}$ phenone as a measured (assumed) $t_{MC}$ value, the $k'$ values of all phenones were calculated using the above-mentioned equation; (3) from the plot of log $k'$ versus the carbon number, a new $k'$ value for $C_{17}$ phenone was calculated; (4) a new $t_{mc}$ was then found by rearranging the above equation and substituting the values of new $k'$ and measured $t_R$ for the $C_{17}$ phenone; (5) all $k'$ values were recalculated, and the procedure was reiterated, using Microsoft Excel Spreadsheet for convenience, until the $t_{MC}$ converged to a value less than 0.1% from its previous iteration. Selectivity factor, $\alpha$, between two peaks, was calculated from the capacity factor values of the two peaks according to the equation:

$$\alpha = k_B / k_A,$$

and the peak resolution ($R_s$) was calculated using the equation:

$$R_s = [(t_R)_B - (t_R)_A/(t_R)_B] \times \frac{1}{4} \sqrt{N},$$

where $N$ was the efficiency that was analyzed automatically by the instrument used.

3. RESULTS AND DISCUSSION

Priority polycyclic aromatic hydrocarbon pollutants (PAHs), whose chemical structures are shown in the Appendix, can be characterized as ubiquitous organic pollutants with at least
two aromatic rings in their basic structure [4]. These PAHs are widely distributed in the environment due to incomplete combustion processes [8]. Because the solubility of most of the PAHs in a purely aqueous micellar solution is poor, owing to the strong hydrophobic properties of PAHs, a significant percentage of acetonitrile (ACN) was added as an organic modifier to the BGE containing each polymeric sulfated surfactant for PAHs separation [4].

3.1 Effect of Hydrocarbon Chain Length of Polymeric Anionic Sulfated Surfactants (poly-SOcS, poly-SNoS, poly-SDeS and poly-SUS) on Retention Behavior and Peak Resolution

In order to understand the mechanisms of PAHs interaction with the four polymeric pseudostationary phases, the retention behavior and resolution of 16 PAHs with widely different hydrophobic properties were studied. Four micellar electrokinetic chromatograms of 16 PAHs are depicted in Figure 3, and the identities of these 16 PAHs solutes are listed in Table 1 along with their (A) migration times and (B) peak resolution. Some changes in retention time were observed. For example, as shown in Table 1A, indeno[1,2,3,c,d]pyrene (solute 16) retained longer as the carbon chain lengths of polymeric sulfated surfactants increased. In other words, the longer the carbon chain length of the surfactant, the longer was the retention of hydrophobic solutes. This effect could be due to an increase of hydrophobicity of surfactants as a carbon was added to the chain length, and more hydrophobicity surfactants resulted in stronger interaction between the surfactants and the solutes. Some changes were also observed in the peak resolution of PAHs. For example, as shown in Table 2A, acenaphthylene, acenaphthene and fluorene (solutes 2, 3, and 4, respectively) were not resolved in poly-SOcS and only partially resolved in poly-SNoS, however they were fairly resolved in poly-SDeS and well resolved in poly-SUS. The same was true for solute pair 6/5 (anthracene/phenanthrene) as well as the pairs 10/9 (chrysene/ benz[a]anthracene) and 12/11 (benzo[k]fluoranthene/benzo[b]fluoranthene). Figure 3
also demonstrated this effect of resolution as a surfactant with a longer carbon-chain length was applied to the separation of PAHs.

3.2 Effect of poly-SUS, poly-SUG and poly-SUCG on retention time ($t_R$), capacity factor ($k'$), and selectivity ($\alpha$) of 16 PAHs

In order to understand the mechanisms of PAHs interaction with poly-SUS (a polymeric sulfated surfactant) and two polymeric glycinated surfactants, poly-SUG and poly-SUCG, the retention time ($t_R$), capacity factor ($k'$) and selectivity ($\alpha$) of 16 PAHs were studied.

The chemical structures of poly SUS, poly-SUG and poly-SUCG are shown in Figure 1 and Figure 2. Figure 4 demonstrates the effect of ACN on the separation of 16 PAHs in poly-SUG. Similar to the optimized ACN amount required for the sulfated surfactants such as poly-SUS, 40% ACN is also found to be the optimized percentage for glycinated surfactants. The $k'$ values of PAHs were calculated using the $t_{MC}$ values of the ketones (see Table 2). Electropherograms showing the separation of ketones are displayed in the Appendix. Three electrokinetic chromatograms for the separation of 16 PAHs in poly-SUS, poly-SUG and poly-SUCG are depicted in Figure 5 and the values of $t_R$, $k'$ and $\alpha$ are listed in Table 3 (A-C). Some changes in $t_R$ were observed. For example, as shown in Table 3A, the $t_R$ of PAHs in poly-SUCG surfactant system were shorter than those in the poly-SUS surfactant system despite the fact that the carbon chain length of poly-SUCG was equal to that of the poly-SUS (see Figure 1 & 2). This effect could be due to the difference between sulfated and glycinated head groups of the two surfactants, causing poly-SUS to become more hydrophobic than poly-SUCG; thus, there was stronger interaction between solutes and surfactants in poly-SUS than in poly-SUCG. As expected, the retention times of PAHs in poly-SUG were the shortest of all due to the shorter carbon chain length and the more hydrophilic head group of poly-SUG. In terms of capacity factor ($k'$), separation of PAHs in poly-SUS possessed the highest values of all (see Table 3B).
Some selectivity differences between the three polymeric surfactants were also observed. For example, as shown in Table 3C, the selectivity factor \( (\alpha = k'_{B}/k'_{A}) \) between solute 3 (acenaphthene) and solute 2 (acenaphthylene) was found to be 1.13, 1.00 and 1.23 in poly-SUS, poly-SUG and poly-SUCG, respectively. An \( \alpha \) value of 1.00 indicated that solute 3 and 2 eluted together in poly-SUG. The same was true for the selectivity factor between solutes 6 and 5 and solutes 12 and 11 (see Table 3C). There were also cases where two solutes eluted together in both poly-SUG and poly-SUCG. One example was shown by the selectivity factor between solute 10 and 9 in Table 3C. Figure 5 also demonstrated this effect.

4. CONCLUSIONS

The effect of hydrocarbon chain length of polymeric anionic sulfated surfactants with 8-, 9-, 10-, and 11- carbon chains (poly-SOcS, poly-SNoS, poly-SDeS and poly-SUS, respectively) on retention behavior and peak resolution (R\( \text{s} \)) of the 16 PAHs indicates that the poly-SAIS surfactant with a shorter hydrocarbon tail (e.g. poly-SOcS) shows a more polar character than that with a longer hydrocarbon tail (e.g. poly-SUS). After all, hydrophobic interaction between solutes and surfactants plays an important role in the retention time, resolution, capacity factor and selectivity factor of solutes in EKC as seen in the electrokinetic chromatograms of 16 PAHs in varied surfactant systems. Poly-SOcS surfactant, which is the least hydrophobic of all surfactants used, provides the fastest separation of 16 PAHs, however the trade off is lower resolution and lower selectivity factor.
References


Table 1

The effect of hydrocarbon chain length of polymeric anionic sulfated surfactants with 8-, 9-, 10-, and 11- carbon chains (poly-SOcS, poly-SNoS, poly-SDeS and poly-SUS, respectively) on (A) retention behavior and (B) peak resolution (Rs) of 16 PAHs

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<td>Acenaphthene</td>
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<td>8.47</td>
<td>9.32</td>
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<td>Fluorene</td>
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<td>8.79</td>
<td>9.82</td>
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<td>Phenanthrene</td>
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<td>9.94</td>
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<td>9.28</td>
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<td>Fluoranthene</td>
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<td>9.98</td>
<td>10.78</td>
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<td>Benz[a]anthracene</td>
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<td>11.58</td>
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Table 2

Data showing $t_{MC}$ values (from the separation of 11 ketones) and the effect of poly-SUS, poly-SUG, poly-SUCG, poly-SUG$_2$ and poly-SUCG$_2$ on the elution window ($t_{MC}/t_0$) in EKC.

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Table 3

The effect of poly-SUS, poly-SUG and poly-SUCG on (A) migration time ($t_R$), (B) capacity factor ($k'$), and (C) selectivity factor ($\alpha$) of 16 PAHs.

<table>
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<th>Migration Time ($t_R$) of PAHs</th>
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### Capacity Factor (k') of PAHs

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### Selectivity (α) of PAHs

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FIGURE CAPTIONS

Figure 1. Scheme for polymerization of sodium alkenyl sulfate (SAIS) surfactants. N represents the number of repeating units (aggregation number) of the monomeric SAIS surfactants. The length of alkenyl hydrocarbon chain is represented by n, where n is 1, 2, 3, and 4 for SOcS, SNoS, SDeS, and SUS, respectively.

Figure 2. Scheme for polymerization of glycinated surfactants (poly-SUG, poly-SUCG, poly-SUG2 and poly-SUCG2). X represents the type of head group of glycinated surfactant, R represents the hydrocarbon chain length and n represents the degree of polymerization.

Figure 3. Comparison of (A) poly-SOcS, (B) poly-SNoS, (C) poly-SDeS, and (D) poly-SUS for separation of 16 PAHs. EKC separation conditions: 0.5% w/v each surfactant in 12.5mM phosphate-borate buffer (pH 9.2); 40% acetonitrile (ACN); pressure injection, 80 psi for 3 s; applied voltage, +20kV; temperature, 25°C; UV detection, 214nm. Peak identifications are same as shown in Table 1.

Figure 4. Electropherograms showing the effect of acetonitrile (ACN) on separation of 16 PAHs using poly- SUG surfactant. EKC separation conditions: 0.5% w/v surfactant in 12.5mM phosphate-borate buffer (pH 9.2); pressure injection, 80 psi for 3 s; applied voltage, +20kV; temperature, 25°C; UV detection, 214nm. Peak identifications are same as shown in Table 1.

Figure 5. Comparison of (A) poly-SUS, (B) poly- SUG, and (C) poly-SUCG for separation of 16 PAHs. EKC separation conditions: 0.5% w/v each surfactant in 12.5mM phosphate-borate buffer (pH 9.2); 40% acetonitrile (ACN); pressure injection, 80 psi for 3 s; applied voltage, +20kV; temperature, 25°C; UV detection, 214nm. Peak identifications are same as shown in Table 1.
$n = 1 - 4$

\[\text{Co irradiation/30 hrs} \rightarrow \text{8 Mrad/hr}\]

Figure 1
Figure 2

$$X = 1 = \text{Glycine}$$
$$X = 2 = \text{Glycyl glycine}$$
$$X = 3 = \text{Glycyl glycyl glycine}$$
$$X = 4 = \text{Glycyl glycyl glycyl glycine}$$

$$n = \text{degree of polymerization}$$

$$X = 1 = \text{polysodium N-undecenoyl glycinate (poly-SUG)}$$
$$X = 2 = \text{polysodium N-undecenoyl glycyl glycinate (poly-SUG}_2)$$

$$R = C_9H_{18}$$

$$n = \text{degree of polymerization}$$

$$X = 1 = \text{polysodium N-undecenoyl carbonyl glycinate (poly-SUGC)}$$
$$X = 2 = \text{polysodium N-undecenacyl carbonyl glycyl glycinate (poly-SUGC}_2)$$
Figure 4

30% ACN

35% ACN

40% ACN

45% ACN
Figure 5

A

Time: 9.000 Minutes  Amp: 0.002517 AU

B

Time: 6.500 Minutes  Amp: 0.006533 AU

C

Time: 6.500 Minutes  Amp: 0.004165 AU
APPENDIX

- Structures of the 16 priority polycyclic aromatic hydrocarbon pollutants (PAHs):

1. Naphthalene (NAPH)
2. Acenaphthylene (ACY)
3. Acenaphthene (ACE)
4. Fluorene (FLU)
5. Phenanthrene (PHEN)
6. Anthracene (ANTH)
7. Fluoranthene (FLT)
8. Pyrene (PYR)
9. Benz[a]anthracene (BaA)
10. Chrysene (CHRY)
11. Benzo[b]fluoranthene (BbF)
12. Benzo[k]fluoranthene (BkF)
13. Benzo[a]pyrene (BaP)
14. Dibenz[ah]anthracene (DIBahA)
15. Benzo[ghi]perylenne (BghiP)
16. Indeno[123cd]pyrene (INPV)
Comparison of (A) poly-SUS, (B) poly-SUG, (C) poly-SUCG, (D) poly-SUG₂, and (E) poly-SUCG₂ for separation of a test mixture of 11 ketones. EKC separation conditions: 0.5% w/v each surfactant in 12.5mM phosphate-borate buffer (pH 9.2); 40% acetonitrile (ACN); pressure injection, 80 psi for 3 s; applied voltage, +20kV; temperature, 25°C; UV detection, 214nm. Peak identifications are same as described in Experimental Section 2.1.

- **A**: Time: 6.000 Minutes. Aemp: 0.000170 AU
- **B**: Time: 6.000 Minutes. Aemp: 0.007322 AU. 11 → C₁₇ = 15.7 min.
- **C**: EOF +1 Time: 6.000 Minutes. Aemp: 0.000051 AU. 10 → C₁₅ = 16.5 min. 11 → C₁₇ = 20.0 min.
- **D**: Time: 6.000 Minutes. Aemp: 0.000245 AU. 11 → C₁₇ = 14.8 min.
- **E**: Time: 6.000 Minutes. Aemp: 0.000171 AU. 11 → C₁₇ = 15.7 min.

Peak identifications:
- **A**: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
- **B**: 1, 2, 3, 4, 5, 6+7, 8, 9, 10
- **C**: 2+3+4, 5, 6, 7, 8, 9
- **D**: 2+3+4, 5, 6+7, 8, 9, 10
- **E**: 1, 2, 3, 4, 5, 6+7, 8, 9, 10, 11
Inhibition Studies of Flavin-Dependent Choline Oxidase

Part II: Tetranitromethane

Submitted by:

Thuy-Trang Hoang
SSN: 255918126
Department of Chemistry
Georgia State University

For Chem4160 in Summer 2004 semester
(CNR #: 52582. Credit Hours: 2)

Advisor:

Dr. Giovanni Gadda
Department of Chemistry and Biology
The Center for Biotechnology and Drug Design
Georgia State University

Author

Advisor

Date
Abstract

Flavin-dependent choline oxidase is capable catalyzing four-electron oxidation of choline into glycine-betaine with betaine aldehyde as the intermediate. Molecular oxygen is used as the final electron acceptor. This enzyme has no 3-D structure available. Therefore, chemical modification with specific reagents was used to investigate the involvement of specific amino acid residues in catalysis. In previous report, six reagents were tested for inhibition effect on choline oxidase, including 2-hydrazino-N,N,N-trimethyl-2-oxo-ethanaminium chloride, trans-2-phenylcyclopropylamine, isonicotinic acid, phenylhydrazine, 3-dimethylamino-1-propyne, and allyltrimethylammonium chloride, but only phenylhydrazine was the most effective inhibitor for choline oxidase. In recent research, one more reagent, tetranitromethane (TNM), was found to inactivate the enzyme significantly. Tetranitromethane inactivated the enzyme with a first-order rate constant, $k_{\text{inact}}$, of $0.324 \pm 0.005 \text{ h}^{-1}$ and equilibrium constant, $K_I$, of $0.66 \pm 0.04 \text{ mM}$. The enzyme was modified irreversibly in the active site by TNM. The residue that got modified was tyrosine, which absorbed light at 350 nm.

Introduction

Choline oxidase (CHO; E.C. 1.1.3.17) has been found to be a dimer with molecular weight of 60,600 Daltons that is capable of converting choline to glycine betaine through four-electron oxidation with betaine aldehyde as the intermediate (1, 2, Scheme 1).

![Scheme 1: Choline Oxidation](image-url)
Recently, the product of choline oxidase catalysis, glycine betaine, was found in bacterial and plants in response to water deficit or salt stress environment. This prompts the interest to research on betaine biosynthesis to genetically engineer water/osmotic stress resistance to beneficial bacterial and crop plants (10-16). However, choline oxidase has no 3-D structure available, so it is necessary to rely on chemical modification using specific reagents to investigate the involvement of specific amino acid in the catalysis.

Choline oxidase was expressed in *Escheria coli* and then purified. The encoding gene was cloned from *A. globiformis* genomic DNA, code A gene. Seven reagents, 2-hydazino-N,N,N-trimethyl-2-oxo-ethanaminium chloride, trans-2-phenylecyclopropylamine, isonicotinic acid, phenylhydrazine, 3-dimethylamino-1-propyne, allyltrimethylammonium chloride, and tetranitromethane, were tested as inhibitors, but only phenylhydrazine and tetranitromethane inactivated choline oxidase with a significant rate. Results obtained for phenylhydrazine was reported in Part I of the paper, this part of the study would focus mainly on the modification of choline oxidase by tetranitromethane using similar kinetic and spectrophotometric techniques.

**Materials and Methods**

**Materials**

Choline chloride was from INC Pharmaceutical. Tetranitromethane and choline oxidase from *A. globiformis* were also from Sigma-Aldrich. Stock solution of choline oxidase was in 20 mM Tris-Cl buffer, pH 8, and stored at -20 °C. The concentration of choline oxidase was determined by Agilent Technologies dioded-array spectrophotometer Model HP 8453, at 454 nm with $\varepsilon_{454} = 11,300 \text{ M}^{-1} \text{ cm}^{-1}$. All other reagents were of the highest purity.
Methods

Samples of stock choline oxidase were incubated with different concentrations of the tetrnutromethane in 20 mM Tris-Cl pH 8, at 20 °C. Enzyme activity of each sample was measured over time in air-saturated buffer by monitoring the rate of oxygen consumption with a computer-interfaced Hansatech oxygen monitoring system thermostated at 25 °C. For each activity assay, 3-20 μL of incubated enzyme was added into the oxygen electrode, which would be containing a mixture of 50 mM potassium phosphate, 10 mM choline chloride, and water. Stock solution of choline, the substrate, was prepared in 100 mM potassium phosphate, pH 7. Stock solution of TNM was prepared in 100% ethanol right before every experiment in such concentration that no more than 10% ethanol would be added into the reaction mixture. The modification process was observed over time through UV-Visible absorbance spectra that recorded on a Hewlett-Packard model HP 8453 spectrophotometer.

Data Analysis

Time course of inactivation of choline oxidase by TNM was analyzed by fitting the residual activity (A) at a given time (t) to eq 1, which is also known as single exponential equation, on a log scale of y-axis. A₀ is the initial activity and k_{obs} is the observed rate of the inactivation. The rates of inactivation of the enzyme were fit to eq 2, where k_{inact} is the first-order rate constant for the conversion of the reversible formed enzyme-inhibitor complex to irreversibly inactivated enzyme, K₁ is the dissociation constant of tetrnutromethane.

\[ A = A_0 e^{-k_{obs}} \]  
\[ k_{obs} = \frac{k_{inact}[I]}{[I]+K_1} \]
Results and Discussion

Due to limited solubility of TNM plus enzyme instability in certain concentration of ethanol, stock solution for TNM has to be prepared in such a way that it can be soluble in the incubation mixture, yet would not effect the enzyme stability. It is commercially indicated that most enzyme will not stable in the solution that exceed 5% of ethanol concentration. This has limited the concentration of TNM that can be used for the experiments. So, enzyme stability was tested in an incubation mixture that already have 10% ethanol. As, show in Figure 1, choline oxidase was very stable in such ethanol concentration. So, later experiments with TNM were carried out ranging from 0.2-10% ethanol concentrations.

*Inactivation of choline oxidase with TNM.* Incubation of choline oxidase with TNM showed a significant loss of enzymatic activity over time. Selected data was showed in Figure 2. According to plot A, the inactivation occurred at two different rate; first rate was fast that happened within the first minute of incubation, and the other one was much slower and measurable. Both rates was time and concentration dependent. The addition of glycine betaine protected the enzyme from inactivation indicating TNM must inactivate CHO by binding to the active site (Figure 2, Plot C). A saturation curve was observed in the secondary plot of the observed rate of inactivation as the function of the concentration of tetranitromethane. This indicates the inactivation was following first-order kinetic, so the data was fit with eq 2 to give a $k_{inact}$ value of 0.324 +/-0.005 h$^{-1}$, and a dissociation rate constant, $K_I$, of 0.66 +/- 0.04 mM. The curve was presented with error bar at some the points because the techniques used was not sensitive enough to
detect the exact inactivation rate, so several experiments were repeated for the same $k_{\text{obs}}$
value in order to obtain precise results.

The question of whether the binding of TNM to the enzyme reversible or
irreversible was also answered in another experiment. An aliquote of choline oxidase
was incubated with 5 mM phenylhydrazine in 10% ethanol until the activity reduced to
35% then it was gel filtrated to get rid of excess TNM in the sample. The modified
choline oxidase was collected and was continued with incubation. Figure 3 showed the
activity data obtained before and after the gel filtration. According to plot B, the percent
activity stayed close to where the reading was stopped before gel filtration for as long as
5 hours of incubation. Therefore, TNM must have bound to the enzyme irreversibly.

The sample of modified enzyme from the experiment in the paragraph above was
separated from excess TNM using gel filtration. The collected sample was used in
apparent kinetic experiment to see if the modified enzyme is still capable of catalyzing
reaction or it is completely inhibited. The results obtained showed in Figure 4 as
compared to the apparent kinetic of the native enzyme from previous experiment. After
gel filtration, the apparent kinetic experiment gave a $k_{\text{cat}}$ value of 7.566 s$^{-1}$, which is 40%
of native choline oxidase $k_{\text{cat}}$ (Figure 4). This is very close to 35% residual activity
reading right before gel filtration. $K_m$ value, on the other hand, remains almost consistent
with the $K_m$ of native enzyme. Since, $k_{\text{cat}}$ dependents on the concentration of active
enzyme and $K_m$ dependents on the concentration of the substrate, such information
obtained from this experiment indicated that the modified enzyme remained active and
the unmodified enzyme were still active; in other words, once being modified by TNM,
choline oxidase was completely inactivated.
TNM was also tested as a substrate. No oxygen consumption was observed when TNM was added into the reaction mixture containing choline oxidase at pH 7 and 25 °C. This indicates that TNM is not a substrate of the enzyme.

*Properties of Choline Oxidase inactivated with TNM.* Tetranitromethane was known as a very effective reagent that modified tyrosine residue in enzyme through nitrination process. The mechanism was represented in the model below (17).

\[
\text{XPhO}^- + \text{TNM} \quad \xrightarrow{\text{Charge-Transfer Complex}} \quad \text{rate-determining}
\]

\[
\text{NO}_2\text{XPHO}^- \quad \xleftarrow{[\text{XPhO}^- + \text{NO}_2^-]} \quad \text{C(NO}_2^3\text{)} + \quad \text{nitroformate anion}
\]

\[
\downarrow
\]

\[
\text{XPhO}^- + \text{NO}_2^-
\]

When TNM reacts with a tyrosyl residue, it will loose a nitro group and form a nitroformate anion. This nitro group will either bind to the tyrosine or become a radical in the solution. The modified tyrosine absorbs at 350 nm with an extinction coefficient of 14,000 M\(^{-1}\) cm\(^{-1}\).

In order to see if choline oxidase was inactivated by TNM due to the modification of tyrosyl residue in the enzyme active site, a sample of 18 μM choline oxidase was incubated with 8 mM TNM in 10% ethanol and 20 mM Tris-Cl, pH 8, at 20 °C in the presence and absence of glycine betaine. The sample without glycine betaine at the end of 6 ½ hours of incubation had 14% residual activity, and the sample with glycine betaine was fully protected from inactivation. Both sample were gel filtrated to get rid of
excess TNM. Spectrophotometer was used to take the spectra of each sample. The spectra was compared to spectra of native enzyme after the enzyme concentration and absorbance at 800 nm normalized. The results showed a large peak at 350 nm and a significant different in absorbance between the two sample of modified enzyme in the presence and absence of glycine betaine (Figure 5). Through quantitative analysis using the different-absorbance of each spectra and the extinction coefficient at 350 nm, there was 23 tyrosyl residues was modified in the absence of glycine betaine and 8 tyrosyl residues in the presence of glycine betaine was modified. The different was 5 residues, this means that there must be at least 5 tyrosine present in choline oxidase active site. However, these numbers might not be real due to the sensitivity of the UV-vis absorbance spectrophotometer used. So the only conclusion can be draw from this part of the research is that the inactivation of choline oxidase by TNM was due to the modification of the tyrosine in the enzyme active site.

**Conclusions**

Tetranitromethane inactivated choline oxidase dependent on both time and inhibitor concentration. Glycine betaine protected choline oxidase from inactivation by TNM indicating that TNM inactivate the enzyme by binding in the active site. The modification of the enzyme by TNM is irreversible and the site of modification was, but not limited to tyrosine. Once being modified, choline oxidase is completely inactivated. TNM is not a substrate of choline oxidase. For future plans, the properties of choline oxidase inactivated by TNM will be study using spectrophotometric technique. Amount of tyrosine modification in the active site of choline oxidase will be investigated using tryptic digestion, peptide mapping, spectrometric analysis.
Acknowledgment

I thank all the lab members for all the help and support. I thank the Grant PRF #37351-G4 Funds for A.C.S., the Research Initiation Grant of Georgia State University, the National Institute of Health and the National Institute of General Medicine, and McNair Post-Baccalaureate Achievement Program for the funding that makes my research possible.

References

12. K.O. Holmstrom, S. Somersalo, A. Mandal, T.E. Palva, B. Welin,


Figure 1. CHO stability in 10% EtOH and ~20 mM Tris-Cl, pH 8, at 20 oC; $k_{obs} = \sim 0$ min$^{-1}$. 
Figure 2. Inactivation of CHO at 7.3 μM by TNM in 20 mM Tris-Cl, pH 8, at 20 °C. (A) Kinetic data that showed two different inactivation rates of CHO by TNM: one was really fast and unmeasurable and one was slow that dependent on both time and concentration of the inhibitor; the concentration of TNM were (●) 0.5 mM,
(○) 1.0 mM, (◆) 4 mM, and (◇) 5 mM. (B) Secondary plot with the observed rate as a function of the concentration of TNM gave a first-order rate constant, \( k_{\text{inact}} \), of 0.324 +/- 0.005 h\(^{-1}\) and an equilibrium constant, \( K_I = 0.66 +/- 0.04 \) mM. (C) In the presence of glycine betaine, CHO was fully protected from the inactivation of 5 mM TNM.
Figure 3. Kinetic data that showed irreversible binding of TNM to CHO active site. (A) CHO at 29 μM incubated in 5 mM TNM, 10% ethanol, and ~20 mM Tris-Cl, pH 8, at 20 °C; last activity reading was 35%; $k_{obs} = 0.00192$ min$^{-1}$. (B) After gel filtration, enzyme activity did not increase indicating irreversibility binding of TNM in the active site of CHO; $k_{obs} = 0.0002$ min$^{-1}$. 
Figure 4. Apparent kinetic of native CHO and TNM-modified CHO (used the incubated sample that was represented in figure 3) in 50 mM Kpi, pH 7; (○) native CHO with $k_{\text{cat}} = 18.641$ s$^{-1}$ and $K_m = 0.6311$ mM; (●) TNM-modified CHO with $k_{\text{cat}} = 7.5661$ s$^{-1}$ and $K_m = 0.6097$ mM.
Figure 5. (A) Spectra of native CHO and TNM-modified CHO in the presence and absence of glycine betaine. (B) Difference in absorbance between native CHO and TNM-modified CHO in the presence and absence of glycine betaine; the peak showed in solid line absorbed at 4.0006 units, and the peak in dots absorbed at 4.7634 units.
Synthesis of Guanidines, Reversed Amidines, Amidines in the 2,5-Diarylfuran Series As Antimicrobial Agents

Phanneth Som, Chad E. Stephens, David W. Boykin

Georgia State University Chemistry Department

graduated with distinction
Introduction:

Leishmania spp. (Leishmaniasis) is a parasite that is known to infect humans, dogs, rodents and other vertebrates.\(^{(a)}\) The carrier (a sand fly) will transmit the parasite to the host (human) by biting the host and injecting promastigotes and then the promastigotes will enter the host’s cells and change into another form called amastigote.\(^{(a)}\) Once the amastigote has entered the cells it will reproduce asexually in the host’s gut and will eventually kill the cell and be released from the cell to venture out and infect other cells.\(^{(a)}\)

Leishmania can cause different diseases (cutaneous, mucocutaneous, and visceral) in humans.\(^{(b)}\) Cutaneous leishmaniasis causes oriental sores, Jericho boil, Aleppo boil, or many other forms of skin ulcers.\(^{(a)}\) There is diffuse cutaneous leishmaniasis, which is the most common type of leishmania.\(^{(a)}\) Visceral leishmaniasis occurs in the visceral organs (liver, spleen, or bone marrow) and can cause Kala-azar or Dum-Dum fever.\(^{(a)}\) If visceral leishmaniasis is left untreated it is fatal in 90% of its cases\(^{2}\), while the Kala-azar form of visceral leishmaniasis has a mortality rate of 100% if left untreated.\(^{(b)}\) The third type of Leishmania is mucocutaneous leishmaniasis, which infects the mucous membranes of the nose, mouth, and throat cavities. This type of leishmaniasis can also lead to high rates of mortality if left untreated.

Leishmaniasis is endemic to 88 countries in Africa, Asia, Europe, and South America, and within these countries there are 350 million people at risk of being infected.\(^{(c)}\) Worldwide it is estimated that around 12 million people are currently infected with leishmaniasis and there are around 2 million new cases of leishmaniasis per year.\(^{(b)}\) Chemotherapy still remains the most effective method of controlling the disease. However, the drugs that are currently used show high levels of toxicities and the disease can develop resistance to the treatment. This leaves the desire to obtain a drug that will be more effective and against this disease. This paper discusses the proposed synthesis of some compounds that could possibly be more effective and have a lower level of toxicity.
The compounds in Figure 1 with the different substituents on the phenyl rings have previously been synthesized and have shown good biological activity against leishmaniasis (IC$_{50}$ < 1 µg/mL against L. donovani). Upon testing these compounds, the chlorine substituted derivative showed a lower level of toxicity than the methyl substituted compound. These phenyl substituted compounds clearly showed more interesting activity than the non-substituted derivatives. Based on these findings, we are now interested in synthesizing the reverse diamidine and diguanidine compounds with chlorine, methyl, or phenyl substituents attached to the furan ring instead of the phenyls (Figure 2). This has yet to have been done and different methods will be employed in order to make an attempt at obtaining the desired compounds.

Figure 1: Structures of Leishmaniasis–active guanidines (1A, 1B) and reversed amidines (2A, 2B).

![Figure 1](image_url)

Figure 2: Structures of proposed furan-substituted guanidines and reversed amidines.

![Figure 2](image_url)
Discussion:

**Scheme 1** shows the synthesis of the phenyl-substituted compounds 3 and 4. First, 1-(4-Bromophenyl)-3-phenylpropenone (compound 9) was made from 4-bromoacetophenone and benzaldehyde using NaOH, EtOH, and H₂O, which is a very high yielding reaction. Using TEA and a 3-ethyl-5-(2-hydroxyethyl)-4-methylthiazolium bromide, 4-bromobenzaldehyde was reacted with 1-(4-Bromophenyl)-3-phenylpropenone to obtain 1,4-Bis(4-bromophenyl)-2-phenylbutane-1,4-dione (compound 10), which is a 1,4-diketone with a phenyl ring branching off the 2 position and is high yielding. Upon treating 1,4-Bis(4-bromophenyl)-2-phenylbutane-1,4-dione with Ac₂O and H₂SO₄ the 1,4-diketone was cyclised to give 2,5-Bis(4-bromophenyl)-3-phenylfuran (compound 11), which oiled out and was crystallized by adding EtOH and acetone. Using Pd catalyst and benzophenone imine, and then NH₂OMe, the bromos were replaced with aminos to give 2,5-Bis(4-aminophenyl)-3-phenylfuran (compound 12), following column chromatography. Treating 2,5-Bis(4-aminophenyl)-3-phenylfuran with a thioimidate naphthyl in MeCN and EtOH gave reversed amidine with the 2-pyridyl (compound 3), which oiled and was crystallized from hexanes and ethyl acetate in low yield. Also, treating 2,5-Bis(4-aminophenyl)-3-phenylfuran with S-methyl-dibocthioure, TEA, DMF, and HgCl₂ gave the NBoC derivative (compound 13). Then the NBoC derivative was treated with HCl, CH₂Cl₂, and EtOH to give the final product 2,5-Bis(4-guanidinophenyl)-3-phenylfuran (compound 4), which oiled out and was crystallized and in high yield.
Scheme 1: Synthesis of phenyl-substituted compounds 3 and 4

1. Pd catalyst, benzophenone imine
2. NH₂OMe

11

Br

12

H₂N

NH₂

Boc

NH

Boc

13

Tea, DMF

HgCl₂

10

Ac₂O

H₂SO₄

9

NaOH

EtOH, H₂O

Br

Br

Br

Tea, Thiazolium Catalyst

Br

Br

Br

Br

3

R = 2-pyridyl or phenyl

R

MeCN, EtOH

HCl

CH₂Cl₂, EtOH

H₂N

NH₂
Scheme 2 shows the synthesis of intermediate chloro- and methyl-substituted diamines 17 and 21. First, 1,4-Bis(4-bromophenyl)-butane-1,4-dione (compound 15) can be synthesized using two different methods. The first method is the Stetter approach, which is low yielding but is a one step reaction. Two equivalent amounts of 4-bromobenzaldehyde and divinyl sulfone was reacted using a thiazolium catalyst to give 1,4-Bis(4-bromophenyl)-butane-1,4-dione (compound 15). The second method was reacting bromobenzene and fumaryl chloride in a Friedel-Crafts reaction using AlCl₃ and CS₂, which gave 1,4-Bis(4-bromophenyl)-but-2-ene-1,4-dione (compound 14) in about 50% yield. The double bond of 1,4-Bis(4-bromophenyl)-but-2-ene-1,4-dione was reduced using SnCl₂ in AcOH and EtOH gave 1,4-Bis(4-bromophenyl)-butane-1,4-dione (compound 15), which is a high yielding reaction and crystallized at room temperature. The second method is a two-step approach, but is higher yielding.

Also, 1,4-Bis(4-bromophenyl)-butane-1,4-dione (compound 15) was reacted with Ac₂O and H₂SO₄ to give the 3,4-unsubstituted 2,5-Bis(4-bromophenyl)furan (compound 18), which crystallized at room temperature. The 2,5-Bis(4-bromophenyl)furan was then treated with HBr and paraformaldehyde to give 3,4-Bisbromomethyl-2,5-bis(4-bromophenyl)furan (compound 19), which was then treated with LiAlH₄ to give the dimethylated 2,5-Bis(4-bromophenyl)-3,4-dimethylfuran (compound 20), which was extracted and concentrated to give a solid. 2,5-Bis(4-bromophenyl)-3,4-dimethylfuran was then reacted with Pd catalyst and benzophenone imine first, then with NH₂OMe, which displaced the bromo substituents and replaced them with amino substituents to yield 2,5-Bis(4-aminophenyl)-3,4-dimethylfuran (compound 21), which crystallized from hexanes and ethyl acetate.

The 2,5-Bis(4-bromophenyl)furan (compound 18) is reacted with PCl₅ at 170°C to chlorinate the 3,4-positions of the furan to give compound 16. Compound 16 will then be treated with Pd catalyst and benzophenone imine, and then with NH₂OMe, to replace the bromos with aminos on the phenyl rings to give compound 17.
Scheme 2: Synthesis of intermediate chloro- and methyl-substituted diamines 17 and 21
Scheme 3 shows the synthesis of the chloro-substituted derivatives 7 and 8. 2,5-Bis(4-aminophenyl)-3,4-dichlorofuran (compound 17) was treated with thioimidate naphthyl in MeCN and EtOH to give compound 7 (reversed diamidine). Also, compound 17 was treated with S-methyl-dibocithioureca, TEA, DMF, and HgCl₂ to obtain compound 23, which was then treated with HCl, CH₂Cl₂, and EtOH to obtain the final product 2,5-Bis(4-guanidinophenyl)-3,4-dichlorofuran (compound 8).

Scheme 3: Synthesis of chloro-substituted derivatives 7 and 8

Scheme 4 shows the synthesis of the methyl-substituted derivatives 5 and 6. Compound 21 was treated with thioimidate naphthyl in MeCN and EtOH to give compound 5 (reverse diamidine). Also, 2,5-Bis(4-aminophenyl)-3,4-dimethylfuran (compound 21) was treated with S-methyl-dibocithioureca, TEA, DMF, and HgCl₂ gave compound 22, which was then treated with HCl, CH₂Cl₂, and EtOH gave the final product 2,5-Bis(4-guanidinophenyl)-3,4-dimethylfuran (compound 6).

Scheme 4: Synthesis of methyl-substituted derivatives 5 and 6
Scheme 5 shows the synthesis of 2,4-Bis(4-amidinophenyl)-5-phenylfuran. The first reaction is of 4-bromoacetophenone and 4-bromobenzaldehyde which is reacted to give the dibromochalcone. The dibromochalcone was then reacted with benzaldehyde which added via Michael Addition with the catalyst, 3-ethyl-5-(2-hydroxyethyl)-4-methylthiazolium bromide, DMF, TEA, and EtOH to give the 1,4-diketone. The 1,4-diketone was then cyclised using Ac₂O and H₂SO₄ to give the furan. The furan then undergoes a reaction with CuCN and DMF to give the dinitrile. The dinitrile was then reacted with hydroxylamine HCl, potassium t-butoxide, and DMSO to give the amidoxime. The amidoxime was then stirred overnight with Ac₂O and AcOH to make the acetate compound, which was then reacted with H₂, Pd (10% on carbon) and EtOH to give the free base amidine. The free base amidine was then boiled in EtOH to remove the acetate salt, which was then passed under HCl gas to give the HCl salt.
Scheme 5: Synthesis of 2,4-Bis(4-amidinophenyl)-5-phenylfuran

1. NaOH, EtOH, H₂O

2. TEA, DMF, Thiazolium catalyst

3. Ac₂O, H₂SO₄

4. CuCN, DMF

5. NH₂OH, DMSO

6. Ac₂O, AcOH

7. H₂, Pd/C

8. HCl, EtOH

9. Potassium t-butoxide
Scheme 6 shows the synthesis of the substituted 3-phenyl amidine series. The first reaction for this series is the aldol with a substituted benzaldehyde and a substituted acetophenone to give the substituted chalcone. The substituted chalcone is then reacted with 4-bromobenzaldehyde, which adds via Michael Addition with the catalyst, 3-ethyl-5-(2-hydroxyethyl)-4-methylthiazolium bromide, DMF, TEA, and EtOH to give the substituted 1,4-diketone. The substituted 1,4-diketone is then cyclized using Ac₂O and H₂SO₄ to give the furan. The furan then undergoes a reaction with CuCN and DMF to give the dinitrile. The dinitrile is then reacted with hydroxylamine HCl, potassium t-butoxide, and DMSO to give the amidoxime. The amidoxime is then stirred overnight with Ac₂O and AcOH to make the acetate compound, which is then reacted with H₂, Pd (10% on carbon) and EtOH to give the acetate salt. The acetate salt is boiled in EtOH to remove the acetate salt to give the free base, which is then passed under HCl gas to give the HCl salt.
Scheme 6: Synthesis of the substituted 3-phenyl amidine series

\[
\begin{align*}
\text{R}_1 = & \text{H} \\
\text{R}_1 = & \text{OCH}_3 \\
\text{R}_1 = & \text{F} \\
\text{R}_1 = & \text{CH}_3
\end{align*}
\]
Scheme 7 shows the synthesis of the pro-drug of the chloro-guanidine. The dichloroamine is reacted with the SCN reagent in CH$_2$Cl$_2$ to give the product 2,5-Bis[4-((N-ethoxycarbonylthioure)phenyl]-3,4-dichlorofuran. The 2,5-Bis[4-((N-ethoxycarbonylthioure)phenyl]-3,4-dichlorofuran is then reacted with DIEA, CH$_2$Cl$_2$, 0.5M NH$_3$ in dioxane, and WSC to give the pro-drug, 2,5-Bis[4-((N-ethoxycarbonylguanidino)phenyl]-3,4-dichlorofuran.

Scheme 7: Synthesis of the pro-drug of the chloro-guanidine

Scheme 8 shows the synthesis of the methoxy pro-drugs of the amidine series. The amidoximes from Scheme 6 is reacted with dimethyl sulfate, 2N NaOH, and 1,4-dioxane to give the methoxy pro-drugs, which is the free base and is passed under HCl gas to give the HCl salt.

Scheme 8: Synthesis of the methoxy pro-drug of the amidine series
Experimental:

1-(4-Bromophenyl)-3-phenylpropenone (9):
Dissolve 0.11 mol NaOH (4.4 g) in 40 mL H₂O and then add 25 mL ethanol. Chill the mixture and add 0.08 mol 4-bromoacetophenone (15.92) and 0.08 mol benzaldehyde (8.49 g). Stir for an hour and then place on a shaker overnight. The next day, the mixture was chilled in the freezer for a few hours and then the crystals were suction filtered and collected and rinsed with copious amounts of H₂O to remove the NaOH. Recrystallization from ethanol gave fluffy, yellow crystals (21.54 g, 94%) mp 103.1-104.4°C (Lit. MP: 103.0-104.0°C). ¹HNMR (CDCl₃, 300 MHz) δ = [insert data]. IR (cm⁻¹): 3650, 3423, 3058, 3033, 3016, 2363, 1924, 1659, 1603, 1584, 1483, 1449, 1397, 1339, 1220, 1107, 1070, 1037, 1008, 983, 893, 874, 828, 792, 761, 728, 692, 667, 624, 573, 536, 487, 471.

1,4-Bis(4-bromophenyl)-2-phenylbutane-1,4-dione (10):
2.5 mmol 3-Ethyl-5-(2-hydroxyethyl)-4-methyl-thiazolium bromide (0.63 g), 12.5 mmol 1-(4-Bromophenyl)-3-phenylpropenone (3.59 g), 15 mmol 4-bromobenzaldehyde (2.78 g), 25.0 mmol triethylamine (2.53 g), and 15 mL ethanol was mixed and refluxed overnight under nitrogen. The next day, the mixture was suction filtered and the crystals collected. Recrystallization from acetone and ethanol gave white crystals (4.97 g, 84%) mp 161.1-162.3°C. Lit. MP: 160 °C. ¹HNMR (DMSO, 400 MHz) δ = 7.95 (dd, J=19 Hz, 4H), 7.71 (dd, J=19 Hz, 4H), 7.39 (d, J=10.7 Hz, 2H), 7.31 (t, J=10.7 Hz, 2H), 7.23 (t, J=10.7 Hz, 1H), 5.35 (dd, J=21.6 Hz, 2H), 4.08 (dd, J=21.6, 2H). IR (cm⁻¹): 3102, 3061, 3023, 2948, 2918, 1677, 1586, 1483, 1452, 1393, 1306, 1289, 1173, 1070, 1004, 835, 788, 775, 701, 586, 562, 524.

2,5-Bis(4-bromophenyl)-3-phenylfuran (11):
10.59 mmol 1,4-Bis(4-bromophenyl)-2-phenylbutane-1,4-dione (5.0 g) was dissolved in 50 mL acetic anhydride at 100°C. After dissolving the starting material, 8 drops of H₂SO₄ was added dropwise and the mixture was refluxed for 10 minutes. The reaction mixture was then poured over ice-water to give a dark oil. The oil was isolated by pouring off the ice-water. Then heating the oil in ethanol and acetone crystallized the oil. Recrystallization from acetone and ethanol gave light yellow crystals (4.33 g, 90%) mp 108.5-109.4°C. Lit. MP: 114°C. ¹HNMR (DMSO, 400 MHz) δ = 7.79 (d, J=8.8 Hz, 2H), 7.66 (d, J=8.8 Hz, 2H), 7.57 (d, J=9.2 Hz, 2H), 7.48 (d, J=9.2 Hz, 2H), 7.44 (d, J=4.4 Hz, 3H), 7.39 (m, J=4.4 Hz, 2H), 7.30 (s, 1H). IR (cm⁻¹): 3126, 3055, 3022, 1495, 1481, 1396, 1149, 1068, 1005, 952, 931, 825, 765, 738, 697, 491.

2,5-Bis(4-N,N-diphenyliminophenyl)-3-phenylfuran (12a):
3.75 mmol 2,5-Bis(4-bromophenyl)-3-phenylfuran (1.7 g), 0.0246 mmol Tris(dibenzylideneacetone)-dipalladium(0) (22 mg), 0.0602 mmol rac-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl (37 mg), 10.5 mmol sodium t-butoxide (1.01 g), and 8.69 mmol benzophenone imine (1.56 g) was mixed with 30 mL anhydrous 1,4-dioxane and the mixture was heated at 95-100°C under nitrogen overnight. The next day, the reaction was diluted with 30 mL CH₂Cl₂ and filtered over Celite. The solution was concentrated to give a dark oil. The oil was crystallized by adding methanol and CH₂Cl₂ and removing both solvents, which gave a solid. The solid was filtered and washed with methanol to
give orangish yellow crystals (2.01g, 82%) mp 118.8-120.1°C. ¹HNMR (CDCl₃, 400 MHz) δ = 7.66 (t, J = Hz, 4H), 7.54 (m, J = Hz, 4H), 7.46 (m, J = Hz, 4H), 7.23 (m, J = Hz, 13H), 7.15 (m, J = Hz, 4H), 7.00 (s, 1H), 6.75 (d, J = Hz, 2H), 6.65 (d, J = Hz, 2H). IR (cm⁻¹): 3461, 3049, 3022, 1617, 1491, 1318, 958, 843, 766, 697, 512, 482.

2,5-Bis(4-aminophenyl)-3-phenylfuran (12b):
2.98 mmol 2,5-Bis(4-N,N-diphenyliminophenyl)-3-phenylfuran (1.93 g), 28mL 1,4-dioxane, 13mL ethanol was mixed. Then 6.27 mmol NaOAc (0.53 g) was added to the mixture along with 6.27 mmol methoxylamine HCl (0.54 g), which was dissolved in 4mL H₂O. The mixture was allowed to stir overnight covered in aluminum foil. The next day, the mixture was diluted with 150mL 0.5 N HCl and extracted with ethyl acetate. The aqueous layer was basified with a solution of NaOH and extracted with ethyl acetate. The organic layer was then washed with brine and dried with Na₂SO₄. Then fine silica gel was added to the solution and the solution was removed leaving an orange coloured silica gel behind. A column was set up and 50/50 mixture of hexanes and ethyl acetate was used. The solution was removed to give an orange/tan solid (0.92 g, 95%) mp 195.0-197.6°C. ¹HNMR (DMSO, 400 MHz) δ = 7.4 (m), 7.29 (t), 7.17 (d, J = Hz, 2H), 6.73 (s, 1H), 6.61 (d, J = Hz, 2H), 6.51 (d, J = Hz, 2H), 5.28 (s, 4H). IR (cm⁻¹): 3488, 3456, 3392, 3374, 3027, 1621, 1514, 1504, 1447, 1291, 1179, 1127, 951, 838, 806, 768, 702, 583, 511.

2,5-Bis(4-N,N-diBoc-guanidinophenyl)-3-phenylfuran (13):
1.0 mmol 2,5-Bis(4-aminophenyl)-3-phenylfuran (0.33 g) and 2.14 mmol 1,3-Bis(tert-butoxycarbonyl)-2-methyl-2-thiopseudourea (0.62 g) was dissolved in 0.63 mmol triethylamine (0.64 g) and 12mL dry dimethylformamide. After dissolving, the mixture was chilled and 2.32 mmol HgCl₂ (0.63 g) was added and a precipitate formed. The mixture was allowed to stir at room temperature overnight. The next day, the mixture was diluted with Na₂CO₃ (aq.) and CH₂Cl₂ and filtered over Celite. The solution was then washed with H₂O three times and brine once and dried with Na₂SO₄. The organic layer was then concentrated to give a dark oil and methanol was added to give crystals. Recrystallisation from CH₂Cl₂ and methanol gave orange crystals (0.66 g, 81%) mp charred above 200°C. ¹HNMR (CDCl₃, 300 MHz) δ = 11.63 (s, 2H), 10.41 (s, 2H), 7.70 (d, J = 2.4 Hz, 4H), 7.56 (d, J = 2.4 Hz, 4H), 7.39 (m, 5H). IR (cm⁻¹): 3542, 3432, 3354, 2982, 1722, 1636, 1412, 1369, 1342, 1303, 1240, 1154, 1121, 1058, 799, 697, 513, 464.

2,5-Bis[4-(2-pyridylimino)aminophenyl]-3-phenylfuran (3a):
1.0 mmol 2,5-Bis(4-aminophenyl)-3-phenylfuran (0.33 g) was dissolved in 10mL CH₃CN and diluted with 15mL dry ethanol under nitrogen. The mixture was chilled in an ice bath and the 2.11 mmol thiouimidate naphthyl (0.76 g) was added and the reaction was allowed to stir at room temperature overnight. The next day, the solution was concentrated to give an oil and ether was added to give a solid. The solid was collected and rinsed with ether. The solid was dissolved in ethanol, basified with aq. NaOH and water/ice was added to give a precipitate. The crystals were collected, recrystallized from ethyl acetate and hexanes. 0.34 g yield of free base. The crystals were passed under HCl gas to give the HCl salt. The crystal is water soluble (0.24 g, 37%) mp 213.4-214.0°C. ¹HNMR (DMSO, 300 MHz) δ = 8.88 (d, 2H), 8.45 (d, 2H), 8.21 (d, 2H), 8.04 (d, 2H), 7.80 (m, 5H), 7.50 (m, 13H). IR (cm⁻¹): 3485, 3373, 3056, 3027, 1642, 1566,
1491, 1440, 1370, 1244, 1142, 1344, 997, 953, 931, 858, 799, 772, 753, 682, 536, 473.
Analysis for C\textsubscript{34}H\textsubscript{28}N\textsubscript{6}O\textsubscript{2}.0HCl-1.5H\textsubscript{2}O (634.55): Calcd: C, 64.35; H, 4.92; N, 13.24; Cl, 11.17. Found: C, 64.02; H, 4.84; N, 12.95; Cl, 11.42.

2,5-Bis(4-guanidinophenyl)-3-phenylfuran (4):
0.803 mmol 2,5-Bis(4-N-diBoc-guanidinophenyl)-3-phenylfuran (0.63 g) was dissolved in 15mL CH\textsubscript{2}Cl\textsubscript{2} and 15mL dry ethanol was added. The mixture was saturated with HCl gas and then allowed to stir with a drying tube connected at room temperature for three days. After three days, the mixture was concentrated to give an oil. Ethanol was added to dissolve the oil and the solution was gravity filtered and the solution was concentrated to give a dark tan solid. The solid was then collected (0.32 g, 82%) mp charred above 200°C. \(^1\)HNMR (DMSO, 300 MHz) \(\delta = 10.00\) (s, 2H), 7.88 (d, 2H), 7.47 (m, 16H), 7.28 (m, 4H). IR (cm\(^{-1}\)): 3434, 3411, 3324, 3165, 3121, 2797, 1674, 1623, 1513, 1448, 1405, 1253, 1148, 1119, 1054, 1015, 954, 933, 830, 765, 699, 656, 538, 505. Analysis for C\textsubscript{23}H\textsubscript{22}N\textsubscript{6}O\textsubscript{2}.0HCl-1.0H\textsubscript{2}O-0.45C\textsubscript{2}H\textsubscript{5}OH (522.14): Calcd: C, 57.27; H, 5.54; N, 16.09. Found: C, 56.95; H, 5.14; N, 15.78.

2,5-Bis[4-(2-phenylimino)aminophenyl]-3-phenylfuran (3b):
1.0 mmol 2,5-Bis[4-(2-aminophenyl)]-3-phenylfuran (0.31 g) was dissolved in 10mL CH\textsubscript{3}CN and diluted with 15mL dry ethanol under nitrogen. The mixture was chilled in an ice bath and the 2.11 mmol thioimidate napthyl (0.76 g) was added and the reaction was allowed to stir at room temperature overnight. The next day, the solution was concentrated to give an oil and ether was added to give a solid. The solid was collected and rinsed with ether. The solid was dissolved in ethanol, basified with aq. NaOH and water/ice was added to give a precipitate. The precipitate was dissolved in ethanol and water was added an allowed to sit overnight. The mixture was extracted with ethyl acetate and washed with brine and dried over Na\textsubscript{2}SO\textsubscript{4}. The mixture was concentrated on vacuo to give a yellowish solid. NMR showed that only half the compound was converted to final product. The solid was dissolved in pyridine and 2.11 mmol thioimidate napthyl (0.76 g) was added and allowed to stir overnight at room temperature. The mixture was concentrated on vacuo to give an oil and ether was added to the oil to give a precipitate. The solid was filtered and collected. The solid was dissolved in ethanol and basified with aq. NaOH and then a water/ice mixture was added to give a yellow precipitate. The precipitate was filtered and collected and rinsed with water. The solid was passed under HCl gas to give a yellow solid (0.07 g and 11%) mp charred above 220°C. \(^1\)HNMR (DMSO, 300 MHz) \(\delta = 11.68\) (s, 2H), 9.95 (s, 2H), 9.17 (s, 2H), 8.03 (s, 2H), 7.94 (s, 4H), 7.68 (m, 11H), 7.46 (m, 8H). IR (cm\(^{-1}\)): 3500, 3411, 3346, 3066, 2819, 1772, 1674, 1618, 1512, 1447, 1372, 1241, 1069, 1002, 954, 934, 834, 771, 698, 521, 465. Analysis for C\textsubscript{36}H\textsubscript{28}N\textsubscript{4}O\textsubscript{3}.35HCl-4.0H\textsubscript{2}O-0.2C\textsubscript{2}H\textsubscript{5}OH (736.05): Calcd: C, 59.37; H, 5.55; N, 7.61; Cl, 16.13. Found: C, 58.95; H, 4.99; N, 7.56; Cl, 15.65.

1,4-Bis(4-bromophenyl)-but-2-ene-1,4-dione (14):
0.242 mol AlCl\textsubscript{3} (32.0 g), 0.140 mol bromobenzene (22.02 g), and 70 mL CS\textsubscript{2} was heated at 50-55°C and the condenser was equipped with a drying tube. 0.070 mol fumaryl chloride (10.70 g) was added in increments and the reaction was allowed to proceed for two days. After two days, the reaction mixture was poured over ice-water. The mixture
was then extracted with CH₂Cl₂ and washed with brine and dried with Na₂SO₄. The solution was then concentrated to leave a reddish yellow solid. The solid was collected and rinsed with ether. After rinsing with ether, the reddish colour was removed leaving a yellow solid (13.02 g, 47%) mp 191.2-192.5°C, Lit MP: 186.5-188.5°C. ¹HNMR (DMSO, 400 MHz) δ = 8.01 (d, J=8.8 Hz, 4H), 7.80 (s, 2H), 7.79 (d, J=8.8 Hz, 4H). IR (cm⁻¹): 3311, 3090, 3055, 3027, 2286, 1933, 1650, 1587, 1485, 1397, 1332, 1202, 1180, 1111, 1073, 1034, 1009, 970, 846, 776, 754, 689, 667, 626, 532, 464.

1,4-Bis(4-bromophenyl)-butane-1,4-dione (15):
10.85 mmol 1,4-Bis(4-bromophenyl)-but-2-ene-1,4-dione (4.3 g), 45.60 mmol SnCl₂ dihydrate (8.6 g), 140mL acetic acid, and 140mL ethanol was mixed at room temperature and refluxed for 10 minutes after dissolving the starting material. After the completion of the reaction, the mixture was allowed to cool at room temperature for two hours and crystals formed. The crystals were collected and rinsed with ether to give white crystals (3.68 g, 86%) mp 183.1-183.9°C, Lit MP: 183.0-185.0°C. ¹HNMR (DMSO, 300 MHz) δ = 7.94 (d, J=10.4 Hz, 4H), 7.75 (d, J=10.4 Hz, 4H), 3.38 (s, 4H). IR (cm⁻¹): 2896, 1671, 1586, 1485, 1408, 1327, 1192, 1075, 1004, 849, 785, 764, 563, 521.

2,5-Bis(bromophenyl)furan (18):
8.83 mmol 1,4-Bis(4-bromophenyl)-butane-1,4-dione (3.5 g) was dissolved in 32mL acetic anhydride at 130°C. After dissolving the 1,4-diketone, 4 drops of H₂SO₄ was added dropwise and the reaction turned dark slightly and was allowed to continue for 5 minutes. After completion of the reaction, the mixture was allowed to cool at room temperature for two hours and crystals formed. The crystals were collected and rinsed with hexanes to give yellow needlelike crystals (2.32 g, 69.44%) mp 205.2-206.4°C, Lit MP: 200.0-201.0°C. ¹HNMR (CDCl₃, 400 MHz) δ = 7.77 (d, J=8.8 Hz, 4H), 7.63 (d, J=8.8 Hz, 4H), 7.15 (s, 2H). IR (cm⁻¹): 3156, 3077, 3049, 3022, 1910, 1646, 1480, 1408, 1107, 1077, 1022, 1008, 927, 828, 794, 716, 669, 496.

3,4-Bisbromomethyl-2,5-bis(4-bromophenyl)furan (19):
0.006 mol 2,5-Bis(4-bromophenyl)furan (2.27 g), 1.14 g paraformaldehyde, and 35mL HBr was mixed and stirred at room temperature under nitrogen for two days. After two days, the mixture was diluted with H₂O and filtered and the solid collected. The solid was dissolved in acetone where some of the solid was insoluble. The mixture was hot filtered and the solution was chilled and crystals formed. The crystals were collected, recrystallized from acetone (1.89 g, 56%) mp 197.3-198.5°C, Lit MP: 194.0-195.0°C. ¹HNMR (DMSO, 300 MHz) δ = 7.77 (s, 8H), 4.86 (s, 4H). IR (cm⁻¹): 3060, 3016, 2967, 1910, 1637, 1485, 1447, 1396, 1210, 1184, 1156, 1082, 1068, 1008, 910, 832, 766, 720, 605, 576, 483.

2,5-Bis(4-bromophenyl)-3,4-dimethylfuran (20):
3.32 mmol 3,4-Bisbromomethyl-2,5-bis(4-bromophenyl)furan (1.82 g) was suspended in 0.64 g LiAlH₄ and 64mL THF was added. The solution was allowed to stir under nitrogen for 30 minutes. After completion of the reaction, wet ether was pipetted dropwise to destroy the LiAlH₄. The solution was filtered over Celite and washed with brine and dried with Na₂SO₄. The ether was removed to give a white solid. Recrystallization from ethanol and acetone to give a white solid (1.17 g, 89%) mp 175.1-
176.7°C, Lit MP: 195.0-196.0°C. \( ^1 \)H NMR (DMSO, 300 MHz) \( \delta = 7.64 \) (s, 8H), 2.19 (s, 6H). IR (cm\(^{-1}\)): 2918, 1618, 1486, 1394, 1101, 1074, 1005, 925, 829, 714, 667, 491.

2,5-Bis(4-N,N-diphenylaminophenyl)-3,4-dimethylfuran (21a):
5.0 mmol 2,5-Bis(4-bromophenyl)-3,4-dimethylfuran (2.03 g), 30 mg Tris(dibenzylideneacetone)-dipalladium(0), 50 mg rac-2,2'-Bis(diphenyl-phosphine)-1,1'-binaphthyl, 14.0 mmol sodium t-butoxide (1.35 g), and 11.7 mmol benzophenone imine (2.10 g) with 40mL anhydrous 1,4-dioxane was mixed and heated at 95-100°C while under nitrogen overnight. The next day, the mixture was diluted with CH\(_2\)Cl\(_2\) and filtered over Celite and the solution was concentrated to leave an oil. 25mL warm methanol was added and crystals formed. The crystals were collected, recrystallized from CH\(_2\)Cl\(_2\) and methanol (1.87 g, 62%) mp Started at 236°C. Melted over broad range. \( ^1 \)H NMR (DMSO, 300 MHz) \( \delta = 7.66 \) (d, 4H), 7.48 (m, 10H), 7.33 (m, 6H), 7.16 (m, 4H), 6.76 (d, 4H), 2.01 (s, 6H). IR (cm\(^{-1}\)): 3428, 3055, 2345, 1618, 1492, 1318, 843, 695, 525.

2,5-Bis(4-aminophenyl)-3,4-dimethylfuran (21b):
1.47 g 2,5-Bis(4-aminophenyl)-3,4-dimethylfuran (1.47 g), 20mL 1,4-dioxane, 12mL ethanol was mixed and stirred under nitrogen. 0.41 g NaOAc and 0.41 g NH\(_2\)OMe dissolved in 3mL H\(_2\)O was added and the reaction was allowed to stir overnight under nitrogen wrapped in aluminum foil. The next day, the mixture was diluted with 0.5 N HCl and extracted with ethyl acetate. The aqueous layer was basified with 1M NaOH and extracted with ethyl acetate. The organic layer was washed with brine and dried with Na\(_2\)SO\(_4\). The organic layer was concentrated to give an oil. The oil was crystallised by dissolving in ethyl acetate and diluting with hexanes and removing both solvents to give a solid. The solid were collected and rinsed with hexanes to give a tan solid (0.48 g, 71%) mp 150°C and melted over a broad range. \( ^1 \)H NMR (CDCl\(_3\), 400 MHz) \( \delta = 7.47 \) (d, J=8.1 Hz, 4H), 6.72 (d, J=8.1 Hz, 4H), 3.69 (s, 4H), 2.17 (s, 6H). IR (cm\(^{-1}\)): 3417, 2939, 1619, 1513, 1292, 1183, 1132, 931, 669, 520, 506, 486, 469.

2,5-Bis(4-N,N-diBoC-guaninophenyl)-3,4-dimethylfuran (22):
1.0 mmol 2,5-Bis(4-aminophenyl)-3,4-dimethylfuran and 2.14 mmol 1,3-Bis(tert-butoxyacarbonyl)-2-methyl-2-thiopseudourea was dissolved in 12mL dimethylformamide and 0.63 mmol triethylamine was added. The mixture was chilled and 2.32 mmol HgCl\(_2\) was added and the mixture was allowed to stir overnight at room temperature. The next day, the mixture was diluted with Na\(_2\)CO\(_3\) (aq.) and CH\(_2\)Cl\(_2\) and filtered over Celite. The solution was then washed with H\(_2\)O three times and brine once and dried with Na\(_2\)SO\(_4\). The solvent was removed to give an orange-yellow solid. Recrystallised from CH\(_2\)Cl\(_2\) and methanol (0.56 g, 73%) mp charred above 250°C. \( ^1 \)H NMR (CDCl\(_3\), 300 MHz) \( \delta = 11.65 \) (s, 2H), 10.40 (s, 2H), 7.67 (dd, J = 9.5 Hz, 8H), 2.23 (s, 6H). IR (cm\(^{-1}\)): 3488, 3437, 3280, 3187, 2981, 1720, 1640, 1553, 1511, 1413, 1368, 1341, 1314, 1298, 1241, 1152, 1118, 1100, 1058, 1029, 813, 512, 470.

2,5-Bis(4-guaninophenyl)-3,4-dimethylfuran (6):
0.71 mmol 2,5-Bis(4-N-diBoC-guaninophenyl)-3,4-dimethylfuran was dissolved in 15mL CH\(_2\)Cl\(_2\) and then 15mL ethanol was added to the mixture. The mixture was saturated with HCl gas and allowed to stir at room temperature with a drying tube connected for three days. After three days, the solvent was removed to leave a brownish,
tan solid. Purified by dissolving in ethanol, filtering, and then concentrating to a solid. This compound is not water soluble, but is soluble in DMSO (0.31 g, 94%) mp charred above 260°C. $^1$HNMR (DMSO, 300 MHz) δ = 10.05 (s, 2H), 7.74 (d, J = 8.6 Hz, 4H), 7.56 (s, 8H), 7.33 (d, J = 8.6 Hz, 4H), 2.22 (s, 6H). IR (cm$^{-1}$): 3526, 3414, 2962, 2940, 2863, 1627, 1514, 1441, 1319, 1298, 1156, 1125, 921, 802, 659, 622, 588, 519, 462. Analysis for C$_{20}$H$_{22}$N$_2$O-2.0HCl-0.4H$_2$O-0.5C$_2$H$_5$OH (465.59): Calcd: C, 54.17; H, 6.01; N, 18.05. Found: C, 53.83; H, 5.66; N, 17.84.

2,5-Bis[4-(2-pyridylimino)aminophenyl]-3,4-dimethylfuran (5):
In a round-bottom flask, 0.5 mmol 2,5-Bis(4-aminophenyl)-3,4-dimethylfuran was dissolved in 10mL CH$_3$CN and then diluted with 15mL dry ethanol and then put under nitrogen. The mixture was chilled in an ice bath and 1.06 mmol thiouramide napthyl (0.38 g) was added and the mixture was allowed to stir overnight at room temperature under nitrogen. The mixture was concentrated on vacuo to give an oil and ether was added to give a solid. The solid was dissolved in ethanol, basified with aq. NaOH and water/ice was added to give a precipitate. The precipitate was filtered and collected (0.15 g, 44%) mp charred above 250°C. $^1$HNMR (DMSO, 300 MHz) δ = 11.92 (s, 2H), 10.15 (s, 2H), 9.38 (s, 2H), 8.89 (d, 2H), 8.51 (d, J = 8.1 Hz, 2H), 8.22 (t, J = 12.5 Hz, 2H), 7.87 (m, J = 12.5 Hz, 6H), 7.60 (d, J = 8.1 Hz, 2H), 2.29 (s, 6H). IR (cm$^{-1}$): 3500, 3434, 3404, 3049, 3011, 2978, 2995, 2912, 2580, 2363, 2341, 2060, 1674, 1607, 1523, 1451, 1372, 1309, 1240, 1150, 1106, 1002, 925, 875, 824, 783, 747, 686, 620, 523, 466. Analysis for C$_{30}$H$_{28}$N$_2$O-4.0HCl-0.5H$_2$O-1.0C$_2$H$_5$OH (681.15): Calcd: C, 59.45; H, 5.30; N, 11.55. Found: C, 59.41; H, 5.21; N, 11.08.

2,5-Bis(4-N-hydroxyaminophenyl)-3-phenylfuran (52):
In a round-bottom flask hydroxylamine HCl was added to 20mL dry DMSO. The temperature was lowered to 0°C and potassium tert-butoxide was added. Then 1.21 g of 2,5-Bis(4-cyanophenyl)-3-phenylfuran was added to the mixture. The reaction was allowed to stir at room temperature overnight under nitrogen. The mixture was diluted with excess water to give a precipitate. The precipitate was filtered and collected and rinsed with water. Recrystallized from ethanol to give yellowish crystals. Then the solid was dissolved in ethanol and passed under HCl gas to give a yellow solid (0.111 g and 85%) mp [insert MP]. $^1$HNMR (DMSO, 300 MHz) δ = 9.70 (s, 2H), 7.84 (d, J = 8.5 Hz, 2H), 7.76 (d, J = 8.5 Hz, 2H), 7.66 (d, J = 8.5 Hz, 2H), 7.55 (d, J = 8.5 Hz, 2H), 7.43 (m, 5H), 7.28 (s, 1H), 5.82 (d, 2H). IR (cm$^{-1}$): [insert data].

2,5-Bis(4-N-methoxyaminophenyl)-3-phenylfuran (59):
In a round-bottom flask, 500 mg 2,5-Bis(4-N-hydroxyaminophenyl)-3-phenylfuran was dissolved in 5 mL 1,4-dioxane. Then the mixture was chilled to 0°C and 2N NaOH was added. Then dimethyl sulfate in 1,4-dioxane was added and the mixture was allowed to stir overnight at room temperature. The next day, the reaction was diluted with water and extracted with ethyl acetate three times and washed with brine and dried over Na$_2$SO$_4$. The solution was then reduced on vacuo to leave a solid and TLC showed three spots and the solid was redissolved in ethyl acetate and loaded on silica gel and passed through a column using 30/70 ethyl acetate/hexanes mixture. The solution was reduced on vacuo to give a yellowish solid and then the solid was dissolved in ethanol and passed under HCl
gas to give a tan solid (0.15 g, 28%) mp 205.1-211.9°C. \(^1\)HNMR (DMSO, 300 MHz) \(\delta = 7.85\) (d, \(J = 8.4\) Hz, 2H), 7.76 (d, \(J = 8.4\) Hz, 2H), 7.65 (d, \(J = 8.5\) Hz, 2H), 7.55 (d, \(J = 8.5\) Hz, 2H), 7.45 (s, 5H), 7.31 (s, 1H), 6.07 (d, 4H), 3.75 (d, 6H). IR (cm\(^{-1}\)) : 3415, 3372, 3052, 2828, 2705, 1668, 1607, 1554, 1377, 1199, 1147, 1121, 1031, 936, 849, 769, 745, 700, 674, 595, 540, 504, 471.

**2,4-Bis(4-bromophenyl)-1-phenylbutane-1,4-dione (25):**

12.5 mmol 1,3-(4-Dibromophenyl)propanone (2.28 g) was dissolved in DMF with heating. 20 mL ethanol was added followed by 12.5 mmol triethylamine (1.26 g), 2.5 mmol 3-Ethyl-5-(2-hydroxyethyl)-4-methyl-thiazolium bromide (0.32 g) 15 mmol benzaldehyde (0.80 g) in that order. The mixture was allowed to reflux overnight under nitrogen. The next day, water was added to the mixture and was extracted with ethyl acetate. The organic layer was washed twice with water and once with brine. The organic layer was dried over Na\(_2\)SO\(_4\) and gravity filtered. The solvent was removed on vacuo to leave an oil. The oil was diluted with ethyl acetate and allowed to sit at room temperature overnight. The following day, crystals formed and the crystals was filtered and collected to give a tan solid (3.48 and 59%) mp 254.7-257.0°C. \(^1\)HNMR (DMSO, 300 MHz) \(\delta = 8.04\) (d, \(J = 12.3\) Hz, 2H), 7.93 (d, \(J = 8.2\) Hz, 2H), 7.73 (d, \(J = 8.3\) Hz, 2H), 7.60 (t, \(J = 12.3\) Hz, 2H), 7.49 (t, 3H), 7.39 (t, 2H), 5.40 (dd, 1H), 4.07 (dd, 2H). IR (cm\(^{-1}\)) : 3074, 3043, 2956, 2918, 2850, 1738, 1669, 1585, 1485, 1468, 1424, 1399, 1372, 1301, 1282, 1229, 1179, 1105, 1073, 1008, 976, 946, 933, 885, 827, 807, 763, 754, 714, 701, 687, 617, 576, 547, 483. Analysis for C\(_{24}\)H\(_{20}\)OBr\(_2\) (484.22): Calcd: C, 55.96%; H, 3.42. Found: C, 55.69%; H, 3.38.

**2,4-Bis(4-bromophenyl)-5-phenylfuran (26):**

8.83 mmol 2,4-Bis(4-bromophenyl)-1-phenylbutane-1,4-dione (3.5 g) was dissolved in 32mL acetic anhydride at 170°C. After dissolving the 1,4-diketone, 8 drops of H\(_2\)SO\(_4\) was added dropwise and the reaction turned dark slightly and was allowed to continue for 5 minutes. After completion of the reaction, the mixture was allowed to cool at room temperature for two hours and crystals formed. The crystals was filtered and collected and washed with hexanes to give a white/transparent crystals (2.79 and 84%) mp 160.3-161.6°C. \(^1\)HNMR (DMSO, 300 MHz) \(\delta = 7.78\) (d, \(J = 9.0\) Hz, 2H), 7.64 (dd, \(J = 8.7\) Hz, 4H), 7.55 (d, \(J = 9.0\) Hz, 2H), 7.38 (m, 5H), 7.33 (s, 1H). IR (cm\(^{-1}\)) : 3121, 3060, 1710, 1649, 1619, 1596, 1541, 1497, 1484, 1443, 1379, 1311, 1219, 1180, 1106, 1069, 1011, 952, 931, 837, 824, 768, 738, 659, 528, 490.

**1-(4-Bromophenyl)-3-(4-methylphenyl)propenone (31):**

Dissolve 0.11 mol NaOH (4.4 g) in 40mL H\(_2\)O and then add 30mL ethanol. Chill the mixture and add 0.05 mol 4-bromoacetophenone (9.95 g) and 0.05 mol 4-methylbenzaldehyde (6.01 g). Stir for two hours and then placed in the freezer overnight. The next day, the mixture was suction filtered and collected and rinsed with copious amounts of H\(_2\)O to remove the NaOH. Recrystallization from ethanol to give white crystals (12.85 g, 85%) mp 146.9-147.5°C. Lit mp 104°C. \(^1\)HNMR (CDCl\(_3\), 300 MHz) \(\delta = 7.88\) (d, \(J = 8.4\) Hz, 2H), 7.80 (d, \(J = 15.6\) Hz, 1H), 7.64 (d, \(J = 8.4\) Hz, 2H), 7.54 (d, \(J = 8.1\) Hz, 2H), 7.43 (d, \(J = 15.6\) Hz, 1H), 7.23 (d, \(J = 8.1\) Hz, 2H), 2.40 (s, 3H). IR (cm\(^{-1}\)) : 3080, 3054, 2916, 1771, 1659, 1599, 1584, 1563, 1513, 1483, 1414, 1397, 1363,
1-(4-Bromophenyl)-3-(4-methoxyphenyl)propenone (32):
Dissolve 0.11 mol NaOH (4.4 g) in 40mL H₂O and then add 30mL ethanol. Chill the mixture and add 0.05 mol 4-bromoacetoephone (9.95 g) and 0.05 mol 4-methoxybenzaldehyde (6.81 g). Stir for two hours and then placed in the freezer overnight. The next day, the mixture was suction filtered and collected and rinsed with copious amounts of H₂O to remove the NaOH. Recrystallization from ethanol to give yellow crystals (7.34 g, 44%) mp 142-147°C. Lit mp 142-143°C. ¹HNMR (CDCl₃, 300 MHz) δ = [insert data]. IR (cm⁻¹): 3060, 3005, 2974, 2938, 1655, 1594, 1512, 1465, 1420, 1397, 1336, 1258, 1217, 1173, 1070, 1032, 1008, 983, 959, 899, 838, 755, 739, 692, 625, 543, 491.

1-(4-Bromophenyl)-3-(3-methoxyphenyl)propenone (33):
Dissolve 0.11 mol NaOH (4.4 g) in 40mL H₂O and then add 30mL ethanol. Chill the mixture and add 0.05 mol 4-bromoacetoephone (9.95 g) and 0.05 mol 3-methoxybenzaldehyde (6.81 g). Stir for two hours and then placed in the freezer overnight. The next day, the mixture was suction filtered and collected and rinsed with copious amounts of H₂O to remove the NaOH. Recrystallization from ethanol to give yellow crystals (9.99 g, 60%) mp 93.1-94.3°C. Lit mp 84-85°C ¹HNMR (CDCl₃, 300 MHz) δ = [insert data]. IR (cm⁻¹): 3313, 3088, 3053, 3014, 2955, 2932, 2834, 2572, 2289, 2070, 1923, 1765, 1663, 1605, 1585, 1495, 1459, 1447, 1432, 1396, 1320, 1258, 1218, 1172, 1107, 1069, 1086, 1052, 1037, 1007, 988, 974, 957, 932, 893, 857, 823, 794, 747, 736, 688, 668, 625, 592, 577, 531, 458.

1-(4-Bromophenyl)-3-(4-fluorophenyl)propenone (34):
Dissolve 0.11 mol NaOH (4.4 g) in 40mL H₂O and then add 30mL ethanol. Chill the mixture and add 0.05 mol 4-bromoacetoephone (9.95 g) and 0.05 mol 4-fluorobenzaldehyde (6.21 g). Stir for two hours and then placed in the freezer overnight. The next day, the mixture was suction filtered and collected and rinsed with copious amounts of H₂O to remove the NaOH. Recrystallization from ethanol to give white crystals (14.65 g, 96%) mp 134.8-135.6°C. ¹HNMR (CDCl₃, 300 MHz) δ = [insert data]. IR (cm⁻¹): 3732, 3563, 3063, 3022, 1989, 1665, 1610, 1599, 1585, 1512, 1486, 1415, 1396, 1335, 1302, 1286, 1233, 1211, 1176, 1159, 1099, 1070, 1031, 1008, 995, 935, 895, 816, 805, 759, 738, 664, 636, 537, 509, 464.

1,3-(4-Dibromophenyl)propenone (24):
Dissolve 0.11 mol NaOH (4.4 g) in 40mL H₂O and then add 30mL ethanol. Chill the mixture and add 0.05 mol 4-bromoacetoephone (9.95 g) and 0.05 mol 4-bromobenzaldehyde (9.25 g). Stir for two hours and then placed in the freezer overnight. The next day, the mixture was suction filtered and collected and rinsed with copious amounts of H₂O to remove the NaOH. Recrystallization from ethanol to give white crystals (4.14 g, 23%) mp 162.1-163.2°C. Lit mp 181-183°C ¹HNMR (CDCl₃, 300 MHz) δ = 7.88 (d, J = 8.1 Hz, 2H), 7.74 (d, J = 15.7 Hz, 1H), 7.65 (d, J = 8.1 Hz, 2H), 7.56 (d, J = 9.0 Hz, 2H), 7.50 (d, J = 9.0 Hz, 2H), 7.45 (d, J = 15.7 Hz, 1H). IR (cm⁻¹): 3304, 3082,
1,4-Bis(4-bromophenyl)-2-(4-methoxyphenyl)-butane-1,4-dione (35):
12.5 mmol 1-(4-Bromophenyl)-3-(4-methoxyphenyl)propenone (4.16 g) was dissolved in 35 mL DMF with heating. 40 mL ethanol was added followed by 25.0 mmol triethylamine (2.53 g), 2.5 mmol 3-Ethyl-5-(2-hydroxyethyl)-4-methyl-thiazolium bromide (0.63 g) 15 mmol benzaldehyde (2.78 g) in that order. The mixture was allowed to reflux for two days under nitrogen. Then water was added to the mixture and was extracted with ethyl acetate. The organic layer was washed twice with water and once with brine. The organic layer was dried over Na₂SO₄ and gravity filtered. The solvent was removed on vacuo to leave an oil. The oil was diluted with ethyl acetate and allowed to sit at room temperature overnight. The following day, crystals formed and the crystals were filtered and collected to give a yellow solid (4.85 and 77%) mp 126.9-129.5°C. 
¹H NMR (DMSO, 300 MHz) δ = 7.94 (dd, 4H), 7.70 (dd, 4H), 7.28 (d, J = 8.8 Hz, 2H), 6.85 (d, J = 8.8 Hz, 2H), 5.29 (d, J = 10.8 Hz, 2H), 4.04 (dd, J = 10.8 Hz, 1H). IR (cm⁻¹): 3344, 3067, 3008, 2941, 2913, 2841, 2551, 2345, 2051, 1918, 1772, 1677, 1585, 1512, 1484, 1463, 1442, 1398, 1323, 1304, 1244, 1173, 1114, 1070, 1030, 998, 945, 893, 834, 776, 715, 667, 626, 556, 529.

1,4-Bis(4-bromophenyl)-2-(3-methoxyphenyl)-butane-1,4-dione (36):
12.5 mmol 1-(4-Bromophenyl)-3-(3-methoxyphenyl)propenone (4.16 g) was dissolved in 35DMF with heating. 40 mL ethanol was added followed by 25.0 mmol triethylamine (2.53 g), 2.5 mmol 3-Ethyl-5-(2-hydroxyethyl)-4-methyl-thiazolium bromide (0.63 g) 15 mmol benzaldehyde (2.78 g) in that order. The mixture was allowed to reflux two days under nitrogen. Then water was added to the mixture and was extracted with ethyl acetate. The organic layer was washed twice with water and once with brine. The organic layer was dried over Na₂SO₄ and gravity filtered. The solvent was removed on vacuo to leave an oil. The oil was diluted with ethyl acetate and allowed to sit at room temperature overnight. The following day, crystals formed and the crystals were filtered and collected to give a brownish tan solid (5.14 and 82%) mp 113.4-115.9°C. 
¹H NMR (DMSO, 300 MHz) δ = 7.95 (dd, J = 8.7 Hz, 4H), 7.70 (dd, J = 7.2 Hz, 4H), 7.21 (t, J = 11.3 Hz, 1H), 6.97 (s, 1H), 6.91 (d, J = 11.3 Hz, 1H), 6.79 (d, J = 11.3 Hz, 1H), 5.31 (dd, J = 11.6 Hz, 2H), 4.07 (dd, J = 11.6 Hz, 1H). IR (cm⁻¹): 3420, 3093, 3060, 3011, 2962, 2912, 2837, 1909, 1678, 1608, 1583, 1483, 1457, 1436, 1393, 1303, 1286, 1254, 1172, 1145, 1069, 1046, 1004, 875, 859, 832, 772, 703, 627, 534, 466.

1,4-Bis(4-bromophenyl)-2-(4-methylphenyl)-butane-1,4-dione (37):
12.5 mmol 1-(4-Bromophenyl)-3-(4-methylphenyl)propenone (3.76 g) was dissolved in 40 mL DMF with heating. 45 mL ethanol was added followed by 25.0 mmol triethylamine (2.53 g), 2.5 mmol 3-Ethyl-5-(2-hydroxyethyl)-4-methyl-thiazolium bromide (0.63 g) 15 mmol 4-bromobenzaldehyde (2.78 g) in that order. The mixture was allowed to reflux two days under nitrogen. Then water was added to the mixture and was extracted with ethyl acetate. The organic layer was washed twice with water and once with brine. The organic layer was dried over Na₂SO₄ and gravity filtered. The solvent
was removed on vacuo to leave an oil. The oil was diluted with ethyl acetate and allowed to sit at room temperature overnight. The following day, crystals formed and the crystals was filtered and collected to give a (4.71 and 78%) mp 226.5-227.6°C. $^1$HNMR (DMSO, 300 MHz) δ = 7.89 (m, 4H), 7.60 (m, 4H), 7.25 (d, J = 7.9 Hz, 2H), 7.10 (d, J = 7.9 Hz, 2H), 5.29 (d, 1H), 4.04 (dd, 2H), 2.21 (s, 3H). IR (cm$^{-1}$): 3311, 3091, 3071, 3033, 3055, 2956, 2571, 2363, 2341, 1919, 1863, 1787, 1665, 1587, 1483, 1399, 1312, 1210, 1174, 1113, 1070, 1009, 930, 881, 833, 761, 749, 726, 682, 624, 508, 466.

1,4-Bis(4-bromophenyl)-2-(4-fluorophenyl)butane-1,4-dione (38):

12.5 mmol 1-(4-Bromophenyl)-3-(4-fluorophenyl)propenone (3.80 g) was dissolved in 40mL DMF with heating. 35 mL ethanol was added followed by 25.0 mmol triethylamine (1.26 g), 2.5 mmol 3-Ethyl-5-(2-hydroxyethyl)-4-methyl-thiazolium bromide (0.32 g) 15 mmol 4-bromobenzaldehyde (2.78 g) in that order. The mixture was allowed to reflux for two days under nitrogen. Then water was added to the mixture and was extracted with ethyl acetate. The organic layer was washed twice with water and once with brine. The organic layer was dried over Na$_2$SO$_4$ and gravity filtered. The solvent was removed on vacuo to leave an oil. The oil was diluted with ethyl acetate and allowed to sit at room temperature overnight. The following day, ether was added and a solid formed and that was filtered off. The filtrate then gave crystals and the crystals was filtered and collected to give a brownish tan crystals (4.00 and 66%) mp 152.1-153.9°C.

$^1$HNMR (DMSO, 300 MHz) δ = 7.97 (q, 4H), 7.72 (t, 4H), 7.44 (t, 2H), 7.15 (t, 2H), 5.39 (d, 1H), 4.83 (dd, 2H). IR (cm$^{-1}$): 3340, 3076, 2962, 2927, 2904, 2780, 2578, 2429, 2295, 2026, 1907, 1764, 1679, 1587, 1507, 1485, 1399, 1334, 1295, 1215, 1199, 1179, 1161, 1101, 1071, 994, 959, 944, 889, 824, 775, 725, 714, 691, 956, 627, 557, 501.

2,4-Bis(4-cyanophenyl)-5-phenylfuran (27):

2.5-Bis(4-bromophenyl)-3-phenylfuran (2.5 g), CuCN (3.0 g), and 40 mL DMF was mixed in a round-bottom flask and allowed to reflux for two days and another equivalent of CuCN was added. The mixture was pored over a water/ammonium hydroxide mixture (100 mL/50 mL). The mixture was extracted with CH$_2$Cl$_2$ (400 mL). The CH$_2$Cl$_2$ layer was then extracted three times with water and twice with brine and then dried over Na$_2$SO$_4$ and gravity filtered. Fine silica gel was added to the solution and the solution was concentrated to give bright orange silica gel. Flash chromatography was used with the solvent being hexanes/ethyl acetate (3:2 ratio) to give orange crystals (1.15 g and 60%) mp 190.6-194.4°C. $^1$HNMR (DMSO, 300 MHz) δ = 8.00 (d, 2H), 7.92 (t, 4H), 7.65 (d, 3H), 7.57 (d, 2H), 7.43 (d, 3H). IR (cm$^{-1}$): 3831, 3682, 3662, 3082, 3053, 2923, 2313, 1225, 1940, 1609, 1494, 1444, 1391, 1178, 954, 932, 844, 817, 776, 705, 587, 554. Analysis for C$_2$dH$_4$N$_2$O-0.15H$_2$O (484.89): Calcd: C, 82.57; H, 4.12; N, 8.02. Found: C, 82.21; H, 4.33; N, 7.72.

2,5-Bis(4-bromophenyl)-3,4-dichlorofuran (16):

In a round bottom flask, 2.5-Bis(4-bromophenyl)-furan and PCl$_5$ are mixed and heated to 160-170°C where both components melted to give a red mixture. The reaction was allowed to continue for 15 minutes. Then water was added to quench the reaction and with the addition of water a tanish solid precipitated. The solid was collected and washed with water. Recrystallized from ethanol and acetone to give white needles (7.50 g, 67%)
mp 165.7-168.1°C. Lit mp 166°C. ¹HNMR (DMSO, 300 MHz) δ = 7.91 (d, J = 7.35 Hz, 4H), 7.74 (d, J = 7.35 Hz, 4H). IR (cm⁻¹): 3082, 3065, 2343, 1905, 1653, 1591, 1541, 1487, 1398, 1356, 1302, 1291, 1136, 1119, 1094, 1073, 1018, 1006, 944, 825, 750, 711, 655, 578, 487.

2,5-Bis(4-N,N-diphenylinophenyl)-3,4-dichlorofuran (17a):
7.14 mmol 2,5-Bis(4-bromophenyl)-3,4-dimethylfuran (7.15 g), 47 mg Tris(dibenzylideneacetone)-dipalladium(0), 78 mg rac-2,2'-Bis(diphenyl-phosphino)1,1'binaphthyl, 14.0 mmol sodium t-butoxide (2.12 g), and 11.7 mmol benzophenone imine (3.30 g) with 65mL anhydrous 1,4-dioxane was mixed and heated at 95-100°C while under nitrogen overnight. The next day, the mixture was diluted with CH₂Cl₂ and filtered over Celite and the solution was concentrated to give an orangish-yellow filtrate. The filtrate was concentrated on vacuo to give an orange yellowish solid. The crystals were collected and washed with methanol to give an orange solid (3.31 g, 32%) mp 272.1-273.6°C. ¹HNMR (CDCl₃, 300 MHz) δ = 7.76 (m, J = 14.7 Hz, 8H), 7.45 (m, J = 14.7 Hz, 8H), 7.28 (m, J = 14.7 Hz, 4H), 7.14 (m, J = 10.3 Hz, 4H), 6.80 (m, J = 10.3 Hz, 4H). IR (cm⁻¹): 3595, 3420, 3073, 3060, 2959, 2919, 2850, 1954, 1910, 1816, 1742, 1672, 1619, 1593, 1575, 1492, 1447, 1415, 1349, 1317, 1289, 1231, 1181, 1141, 1123, 1093, 1073, 1019, 1002, 960, 944, 913, 875, 845, 783, 765, 742, 705, 693, 661, 639, 614, 572, 535, 516, 486, 467, 458.

2,5-Bis(4-aminophenyl)-3,4-dichlorofuran (17b):
2.5 g 2,5-Bis(4-N,N-diphenylinophenyl)-3,4-dichlorofuran, 150mL 1,4-dioxane, 30mL ethanol was mixed and refluxed under nitrogen until the imine was dissolved. The reaction was cooled and 0.80 g NaOAc and 0.80 g NH₂OMe dissolved in 50mL H₂O was added and the reaction was allowed to stir overnight under nitrogen wrapped in aluminum foil. The next day, the mixture was diluted with 0.5 N HCl and extracted with ethyl acetate. The aqueous layer was basified with 1M NaOH and extracted with ethyl acetate. The organic layer was washed with brine and dried with Na₂SO₄. The organic layer was concentrated to give a tan solid (0.48 g, 71%) charred at 170°C. ¹HNMR (DMSO, 300 MHz) δ = 7.59 (d, J = 8.1 Hz, 4H), 6.66 (d, J = 8.1 Hz, 4H), 5.54 (s, 4H). IR (cm⁻¹): 3439, 3357, 3202, 3035, 2684, 2574, 2441, 2227, 2117, 1889, 1736, 1618, 1507, 1433, 1357, 1290, 1184, 1125, 1102, 1064, 1017, 1003, 958, 943, 830, 703, 674, 656, 618, 579, 555, 510, 472.

2,5-Bis(4-N,N-diBoC-guanidinophenyl)-3,4-dichlorofuran (23):
1.0 mmol 2,5-Bis(4-aminophenyl)-3,4-dichlorofuran and 2.14 mmol 1,3-Bis(tert-butoxycarbonyl)-2-methyl-2-thiopseudouracil was dissolved in 12mL dimethylformamide and 0.63 mmol triethylamine was added. The mixture was chilled and 2.32 mmol HgCl₂ was added and the mixture was allowed to stir overnight at room temperature. The next day, the mixture was diluted with Na₂CO₃ (aq.) and CH₂Cl₂ and filtered over Celite. The solution was then washed with water three times and brine twice and dried with Na₂SO₄. The solvent was removed on vacuo to give an orange-yellow solid. Recrystallised from CH₂Cl₂ and methanol (0.61 g, 81%) mp charred above 240°C. ¹HNMR (CDCl₃, 300 MHz) δ = 11.64 (s, 2H), 10.47 (s, 2H), 7.96 (d, J = 8.8 Hz, 4H), 7.74 (d, J = 8.8 Hz, 4H). IR (cm⁻¹): 3274, 3149, 2981, 2934, 2454, 2363, 2291, 1903, 1722, 1642, 1642, 1605,
2,5-Bis(4-guanidinophenyl)-3,4-dichlorofuran (8):
0.71 mmol 2,5-Bis(4-N-diBoC-guanidinophenyl)-3,4-dichlorofuran was dissolved in 15mL CH₂Cl₂ and then 15mL ethanol was added to the mixture. The mixture was saturated with HCl gas and allowed to stir at room temperature with a drying tube connected for three days. After three days, the solvent was removed to leave a brownish, tan solid. Recrystallised by dissolving in ethanol, filtering, and then concentrating to a solid. This compound is not water soluble, but is soluble in DMSO (insert yield and percent yield) mp charred above [insert MP]. ¹HNMR (DMSO, 300 MHz) δ = [insert NMR data]. IR (cm⁻¹): [insert IR data].

2,5-Bis[4-(N-ethoxycarbonylthioureaphenyl)-3,4-dichlorofuran (57):
In a round-bottom flask, 1.5 mmol 2,5-Bis(4-aminophenyl)-3,4-dichlorofuran was dissolved in 65 mL dry CH₂Cl₂ and stirred. While stirring, 3.1 mmol SCN reagent [enter IUPAC name] was added and the reaction was allowed to stir overnight at room temperature. A precipitate formed 20 minutes after setting up. The next day, the reaction was diluted with excess hexanes and the precipitate was suction filtered and collected and rinsed with hexanes to give a tan solid (0.71 g, 89%) mp 226.3-227.9°C. ¹HNMR (DMSO, 300 MHz) δ = 11.67 (s, 2H), 11.32 (s, 2H), 8.01 (d, J = 9.0 Hz, 4H), 7.83 (d, J = 9.0 Hz, 4H), 4.23 (q, J = 17.7 Hz, 4H), 1.27 (t, J = 17.7 Hz, 6H). IR (cm⁻¹): 3215, 3166, 2994, 2705, 2549, 2348, 2337, 2329, 2252, 1910, 1731, 1713, 1605, 1529, 1477, 1443, 1414, 1373, 1346, 1290, 1247, 1194, 1178, 1118, 1095, 1041, 972, 945, 868, 838, 770, 743, 704, 667, 639, 591, 551, 503, 480, 470.

2,5-Bis[4-(N-ethoxycarbonylguanidinophenyl)-3,4-dichlorofuran (58):
In a round-bottom flask, 1.2 mmol g 2,5-Bis[4-(N-ethoxycarbonylthiourea)phenyl]-3,4-dichlorofuran (0.69 g) in 45 mL dry CH₂Cl₂ and then 7.2 mmol DIEA [enter correct IUPAC name] (1.00 g) was added and the reaction was chilled under nitrogen. While cold, 9.6 mL 0.5M NH₃ in 1,4-dioxane was added followed by 4 mmol WSC [enter correct IUPAC name] (0.77 g) and the reaction was allowed to stir overnight at room temperature. ¹HNMR (DMSO, 300 MHz) δ = [insert NMR data]. IR (cm⁻¹): [insert IR data].

2,4-Bis(4-N-hydroxyamidinophenyl)-5-phenylfuran (28):
In a round-bottom flask, 2.4 g hydroxylamine HCl was added to 40mL dry DMSO. The temperature was lowered to 0°C and 3.2 g potassium tert-butoxide was added. Then 1.20 g of 2,4-Bis(4-cyanophenyl)-5-phenylfuran was added to the mixture. The reaction was allowed to stir at room temperature overnight under nitrogen. The mixture was diluted with excess water to give a precipitate. The precipitate is filtered and collected and rinsed with water to give a white solid, which is the free base. Then the free base was dissolved in ethanol and passed under HCl to give the HCl salt (0.07 g and 58%). ¹HNMR (DMSO, 300 MHz) δ = 9.71 (d, 2H), 7.83 (d, J = 8.7 Hz, 2H), 7.77 (d, J = 8.7 Hz, 2H), 7.73 (d, J = 7.6 Hz, 2H), 7.58 (d, J = 7.6 Hz, 2H), 7.39 (m, 6H), 5.87 (s, 4H). IR (cm⁻¹): 3611, 3472, 3373, 3080, 2827, 2349, 2312, 1911, 1759, 1639, 1612, 1483, 1445,
1390, 1378, 1281, 1214, 1149, 1121, 1074, 1051, 1026, 1012, 953, 933, 922, 850, 816, 763, 746, 692, 661, 627, 596, 579, 546, 534, 481, 473, 455.

2,4-Bis(4-amidinophenyl)-5-phenylfuran (29):
In a round-bottom flask, 0.4 g 2,4-Bis(4-N-hydroxylamidinophenyl)-5-phenylfuran was dissolved in 1.5 mL Ac₂O and 20 mL AcOH and allowed to stir overnight at room temperature. The next day the mixture was poured into a hydrogenator flask and diluted with ethanol and 0.2 Pd (10% on carbon) was added and hydrogenated for two hours. After completion, the mixture was filtered over Celite and the solution was removed on vacuo to give an oil. The oil was dissolved and boiled in ethanol to remove the acetate salt to give the free base. HNMR (DMSO, 300 MHz) δ = [insert NMR data]. IR (cm⁻¹): [insert IR data].

2,5-Bis(4-bromophenyl)-3-(4-methoxyphenyl)furan (39):
14.22 mmol 1,4-Bis(4-bromophenyl)-2-(4-methoxyphenyl)-butane-1,4-dione (7.14 g) was dissolved in 75mL acetic anhydride at 140°C. After dissolving the 1,4-diketone, 10 drops of H₂SO₄ was added dropwise and the reaction turned red and was allowed to continue for 5 minutes. After completion of the reaction, the mixture was allowed to cool at room temperature and crystals precipitated. The crystals was filtered and collected and washed with hexanes to give a tanish solid (4.31 g, 63%) mp 194.1-150.0°C. HNMR (DMSO, 300 MHz) δ = 7.77 (d, J = 8.1 Hz, 2H), 7.64 (d, J = 8.1 Hz, 2H), 7.56 (d, J = 9.1 Hz, 2H), 7.48 (d, J = 9.1 Hz, 2H), 7.35 (d, J = 8.2 Hz, 2H), 7.24 (s, 1H), 6.99 (d, J = 8.2, 2H), 3.79 (s, 3H). IR (cm⁻¹): 3112, 3088, 3045, 3013, 2971, 2939, 2909, 2838, 2705, 2535, 2296, 2047, 1909, 1857, 1787, 1698, 1654, 1618, 1604, 1584, 1569, 1542, 1510, 1485, 1439, 1397, 1387, 1348, 1311, 1301, 1288, 1250, 1212, 1182, 1149, 1115, 1103, 1070, 1050, 1028, 1006, 954, 930, 830, 817, 796, 730, 721, 695, 662, 631, 618, 590, 556, 523, 504, 494, 477, 465.

2,5-Bis(4-bromophenyl)-3-(4-fluorophenyl)furan (40):
12.63 mmol 1,4-Bis(4-bromophenyl)-2-(4-fluorophenyl)-butane-1,4-dione (6.15 g) was dissolved in 95mL acetic anhydride at 150°C. After dissolving the 1,4-diketone, 8 drops of H₂SO₄ was added dropwise and the reaction turned dark and was allowed to continue for 5 minutes. After completion of the reaction, the mixture was allowed to cool at room temperature and a solid precipitated and the solid was filtered and washed with hexanes to give a light tan solid (3.46 g and 58%) mp 120.6-123.8°C. HNMR (DMSO, 300 MHz) δ = 7.77 (d, J = 8.8 Hz, 2H), 7.65 (d, J = 8.8 Hz, 2H), 7.57 (d, J = 9.0 Hz, 2H), 7.47 (m, 4H), 7.28 (t, J = 9.0 Hz, 3H). IR (cm⁻¹): 3130, 3064, 2824, 2692, 2566, 2442, 2363, 2354, 2335, 2299, 2247, 2115, 2043, 1979, 1905, 1892, 1873, 1765, 1652 1571, 1538, 1507, 1483, 1439, 1397, 1382, 1351, 1310, 1288, 1279, 1234, 1185, 1153, 1104, 1091, 1071, 1047, 1007, 953, 932, 842, 825, 764, 733, 724, 715, 688, 660, 636, 615, 586, 558, 527, 519, 495, 466.

2,5-Bis(4-bromophenyl)-3-(4-methylphenyl)furan (41):
14.17 mmol 1,4-Bis(4-bromophenyl)-2-(4-methylphenyl)-butane-1,4-dione (6.89 g) was dissolved in 70mL acetic anhydride at 140°C. After dissolving the 1,4-diketone, 8 drops of H₂SO₄ was added dropwise and the reaction turned orange and was allowed to
continue for 5 minutes. After completion of the reaction, the mixture was allowed to cool at room temperature and crystals precipitated. The crystals were filtered and collected and washed with hexanes to give a tanish solid (4.58 g, 69%) mp 137.4-138.0°C. $^1$H NMR (DMSO, 300 MHz) $\delta$ = 7.78 (d, $J$ = 8.7 Hz, 2H), 7.65 (d, $J$ = 8.7 Hz, 2H), 7.56 (d, $J$ = 8.7 Hz, 2H), 7.49 (d, $J$ = 8.7 Hz, 2H), 7.32 (d, $J$ = 8.1 Hz, 2H), 7.24 (d, $J$ = 8.1 Hz, 3H), 2.34 (s, 3H). IR (cm$^{-1}$): 3028, 2956, 2916, 2858, 2776, 2732, 2597, 2292, 2136, 1908, 1785, 1704, 1666, 1607, 1586, 1568, 1508, 1582, 1398, 1382, 1347, 1311, 1276, 1210, 1178, 1152, 1108, 1070, 1050, 1008, 954, 932, 992, 931, 808, 760, 748, 733, 724, 715, 690, 659, 638, 629, 616, 588, 556, 509, 492, 485, 466.

2,5-Bis(4-cyanophenyl)-3-phenylfuran (42):
8.8 mmol 2,5-Bis(4-bromophenyl)-3-phenylfuran (4.0 g), 33.5 mmol CuCN (3.0 g), and 40 mL DMF was mixed in a round-bottom flask and allowed to reflux overnight. The next day, the mixture was poured over a water/ammonium hydroxide mixture (100 mL/50 mL). The mixture was extracted with two portions of CH$_2$Cl$_2$ (400 mL). The CH$_2$Cl$_2$ layer was then extracted three times with water and twice with brine and then dried over Na$_2$SO$_4$ and gravity filtered. Fine silica gel was added to the solution and the solution was concentrated to give bright orange silica gel. Flash chromatography was used with the solvent being hexanes/ethyl acetate (2:3 ratio) to give orange crystals (0.96 g, 31.5%) mp 212.2-213.0°C. $^1$H NMR (DMSO, 300 MHz) $\delta$ = 8.05 (d, $J$=8.6 Hz, 2H), 7.91 (d, $J$=8.6 Hz, 2H), 7.82 (d, $J$=8.6 Hz, 2H), 7.72 (d, $J$=8.6 Hz, 2H), 7.52 (s, 1H), 7.46 (s, 5H). IR (cm$^{-1}$): 3125, 3066, 3027, 2226, 1607, 1492, 1445, 1418, 1392, 1179, 1152, 1115, 1073, 953, 932, 849, 819, 761, 698, 683, 586, 547, 512, 472. Analysis for C$_{24}$H$_{14}$N$_2$O (346.38): Calcd: C, 83.22; H, 4.07; N, 8.09. Found: C, 83.16; H, 4.15; N, 8.06.

2,5-Bis(4-cyanophenyl)-3-(4-methoxyphenyl)furan (43):
2,5-Bis(4-bromophenyl)-3-(4-methoxyphenyl)phenylfuran (2.15 g), CuCN (2.0 g), and 40 mL DMF was mixed in a round-bottom flask and allowed to reflux overnight. The next day, the mixture was poured over a water/ammonium hydroxide mixture (100 mL/50 mL). The mixture was extracted with two portions of CH$_2$Cl$_2$ (400 mL). The CH$_2$Cl$_2$ layer was then extracted three times with water and twice with brine and then dried over Na$_2$SO$_4$ and gravity filtered. Fine silica gel was added to the solution and the solution was concentrated to give bright orange silica gel. Loaded on a column and eluted using 30/70 ethyl acetate/hexanes ratio. Solvent removed on vacuo recrystallized from ethanol to give an orange solid (1.3 and 78%) mp 247.9-251.1°C. $^1$H NMR (DMSO, 300 MHz) $\delta$ = 8.05 (d, $J$ = 8.8 Hz, 2H), 7.93 (d, $J$ = 8.8 Hz, 2H), 7.83 (d, $J$ = 8.7 Hz, 2H), 7.74 (d, $J$ = 8.7 Hz, 2H), 7.50 (s, 1H), 7.38 (d, $J$ = 8.8 Hz, 2H), 7.04 (d, $J$ = 8.8 Hz, 2H), 3.80 (s, 3H). IR (cm$^{-1}$): 3463, 3408, 3357, 3125, 3064, 2952, 2928, 2904, 2834, 2775, 2532, 2354, 2225, 2172, 2034, 1937, 1893, 1763, 1684, 1606, 1574, 1541, 1516, 1497, 1464, 1439, 1413, 1390, 1361, 1323, 1292, 1247, 11781155, 1110, 1063, 1030, 954, 932, 848, 822, 770, 735, 795, 661, 652, 627, 601, 573, 558, 546, 524, 503, 479, 471, 464, 457.
2,5-Bis(4-cyanophenyl)-3-(4-fluorophenyl)furan (44):
2,5-Bis(4-bromophenyl)-3-(4-fluorophenyl)-phenylfuran (2.5 g), CuCN (3.0 g), and 40 mL DMF was mixed in a round-bottom flask and allowed to reflux overnight. The next day, the mixture was poured over a water/ammonium hydroxide mixture (100 mL/50 mL). The mixture was extracted with two portions of CH₂Cl₂ (400 mL). The CH₂Cl₂ layer was then extracted three times with water and twice with brine and then dried over Na₂SO₄ and gravity filtered. Fine silica gel was added to the solution and the solution was concentrated to give bright orange silica gel. Loaded on a column and eluted using 40/60 ethyl acetate/hexanes ratio. Solvent removed on vacuo recrystallized from ethanol to give an orange solid (1.2 and 62%) mp 183.3-187.6°C. ¹H NMR (DMSO, 300 MHz) δ = 8.04 (d, J = 7.5 Hz, 2H), 7.93 (d, J = 7.5 Hz, 2H), 7.83 (d, J = 8.2 Hz, 2H), 7.71 (d, J = 8.2 Hz, 2H), 7.51 (m, 3H), 7.32 (m, 2H). IR (cm⁻¹): 3415, 3328, 3186, 3057, 2915, 2566, 2441, 2224, 1910, 1792, 1676, 1607, 1514, 1493, 1411, 1384, 1320, 1223, 1178, 1157, 1112, 1074, 1063, 1009, 953, 933, 838, 817, 770, 718, 689, 666, 647, 628, 619, 602, 547, 525, 503, 497, 480, 465.

2,5-Bis(4-cyanophenyl)-3-(4-methylphenyl)furan (45):
2,5-Bis(4-bromophenyl)-3-(4-methylphenyl)-phenylfuran (2.0 g), CuCN (2.50 g), and 40 mL DMF was mixed in a round-bottom flask and allowed to reflux overnight. The next day, the mixture was poured over a water/ammonium hydroxide mixture (100 mL/50 mL). The mixture was extracted with two portions of CH₂Cl₂ (400 mL). The CH₂Cl₂ layer was then extracted three times with water and twice with brine and then dried over Na₂SO₄ and gravity filtered. Fine silica gel was added to the solution and the solution was concentrated to give bright orange silica gel. Loaded on a column and eluted using 30/70 ethyl acetate/hexanes ratio. Solvent removed on vacuo recrystallized from ethanol to give a yellow solid (0.85 g and 55%) mp 231.1-231.9°C. ¹H NMR (DMSO, 300 MHz) δ = 8.06 (dd, J = 10.2 Hz, 2H), 7.93 (dd, J = 10.2 Hz, 2H), 7.84 (dd, J = 10.6 Hz, 2H), 7.74 (dd, J = 10.6 Hz, 2H), 7.52 (dd, J = 1.0 Hz, 1H), 7.35 (dd, J = 7.9 Hz, 2H), 7.29 (d, J = 7.9 Hz, 2H). IR (cm⁻¹): 3437, 3357, 3202, 3036, 2934, 2675, 2574, 2442, 2365, 2354, 2225, 2117, 1893, 1737, 1697, 1619, 1543, 1509, 1358, 1289, 1184, 1125, 1101, 1088, 1017, 1003, 960, 943, 831, 703, 688, 656, 628, 616, 579, 552, 507, 494, 481, 471, 464.

2,5-Bis(4-N-hydroxylaminophenyl)-3-(4-methoxyphenyl)furan (49):
In a round-bottom flask 2.5 g hydroxylamine HCl was added to 40 mL dry DMSO. The temperature was lowered to 0°C and 3.0 g potassium tert-butoxide was added. Then 1.00 g of 2,5-Bis(4-cyanophenyl)-3-(4-methoxyphenyl)-furan was added to the mixture. The reaction was allowed to stir at room temperature overnight under nitrogen. The mixture was diluted with excess water to give a precipitate. The precipitate was filtered and collected and rinsed with water. Recrystallized from ethanol to give orangish crystals (insert yield and percent yield) mp [insert MP]. ¹H NMR (DMSO, 300 MHz) δ = [insert data]. IR (cm⁻¹): 3489, 3320, 3251, 2910, 2835, 2299, 2203, 2031, 1911, 1781, 1740, 1642, 1611, 1584, 1522, 1509, 1465, 1441, 1390, 1379, 1293, 1246, 1182, 1148, 1117, 1087, 1052, 1028, 931, 847, 817, 770, 745, 695, 668, 643, 593, 556, 524, 504, 480, 464.
2,5-Bis(4--N-hydroxylaminophenyl)-3-(4-fluorophenyl)furan (50):
In a round-bottom flask, 2.4 g hydroxylamine HCl was added to 40mL dry DMSO. The
temperature was lowered to 0°C and 3.2 g potassium tert-butoxide was added. Then 1.20
g of 2,5-Bis(4-cyanophenyl)-3-(4-fluorophenyl)-furan was added to the mixture. The
reaction was allowed to stir at room temperature overnight under nitrogen. The mixture
was diluted with excess water to give a precipitate. The precipitate was filtered and
collected and rinsed with water to give a white solid, which is the free base (0.90 g and
percent yield) mp 215.9-218.4°C. Then 0.40 g of the free base was dissolved in ethanol
and passed under HCl to give the HCl salt (insert yield and percent yield). ¹HNMR
(DMSO, 300 MHz) δ = [insert data]. IR (cm⁻¹): 3472, 3416, 3371, 2904, 2854, 1907,
1741, 1647, 1610, 1585, 1544, 1508, 1376, 1224, 1158, 1119, 1090, 1015, 934, 847, 810,
745, 701, 668, 615, 587, 568, 523, 498, 473, 458.

2,5-Bis(4-N-hydroxylaminophenyl)-3-(4-methylphenyl)furan (51):
In a round-bottom flask 2.0 g hydroxylamine HCl was added to 40mL dry DMSO. The
temperature was lowered to 0°C and 2.5 g potassium tert-butoxide was added. Then 0.65
g of 2,5-Bis(4-cyanophenyl)-3-(4-methylphenyl)-furan was added to the mixture. The
reaction was allowed to stir at room temperature overnight under nitrogen. The mixture
was diluted with excess water to give a precipitate. The precipitate was filtered and
collected and rinsed with water. Recrystallized from ethanol to give yellowish crystals
(insert yield and percent yield) mp [insert MP]. ¹HNMR (DMSO, 300 MHz) δ = [insert data]. IR (cm⁻¹): 3490, 3390, 3300, 2909, 2824, 2356, 2336, 2313, 2064, 1935, 1792,
1740, 1643, 1611, 1580, 1509, 1474, 1443, 1388, 1280, 1190, 1116, 1087, 1064, 1041,

2,5-Bis(4-amidinophenyl)-3-(4-methoxyphenyl)furan (53):
In a round-bottom flask, 0.3 g 2,5-Bis(4-N-hydroxylaminophenyl)-3-(4-
methoxyphenyl)-furan was dissolved in 1.5 mL Ac₂O and 20 mL AcOH and allowed to
stir overnight at room temperature. The next day the mixture was poured into a
hydrogenator flask and diluted with ethanol and 0.15 Pd (10% on carbon) was added and
hydrogenated for two hours. After completion, the mixture was filtered over Celite and
the solution was removed on vacuo to give a yellow solid, which is the free base (0.35 g,
insert percent yield) mp [insert MP]. ¹HNMR (DMSO, 300 MHz) δ = [insert data]. IR (cm⁻¹): [insert IR data].

2,5-Bis(4-amidinophenyl)-3-(4-fluorophenyl)furan (54):
In a round-bottom flask, 0.4 g 2,5-Bis(4-N-hydroxylaminophenyl)-(4-fluorophenyl)-
furan was dissolved in 1.5 mL Ac₂O and 20 mL AcOH and allowed to stir overnight at
room temperature. The next day the mixture was poured into a hydrogenator flask and
diluted with ethanol and 0.2 Pd (10% on carbon) was added and hydrogenated for two
hours. After completion, the mixture was filtered over Celite and the solution was
removed on vacuo. ¹HNMR (DMSO, 300 MHz) δ = [insert data]. IR (cm⁻¹): [insert IR
data].
2,5-Bis(4-amidinophenyl)-3-(4-methylphenyl)furan (55):
In a round-bottom flask, 0.35 g 2,5-Bis(4-N-hydroxyaminophenyl)-3-(4-
methylphenyl)-furan was dissolved in 1.5 mL Ac₂O and 20 mL AcOH and allowed to stir overnight at room temperature. The next day the mixture was poured into a hydrogenator flask and diluted with ethanol and 0.18 Pd (10% on carbon) was added and hydrogenated for two hours. After completion, the mixture was filtered over Celite and the solution was removed on vacuo to give a greenish yellow solid, which is the free base (0.37 g, insert percent yield) mp [insert MP]. ¹H NMR (DMSO, 300 MHz) δ = [insert data]. IR (cm⁻¹): [insert IR data].

2,5-Bis(4-amidinophenyl)-3-phenylfuran (56):
In a hydrogenation flask the 2,5-Bis(4-N-hydroxyaminophenyl)-3-phenylfuran was dissolved in a minimal amount of acetic anhydride and acetic acid. In the flask, Pd (10% on carbon) catalyst was added and the mixture was put on the hydrogenation apparatus and allowed to shake under H₂ for a few hours. Checked using TLC showed completion of reaction. The mixture was filtered over Celite and the filtrate was concentrated on vacuo to give a semi-solid oil. The product was dried on the vacuum pump. NMR showed impurity and the solid was boiled in ethanol to make the free base. The free base was passed under HCl gas and then dried on vacuo and dried on the vacuum pump and collected to give a yellow solid (0.10 g and 21%) mp charred above 250°C. ¹H NMR (DMSO, 300 MHz) δ = 9.47 (d, 4H), 9.22 (d, 4H), 8.16 (d, J = 8.5 Hz, 2H), 8.00 (d, J = 8.5 Hz, 2H), 7.85 (dd, J = 8.7 Hz, 4H), 7.62 (s, 1H), 7.52 (s, 5H). IR (cm⁻¹): 3626, 3649, 3595, 3419, 3385, 3261, 3204, 3140, 2960, 2918, 2856, 2777, 2727, 2623, 2561, 2359, 2333, 2305, 1947, 1692, 1673, 1606, 1536, 1484, 1365, 1300, 1237, 1212, 1161, 1138, 1063, 1032, 992, 954, 934, 913, 995, 949, 815, 752, 724, 700, 676, 658, 589, 561, 530, 514, 505, 486, 467. Analysis for C₂₄H₂₀N₄O·2.0HCl·1.75H₂O (484.89): Calcd: C, 59.45; H, 5.30; N, 11.55. Found: C, 59.41; H, 5.21; N, 11.08.

2,5-Bis(4-N-methoxyaminophenyl)-3-(4-methoxyphenyl)furan (61):
In a round-bottom flask, [insert amount] 2,5-Bis(4-N-hydroxyaminophenyl)-3-(4-
methoxyphenyl)-furan was dissolved in 5 mL 1,4-dioxane. Then the mixture was chilled to 0°C and 2N NaOH was added. Then dimethyl sulfate in 1,4-dioxane was added and the mixture was allowed to stir overnight at room temperature. The next day, the reaction was diluted with water and extracted with ethyl acetate three times and washed with brine and dried over Na₂SO₄. (insert yield and percent yield) mp [insert MP]. ¹H NMR (DMSO, 300 MHz) δ = [insert NMR data]. IR (cm⁻¹): [insert IR data].

2,5-Bis(4-N-methoxyaminophenyl)-3-(4-methylphenyl)furan (62):
In a round-bottom flask, [insert amount] 2,5-Bis(4-N-hydroxyaminophenyl)-3-(4-
methylphenyl)-furan was dissolved in 5 mL 1,4-dioxane. Then the mixture was chilled to 0°C and 2N NaOH was added. Then dimethyl sulfate in 1,4-dioxane was added and the mixture was allowed to stir overnight at room temperature. The next day, the reaction was diluted with water and extracted with ethyl acetate three times and washed with brine and dried over Na₂SO₄. (insert yield and percent yield) mp [insert MP]. ¹H NMR (DMSO, 300 MHz) δ = [insert NMR data]. IR (cm⁻¹): [insert IR data].
2,5-Bis(4-N-methoxyamidinophenyl)-3-(4-fluorophenyl)furan (63):
In a round-bottom flask, [insert amount] 2,5-Bis(4-N-hydroxyamidinophenyl)-3-(4-fluorophenyl)-furan was dissolved in 5 mL 1,4-dioxane. Then the mixture was chilled to 0°C and 2N NaOH was added. Then dimethyl sulfate in 1,4-dioxane was added and the mixture was allowed to stir overnight at room temperature. The next day, the reaction was diluted with water and extracted with ethyl acetate three times and washed with brine and dried over Na₂SO₄. (insert yield and percent yield) mp [insert MP]. ¹HNMR (DMSO, 300 MHz) δ = [insert NMR data]. IR (cm⁻¹): [insert IR data]

References:

1. For information concerning leishmaniasis, please see the follow worldwide web locations: (a) http://www.biosci.ohio-state.edu/~parasite/leishmania.html and (b) http://www.who.int/inf-fs/en/fact116.html.
12. C. E. Stephens, D. A. Patrick, H. Chen, R. R. Tidwell, and D. W. Boykin. Synthesis of Deuterium-Labelled 2,5-Bis(4-amidinophenyl)furan, 2,5-Bis(4-

Table E-1
Mean Standardized Graduate Admission Test Scores
FY 2003- FY 2005
Chemistry Department
Self Study 2005

<table>
<thead>
<tr>
<th>FY</th>
<th>ACADEMIC PROGRAM</th>
<th>APPLIED</th>
<th>ACCEPTED</th>
<th>ENROLLED</th>
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<td>GRE VERB</td>
<td>GRE QUANT</td>
<td>GRE VERB</td>
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<td>MS CHM</td>
<td>429</td>
<td>422</td>
<td>540</td>
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<td>PhD CHM</td>
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<td>504</td>
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<td>MS CHM</td>
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<td>PhD CHM</td>
<td>455</td>
<td>505</td>
<td>576</td>
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Table E-2
Selection Ratio of Applicant/Accepted Graduate Students
FY 2003- FY 2005
Chemistry Department
Self Study 2005

<table>
<thead>
<tr>
<th>FY</th>
<th>ACADEMIC PROGRAM</th>
<th># OF APPLICANTS</th>
<th># OF ACCEPTED</th>
<th>RATIO</th>
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<td>17</td>
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<td>FY03</td>
<td>PhD CHM</td>
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<td>14</td>
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<tr>
<td>FY04</td>
<td>MS CHM</td>
<td>36</td>
<td>21</td>
<td>58%</td>
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<tr>
<td>FY04</td>
<td>PhD CHM</td>
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<td>23</td>
<td>31%</td>
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<tr>
<td>FY05</td>
<td>MS CHM</td>
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<tr>
<td>FY05</td>
<td>PhD CHM</td>
<td>69</td>
<td>29</td>
<td>42%</td>
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### Appendix E-1
Chemistry Department
Self-Study 2005
Graduate Programs Admissions Requirements

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<th>Degree</th>
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<td>2. List of References Form</td>
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<tr>
<td></td>
<td>3. Goal Statement</td>
</tr>
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<td></td>
<td>5. TOEFL Scores (for applicants whose primary language is not English)</td>
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<td>6. Two (2) official transcripts from each institution of higher education that has been attended.</td>
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<td>1. GRE Scores</td>
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<td>2. Three (3) Recommendation Letters.</td>
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<tr>
<td></td>
<td>3. Goal Statement</td>
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<td>4. TOEFL Scores (for applicants whose primary language is not English)</td>
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<tr>
<td></td>
<td>5. Two (2) official transcripts from each institution of higher education that has been attended.</td>
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Applications are evaluated by the Director of Graduate Studies in consultation with area advisors and the faculty for admission to the Ph. D program. The M.S. Admissions, Honors and Awards Committee of the Department of Chemistry assist the Graduate Director in M.S. admissions.
## Appendix E-2
Chemistry Majors Students Awards, Fellowships and Employment
Chemistry Department
Self-Study 2005

### Dr. Stuart Allison’s students

<table>
<thead>
<tr>
<th>Name</th>
<th>Select one</th>
<th>Accomplishments / Honors / Fellowships received / Specific funding received / Employment</th>
<th>When</th>
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<tbody>
<tr>
<td>Chuanying Chen</td>
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<tr>
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<td>Postdoc</td>
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</tr>
<tr>
<td></td>
<td>Grad</td>
<td>Postdoc</td>
<td></td>
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<tr>
<td></td>
<td>Ugrad</td>
<td>Postdoc</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td>Grad</td>
<td>Postdoctoral Associate in Dr. M. Pettit’s laboratory at the University of Houston</td>
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### Dr. David Boykin’s students

<table>
<thead>
<tr>
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<th>When</th>
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<tr>
<td>Reem Arafa</td>
<td></td>
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<tr>
<td></td>
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<td>Postdoc</td>
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<tr>
<td></td>
<td>Grad</td>
<td>Postdoc</td>
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### Dr. Alfons Baumstark’s students

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<td>Pamela Leggett-Robinson</td>
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<td>Postdoc</td>
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<td></td>
<td>Grad</td>
<td>Postdoc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Postdoc</td>
<td>2002</td>
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<tr>
<td></td>
<td>Grad</td>
<td>South East Regional Dissertation Award</td>
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<tr>
<td>Name</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
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**Dr. Emelita Breyer’s students**

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<th>Grad</th>
<th>Postdoc</th>
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<th>When</th>
</tr>
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<td>Kirtan Koticha</td>
<td>Ugrad</td>
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<td>Postdoc</td>
<td>American Society of Biochemistry and Molecular Biology Award</td>
<td>2005</td>
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<tr>
<td></td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>American Society of Biochemistry and Molecular Biology Award</td>
<td>2004</td>
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<tr>
<td>Hetal Patel</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Oak Ridge Fellowship at CDC</td>
<td>Since 2003</td>
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<tr>
<td>Ying Tao Zhou</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Oak Ridge Fellowship at CDC</td>
<td>Since 2003</td>
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<tr>
<td>Sarah Howard</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Oak Ridge Fellowship at CDC</td>
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<td>Name</td>
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<td>Accomplishments / Honors / Fellowships received / Specific funding received / Employment</td>
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<tr>
<td>Brian Sook</td>
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<td>Grad Postdoc Molecular Basis of Disease Fellowship</td>
<td>2004 &amp; 2005</td>
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<tr>
<td>Ruel McKnight</td>
<td>Ugrad Grad</td>
<td>Postdoc Assistant Professor SUNY, Geneseo</td>
<td>Since 2004</td>
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<tr>
<td></td>
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<td>Grad Postdoc Department of Chemistry, Graduate Award for Outstanding Instruction</td>
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<tr>
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<td>Grad Postdoc Department of Chemistry, Graduate Award for Outstanding Instruction</td>
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<tr>
<td>Sophia Edwards-Bennett</td>
<td>Ugrad</td>
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<tr>
<td>Hui Mao</td>
<td>Ugrad</td>
<td>Grad Postdoc Assistant Professor, Emory Medical School</td>
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<tr>
<td>Xiaole Hong</td>
<td>Ugrad</td>
<td>Grad Postdoc Vice President of Research and Development Aurora Imaging</td>
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<tr>
<td>Scott Woehler</td>
<td>Ugrad</td>
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<tr>
<td>Wanda Santana-Jorgenson</td>
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<td>Atia Alam</td>
<td>Ugrad</td>
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<tr>
<td>Nancy Thornton</td>
<td>Ugrad Grad</td>
<td>Postdoc Faculty position at Drew University</td>
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<tr>
<td>Nichole Powell</td>
<td>Ugrad</td>
<td>Presented talk at the 53rd Southeast Regional Meeting of the American Chemical Society, Savannah, GA</td>
<td>09/23/01</td>
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<td></td>
<td>Grad</td>
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<td>11/13/02</td>
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<tr>
<td></td>
<td>Grad</td>
<td>Assistant Professor, Chemistry Department, Tuskegee University</td>
<td>Since 2004</td>
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<td>Bethany Russell</td>
<td>Ugrad</td>
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<td>11/13/02</td>
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<td>Grad</td>
<td>Environmental Protection Agency, Atlanta</td>
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<td>Fan Fan</td>
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<td>2004 &amp; 2005</td>
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<td>Department of Chemistry, Graduate Award for Outstanding Research at the Doctoral Level</td>
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<td>Dawit Seyfe</td>
<td>Ugrad</td>
<td>Laboratory Technician, Emory University</td>
<td>Since 2003</td>
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### Dr. Markus Germann’s students

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<td>Jim Aramini</td>
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<td>Research Assistant Professor, Rutgers</td>
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<tr>
<td>Christopher Shelley</td>
<td>Ugrad Grad Postdoc</td>
<td>Chemistry &amp; Biology Instructor, Bellevue College, WA.</td>
<td>2001</td>
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<tr>
<td>Stephen H. Cleaver</td>
<td>Ugrad Grad Postdoc</td>
<td>Novantis Bioinformatics</td>
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</tr>
<tr>
<td>Subrata Mishra</td>
<td>Ugrad Grad Postdoc</td>
<td>Department of Chemistry, Graduate Award for Outstanding Instruction</td>
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<td>Ugrad Grad Postdoc</td>
<td>Brains and Behavior Fellowship</td>
<td>2005</td>
</tr>
<tr>
<td>Gallen Collier</td>
<td>Ugrad Grad Postdoc</td>
<td>Molecular Basis of Disease Fellowship</td>
<td>2005</td>
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### Dr. Kathryn Grant’s students

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<th>When</th>
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<tbody>
<tr>
<td>Tjasa Bantan-Polak</td>
<td>Ugrad Grad Postdoc</td>
<td>Current Position: Head of Analytical Development Department, Lek Pharmaceuticals</td>
<td></td>
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<tr>
<td>Xia Yang</td>
<td>Ugrad Grad Postdoc</td>
<td>Current Position: Postdoctoral Associate, Department of Medicine, U.C.L.A.</td>
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<tr>
<td>Nichole Powell (G. Gadda co-advisor)</td>
<td>Ugrad Grad Postdoc</td>
<td>Current Position: Assistant Professor, Tuskegee University</td>
<td></td>
</tr>
<tr>
<td>Sowmya Pattabhi</td>
<td>Ugrad Grad Postdoc</td>
<td>Current Position: Research Assistant, Division of Parasitic Diseases, Centers for Disease Control and Prevention</td>
<td></td>
</tr>
<tr>
<td>Beth Wilson</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
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<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
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### Dr. Zhen Huang’s students

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<tr>
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<td>Postdoc</td>
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<td>Grad</td>
<td>Postdoc</td>
</tr>
<tr>
<td>Julianne Caton-Williams</td>
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<td>Postdoc</td>
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<tr>
<td></td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
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### Dr. Gabor Patonay’s students

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<th>Name</th>
<th>Select one</th>
<th>Accomplishments / Honors / Fellowships received / Specific funding received / Impressive Job offers / Others</th>
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<tbody>
<tr>
<td>Kimberly Agnew-Heard</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
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</table>
### Dr. Jerry Smith’s students

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<tr>
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<th>Grad</th>
<th>Postdoc</th>
<th>Accomplishments / Honors / Fellowships received / Specific funding received / Employment</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doyle Barrow</td>
<td></td>
<td></td>
<td></td>
<td>Lecturer Department of Chemistry, Georgia State University</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Department of Chemistry, Graduate Award for Outstanding Instruction</td>
<td>2002</td>
</tr>
<tr>
<td>Charmita Burch</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>GAANN Fellowship</td>
<td>2004</td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Department of Chemistry, Graduate Award for Outstanding Instruction</td>
<td>2004</td>
</tr>
</tbody>
</table>

### Dr. Shahab Shamsi’s students

<table>
<thead>
<tr>
<th>Name</th>
<th>Ugrad</th>
<th>Grad</th>
<th>Postdoc</th>
<th>Accomplishments / Honors / Fellowships received / Specific funding received / Employment</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cevdet Akbay</td>
<td></td>
<td>Grad</td>
<td>Postdoc</td>
<td>Assistant Professor, Department of Natural Sciences Fayetteville State University</td>
<td>2004</td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Solvay Fellowship, (Solvay Pharmaceutical, Inc.)</td>
<td>2002-2005</td>
</tr>
<tr>
<td>Dean Norton</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Department of Chemistry, Graduate Award for Outstanding Instruction</td>
<td>2003</td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Department of Chemistry, Graduate Award for Outstanding Instruction</td>
<td>2004</td>
</tr>
</tbody>
</table>
### Dr. Lucjan Strekowski’s students

<table>
<thead>
<tr>
<th>Name</th>
<th>Select one</th>
<th>Accomplishments / Honors / Fellowships received / Specific funding received / Employment</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steve Patterson</td>
<td>Ugrad</td>
<td>Assistant Director at the University of Minnesota Center for Drug Design</td>
<td>Since 1994</td>
</tr>
<tr>
<td>Ekaterina Mineva</td>
<td>Ugrad</td>
<td>Department of Chemistry, Chair’s Award</td>
<td>2003</td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Georgia State University Dissertation Award</td>
<td>2004</td>
</tr>
<tr>
<td>Ekaterina Mineva</td>
<td>Ugrad</td>
<td>Department of Chemistry, Graduate Award for Outstanding Research at the Doctoral Level</td>
<td>2004</td>
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</table>

### Dr. Binghe Wang’s students

<table>
<thead>
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<th>Select one</th>
<th>Accomplishments / Honors / Fellowships received / Specific funding received / Employment</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wei Wang</td>
<td>Ugrad</td>
<td>Assistant Professor, University of New Mexico</td>
<td></td>
</tr>
<tr>
<td>Eric Ballard</td>
<td>Ugrad</td>
<td>Assistant Professor, University of Tampa</td>
<td></td>
</tr>
<tr>
<td>Miles Sweet</td>
<td>Ugrad</td>
<td>Rhodes Scholar (graduate studies at Oxford)</td>
<td>Since 2001</td>
</tr>
<tr>
<td>Susiana Mulyadi</td>
<td>Ugrad</td>
<td>Currently attending to medical school at Medical College of Georgia.</td>
<td></td>
</tr>
<tr>
<td>Susan Deeter</td>
<td>Ugrad</td>
<td>Currently graduate student at Johns Hopkins University.</td>
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## Dr. W. David Wilson's students

<table>
<thead>
<tr>
<th>Name</th>
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<th>Grad</th>
<th>Postdoc</th>
<th>Accomplishments / Honors / Fellowships received / Specific funding received / Employment</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donald Hamelberg</td>
<td></td>
<td></td>
<td></td>
<td>Howard Hughes Medical Institute Fellowship University of California at San Diego</td>
<td>2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>David Withers Boykin Graduate Fellowship in Medicinal Chemistry</td>
<td>2001</td>
</tr>
<tr>
<td>Binh Nguyen</td>
<td></td>
<td></td>
<td></td>
<td>David Withers Boykin Graduate Fellowship in Medicinal Chemistry</td>
<td>2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1st Place at the 2002 Suddath Symposium Poster Competition</td>
<td>2002</td>
</tr>
<tr>
<td>Yi Miao</td>
<td></td>
<td></td>
<td></td>
<td>Won a poster award at BIAcore 2005 International Conference</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Department of Chemistry, Graduate Award for Outstanding Instruction</td>
<td>2004</td>
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<tr>
<td>Elizabeth White</td>
<td></td>
<td></td>
<td></td>
<td>Invited oral presentation at 2005 Pacific Chemistry International Meeting</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>David Withers Boykin Graduate Fellowship in Medicinal Chemistry</td>
<td>2004</td>
</tr>
<tr>
<td>Elizabeth White</td>
<td></td>
<td></td>
<td></td>
<td>Department of Chemistry, Graduate Award for Outstanding Instruction</td>
<td>2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Molecular Basis of Disease Fellowship</td>
<td>2004 &amp; 2005</td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
<td>Ambrose H. Pendergrast Fellowship</td>
<td>2003</td>
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</table>
### Dr. Jenny Yang’s students

<table>
<thead>
<tr>
<th>Name</th>
<th>Select one</th>
<th>Accomplishments / Honors / Fellowships received / Specific funding received / Impressive Job offers / Others</th>
<th>When</th>
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<tbody>
<tr>
<td>April Ellis</td>
<td>Ugrad</td>
<td>American Heart Association Fellowship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grad</td>
<td>Brains and Behavior Fellowship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Postdoc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hsiau-wei Lee</td>
<td>Ugrad</td>
<td>Molecular Basis of Disease Fellowship</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td>Grad</td>
<td>Department of Chemistry, Chair’s Award</td>
<td>2004</td>
</tr>
<tr>
<td></td>
<td>Postdoc</td>
<td>Department of Chemistry, Graduate Award for Outstanding Instruction</td>
<td>2003</td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Awarded for best poster presentation at the Suddath Symposium, Georgia Institute of Technology.</td>
<td></td>
</tr>
<tr>
<td>Ana Wilkins Maniccia</td>
<td>Ugrad</td>
<td>Postdoctoral Associate, Department of Chemistry Georgia State University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grad</td>
<td>NIH Fellowship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Postdoc</td>
<td>Department of Chemistry, Chair’s Award</td>
<td>2003</td>
</tr>
<tr>
<td></td>
<td>Ugrad</td>
<td>Award for best poster presentation at the Suddath Symposium, Georgia Institute of Technology.</td>
<td></td>
</tr>
<tr>
<td>Lisa Jones</td>
<td>Ugrad</td>
<td>GANN Fellowship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grad</td>
<td>Ambrose H. Pendergrast Fellowship</td>
<td>2002</td>
</tr>
<tr>
<td>Name</td>
<td>Degree</td>
<td>Status</td>
<td>Designation</td>
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<td>-----------------</td>
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<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>Lisa Jones</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
</tr>
<tr>
<td>Julian Johnson</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
</tr>
<tr>
<td>Shane Johnson</td>
<td>Ugrad</td>
<td>Grad</td>
<td>Postdoc</td>
</tr>
<tr>
<td>Fiscal Year</td>
<td>PhD. awardee name</td>
<td>Advisor</td>
<td>Current position</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1997</td>
<td>Dr. Ted Rigl</td>
<td>Dr. Wilson</td>
<td>Senior Chemist</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Dr. Richard Williams</td>
<td>Dr. Patonay</td>
<td>Faculty position.</td>
</tr>
<tr>
<td></td>
<td>Dr. David Hamilton</td>
<td>Dr. Hopkins</td>
<td>Upper Division Chemistry</td>
</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>Dr. Elba Michelena-Baez</td>
<td>Dr. Baumstark</td>
<td>Professor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td></td>
<td>Dr. Varsha Vaishnav</td>
<td>Dr. Cheniak</td>
<td>Industrial Position</td>
</tr>
<tr>
<td></td>
<td>Dr. Maryam Daneshvar</td>
<td>Dr. Patonay</td>
<td>Group Leader</td>
</tr>
<tr>
<td>1998</td>
<td>Dr. Kishia Towns</td>
<td>Dr. Kennedy</td>
<td>High School Science Coordinator</td>
</tr>
<tr>
<td>1999</td>
<td>Dr. Lawrence Evans</td>
<td>Dr. Patonay</td>
<td>Industry Position</td>
</tr>
<tr>
<td></td>
<td>Dr. Tim Baranowski</td>
<td>Dr. Strekwoski</td>
<td>Research Chemist at Zygogen, LLC</td>
</tr>
<tr>
<td>Name</td>
<td>Supervisor</td>
<td>Current Position/Positional Details</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Dr. Derrick Bennett</td>
<td>Dr. Kennedy</td>
<td>Teaching High School New York City</td>
<td></td>
</tr>
<tr>
<td>Dr. Iris Francesconi</td>
<td>Dr. Boykin</td>
<td>Commodities Analyst Wall Street</td>
<td></td>
</tr>
<tr>
<td>Dr. Katherine Hopkins</td>
<td>Dr. Wilson</td>
<td>Senior Clinical Chemist Centocor, Inc.</td>
<td></td>
</tr>
<tr>
<td>Dr. Alesia Parker</td>
<td>Dr. Strekowski</td>
<td>Research Chemist at Environmental Protection Agency</td>
<td></td>
</tr>
<tr>
<td>Dr. Mark Cunningham</td>
<td>Dr. Baumstark</td>
<td>Assistant Professor Department of Chemistry Berea College Berea, Kentucky</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recently moved from faculty position at Atlanta Metro (junior college)</td>
<td></td>
</tr>
<tr>
<td>Dr. Leila Tarazi</td>
<td>Dr. Patonay</td>
<td>Teaching High School in Atlanta, GA</td>
<td></td>
</tr>
<tr>
<td>Dr. Menno Baars</td>
<td>Dr. Patonay</td>
<td>Industrial position</td>
<td></td>
</tr>
<tr>
<td>Dr. S. Edwards-Bennett</td>
<td>Dr. Dixon</td>
<td>M.D., Columbia University</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>After working in industry.</td>
<td></td>
</tr>
<tr>
<td>Dr. Ge Xiao</td>
<td>Dr. Wilson</td>
<td>Chemist Biochemistry Analysis Group CDC</td>
<td></td>
</tr>
<tr>
<td>Dr. Anand Swamy</td>
<td>Dr. Patonay</td>
<td>Group CDC</td>
<td></td>
</tr>
<tr>
<td>Dr. Hyeran Lee</td>
<td>Dr. Strekowski</td>
<td>Postdoctoral Associate Washington University</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
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<tr>
<td>Dr. Sue Mazur</td>
<td>Dr. Allison</td>
<td>A.P. High School Chemistry Teacher Roswell, GA</td>
<td></td>
</tr>
<tr>
<td>Dr. Ibrahim Abdou</td>
<td>Dr. Strekowski</td>
<td>Professor of Chemistry, United Arab Emirates</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Name</td>
<td>Supervisor</td>
<td>Position</td>
</tr>
<tr>
<td>------</td>
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<td>------------</td>
<td>--------------------------------------------------------------------------</td>
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<tr>
<td></td>
<td>Dr. Fred Meadows</td>
<td>Dr. Patonay</td>
<td>Research Scientist CIBA</td>
</tr>
<tr>
<td></td>
<td>Dr. Maged Henary</td>
<td>Dr. Strekowski</td>
<td>Research Chemist at KPS LLC, Atlanta, GA</td>
</tr>
<tr>
<td>2001</td>
<td>Dr. Lei Wang</td>
<td>Dr. Wilson</td>
<td>Computational Chemist, Software Development and Applications Tripos, Inc.</td>
</tr>
<tr>
<td></td>
<td>Dr. Donald Hamelberg</td>
<td>Dr. Wilson</td>
<td>Howard Hughes Postdoctoral Fellow University of California at San Diego</td>
</tr>
<tr>
<td></td>
<td>Dr. Hsin-Hung Chen</td>
<td>Dr. Baumstark</td>
<td>Postdoctoral Associate Baylor College of Medicine Houston, Texas</td>
</tr>
<tr>
<td></td>
<td>Dr. Christian Mason</td>
<td>Dr. Strekowski</td>
<td>deceased</td>
</tr>
<tr>
<td></td>
<td>Dr. Martial Say</td>
<td>Dr. Strekowski</td>
<td>Postdoctoral Research Associate Department of Chemistry Georgia State University (Dr. Boykin)</td>
</tr>
<tr>
<td>2002</td>
<td>Dr. Yiming Ye</td>
<td>Dr. Jenny Yang</td>
<td>Postdoctoral Associate at CDC</td>
</tr>
<tr>
<td></td>
<td>Dr. Eilyn Lacy</td>
<td>Dr. Wilson</td>
<td>Industry position</td>
</tr>
<tr>
<td></td>
<td>Dr. Binh Nguyen</td>
<td>Dr. Wilson</td>
<td>Senior Research Associate Department of Chemistry Georgia State University</td>
</tr>
<tr>
<td></td>
<td>Dr. Wei Yang</td>
<td>Dr. Jenny Yang</td>
<td>Postdoctoral Associate Department of Chemistry Georgia State University</td>
</tr>
<tr>
<td>2003</td>
<td>Dr. Yasser Abudulrazek</td>
<td>Dr. Netzel</td>
<td>Assistant Professor University of Alexandria Alexandria, Egypt</td>
</tr>
<tr>
<td>Name</td>
<td>Supervisor</td>
<td>Position/Institution</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------</td>
<td>----------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Dr. Kimberly Agnew-Heard</td>
<td>Dr. Patonay</td>
<td>Industrial Position Quintiles</td>
<td></td>
</tr>
<tr>
<td>Dr. Doyle Barrow</td>
<td>Dr. Smith</td>
<td>Lecturer Department of Chemistry Georgia State University</td>
<td></td>
</tr>
<tr>
<td>Dr. Patricia Ruiz</td>
<td>Dr. Wilson</td>
<td>Computational Chemist CDC</td>
<td></td>
</tr>
<tr>
<td>Dr. Tony Testino</td>
<td>Dr. Patonay</td>
<td>Industrial Position Solvay Pharmaceuticals</td>
<td></td>
</tr>
<tr>
<td>Dr. Adalgisa Batista-Parra</td>
<td>Dr. Boykin</td>
<td>Professor Department of Chemistry Universidad Pontificia de Ponce, Puerto Rico</td>
<td></td>
</tr>
<tr>
<td>Dr. Samir Gaballah</td>
<td>Dr. Netzel</td>
<td>Staff Research Scientist Dept of Photochemistry National Research Center Cairo, Egypt</td>
<td></td>
</tr>
<tr>
<td>Dr. José Gonzalez-Román</td>
<td>Dr. Boykin</td>
<td>Assistant Professor GA Perimeter College</td>
<td></td>
</tr>
<tr>
<td>Dr. Chuanying Chen</td>
<td>Dr. Allison</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. John Sowell</td>
<td>Dr. Patonay</td>
<td>Postdoctoral Associate University of Oregon</td>
<td></td>
</tr>
<tr>
<td>Dr. Angela Navarro-Eisenstein</td>
<td>Dr. Baumstark</td>
<td>Visiting Lecturer Department of Chemistry Georgia State University</td>
<td></td>
</tr>
<tr>
<td>Dr. Xia Yang</td>
<td>Dr. Grant</td>
<td>Postdoctoral Associate Department of Medicine UCLA</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>Dr. Pamela Leggett-Robinson</td>
<td>Assistant Professor Department of Chemistry Tuskegee University</td>
<td></td>
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</table>

She was Research Scientist in Bristol-Myers Squibb, Barceloneta, Puerto Rico.
<table>
<thead>
<tr>
<th>2005</th>
<th>Dr. Alfred Eiser (Geochem.)</th>
<th>Postdoctoral Research Associate Department of Chemistry Georgia State University (Dr. Boykin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ekaterina Paliakov</td>
<td>Dr. Strekowski</td>
<td>Postdoctoral Research Associate Department of Chemistry Georgia State University (Dr. Boykin)</td>
</tr>
<tr>
<td>Dr. Rucks Winkeljohn</td>
<td>Drs. Baumstark and Strekowski</td>
<td>Postdoctoral Associate Department of Chemistry Georgia State University</td>
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</tbody>
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<table>
<thead>
<tr>
<th>2006</th>
<th>Dr. Anna Wilkins Maniccia</th>
<th>Postdoctoral Associate Department of Chemistry Georgia State University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Brian Crow</td>
<td>Dr. Baumstark</td>
<td>Senior Scientist Metametrix Norcross, Georgia</td>
</tr>
</tbody>
</table>
The maps below show the past, current and future locations for the Workshops courses/laboratories.

2004-07 Proposed Workshop Locations

2001-03 Workshop Locations
Table F-1: Faculty Productivity Average
Chemistry Department
Self Study 2005

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of TT Faculty</th>
<th>Ave# Refereed Publications</th>
<th>Ave Amt. Of External Funding (FY2001-FY2005)</th>
<th>Ave# Conference Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>16</td>
<td>3.3</td>
<td>$151,063.3</td>
<td>4.1</td>
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<tr>
<td>2002</td>
<td>16</td>
<td>3.9</td>
<td>$180,476.2</td>
<td>4.2</td>
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<tr>
<td>2003</td>
<td>17</td>
<td>3.8</td>
<td>$196,479.9</td>
<td>4.7</td>
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<tr>
<td>2004</td>
<td>18</td>
<td>4.5</td>
<td>$246,628.2</td>
<td>4.2</td>
</tr>
<tr>
<td>2005</td>
<td>18</td>
<td>5.1</td>
<td>$284,705.4</td>
<td>4.1</td>
</tr>
</tbody>
</table>
The departmental Graduate Faculty Committee has the responsibility to assess and recommend faculty who demonstrate current scholarly competence to the Dean for appointment to Graduate Faculty status. The faculty has designated the departmental Advisory P&T Committee to also serve as the Graduate Faculty Committee. In addition to following the departmental guidelines, College and University policy must be met. Changes to the departmental guidelines must be approved by the Dean's Office.

Criteria for Selection

In accordance with the College of Arts and Sciences’ Graduate Faculty policy, the Chemistry Department makes recommendations to the Dean for appointment to the Graduate Faculty for tenure-track faculty via recommendations from the departmental Graduate Faculty Committee using the following criteria:

1) An earned doctoral (terminal) degree in the relevant discipline.
2) A strong record of scholarly (refereed) high quality publications and grant support during the last five years.
3) Evidence of effective teaching in graduate courses.
4) Evidence of effective supervision/mentoring of graduate students.

Because of the extensive evaluation during the hiring process, all new tenure-track faculty are automatically appointed to Graduate Faculty status upon hiring. Faculty who hold Graduate Faculty status in the Department of Biology automatically hold that status in the Department of Chemistry and vice versa if they are members of the Center for Biotechnology and Drug Design.

Other faculty (NTT Senior Lecturers, Lecturers, Adjunct Faculty, etc.) whose position and workload allows for involvement in the graduate education program can hold Graduate Faculty status but cannot chair Ph.D. dissertation committees. The chairing of M.S. thesis committees will only be allowed after approval of both the departmental Chair and the departmental Graduate Director. Criteria 1, 2 and 3 above apply except the grant support record in criterion 2 is not required. The graduate status of this group will be reviewed at least every three years.

Procedures

For tenured/tenure-track faculty:

1) All new tenure-track faculty will be appointed to Graduate Faculty status upon hiring. Successful completion of the pre-tenure review will automatically reappoint them to Graduate Faculty status. Newly hired tenured faculty will be appointed to Graduate Faculty status automatically.
2) Tenure-track and tenured faculty members who have Graduate Faculty status will have their status reviewed by the departmental Graduate Faculty Committee, and continuation will be recommended, or denied, as part of the tenure, or post-tenure review process to the Dean. The evidence for “current scholarly competence” beyond that defined in the University policy will be based on the Department of Chemistry’s P&T manual and guidelines regarding Graduate Faculty.

3) Tenure-track and tenured faculty from other departments (except for Biology faculty who have Chemistry Graduate Faculty status as described) may request Graduate Faculty status in Chemistry via a request to the chair at the time of their initial appointment, or at the beginning of Spring Semester. Their continuation in Graduate Faculty status in the Department of Chemistry will also be reviewed at the same time as their tenure, or post-tenure review in their primary department. The evidence for “current scholarly competence” beyond that defined in the University policy will be based on the Department of Chemistry P&T manual and guidelines regarding Graduate Faculty. Graduate Faculty status must be explicitly addressed in the documentation establishing any joint appointments.

4) Tenure-track and tenured faculty members who do not hold Graduate Faculty status may request consideration from the departmental Graduate Faculty Committee at the beginning of Spring Semester each year.

5) Tenured faculty who do not participate in post-tenure review will have their Graduate Faculty status reviewed every five years (or as part of their regular review cycle) by either the Dean’s Office of the College of Arts and Sciences (or the Provost’s Office) using the criteria from the department’s guidelines for Graduate Faculty status.

6) All changes in a faculty member’s Graduate Faculty status must be approved by the Dean’s Office.

For other faculty:

Non-tenure-track and adjunct faculty may be recommended for appointment to Graduate Faculty status by the departmental Graduate Faculty Committee upon nomination by a member of the department’s Graduate Faculty.

1) New NTT faculty and adjunct faculty will be reviewed for faculty status at the time of hire and receive Graduate Faculty status to be in cycle with the rest of the appointments.

2) Other faculty may be nominated for Graduate Faculty status by a member of the Graduate Faculty at the beginning of the Spring Semester each year.

3) Every three years the Graduate Faculty status of other faculty must be reviewed by the departmental Graduate Faculty Committee and the recommendations sent to the Dean.

4) All changes in an “other” faculty member’s Graduate Faculty status must be approved by the Dean’s Office.

Specific Guidelines for Evaluation

For Tenured/Tenure-Track Faculty
The candidate for renewal must submit: (1) an up-to-date resume (C.V.) which lists publications and grant support for the last five years; (2) printouts of (on-line) evaluations for graduate courses taught in the last five years; and (3) evidence of effective supervision/training/mentoring of M.S. and Ph.D. graduate students. The Committee will assess the material to determine if the candidate has demonstrated current scholarly competence based on the criteria in the departmental P&T manual.

For Other Faculty

If nominated by a member of the Graduate Faculty, the candidate must submit: (1) a C.V. that lists publications for the last five years and (2) statements of Teaching Philosophy and evidence of teaching ability/effectiveness. The material will be assessed by the Graduate Faculty Committee to determine current scholarly competence based on the criteria in the departmental P&T manual.

For All Faculty

If the Committee recommends Graduate Faculty status, the name(s) and appropriate materials will be forwarded to the Dean's Office for approval by the departmental Chair.

Recommendations for removal from Graduate Faculty status must be sent to the Dean’s Office for evaluation. Faculty who have been denied Graduate Faculty status must wait two years to apply for reconsideration.
### Appendix F-2: List of Graduate Faculty
**Chemistry Department**  
Self Study 2005

<table>
<thead>
<tr>
<th>Faculty names</th>
<th>Faculty ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allison, Stuart A.</td>
<td>Professor</td>
</tr>
<tr>
<td>Baumstark, A.L.</td>
<td>Professor</td>
</tr>
<tr>
<td>Boykin, David W.</td>
<td>Regents’ Professor Emeritus</td>
</tr>
<tr>
<td>Breyer, Emelita D.</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Dixon, Dabney White</td>
<td>Professor</td>
</tr>
<tr>
<td>Gadda, Giovanni</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Germann, Markus W.</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Grant, Kathryn Betty</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Huang, Zhen</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Kennedy, G. Davon</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Netzel, Thomas L.</td>
<td>Professor</td>
</tr>
<tr>
<td>Patonay, Gabor</td>
<td>Professor</td>
</tr>
<tr>
<td>Shamsi, Shahab</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Smith, Jerry C.</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Strekowski, Lucjan</td>
<td>Professor</td>
</tr>
<tr>
<td>Wang, Binghe</td>
<td>Professor, GRA-ES</td>
</tr>
<tr>
<td>Weber, Irene</td>
<td>Professor</td>
</tr>
<tr>
<td>Wilson, W. David</td>
<td>Regents’ Professor</td>
</tr>
<tr>
<td>Yang, Jenny J.</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>
This appendix contains a limited Curriculum Vitae Chemistry Tenure Track Faculty that includes the following relevant information:

- Education
- Memberships
- Recent publications
- Recent conferences, seminars and invited talks
- External Grants
- Scholarly works
- Professional activities
CURRICULUM VITAE

NAME

Stuart Anthony Allison

ADDRESS

Department of Chemistry
Georgia State University
University Plaza
Atlanta, Georgia 30303-3083

BIRTH

March 26, 1951
Kalispell, Montana

PRESENT POST

Professor

EDUCATION

B.A. (suma cum laude, chemistry) 1973, University of Montana, Missoula, MT
M.S. (physical chemistry) 1976, University of California, Berkeley, CA
Ph.D. (physical chemistry) 1980, University of Washington, Seattle, WA

SCHOLARSHIPS

NSF Energy Trainee 1974-75
Chevron Oil Fellowship 1976-77
National Research Service Award (NIH) 1981-82

THESIS TITLES

Carbon-13 NMR Studies of Thermotropic Liquid Crystals (M.S.)
Effects of Simple Triamines on the Internal Brownian Motions and Conformation of DNA (Ph.D.)

POST-GRADUATE WORK
Postdoctoral Fellow, 1980-82, Institute of Molecular Biology, University of Oregon, Eugene, OR

Postdoctoral Fellow, 1982-83, Department of Chemistry, University of Houston, Houston, TX

Visiting Assistant Professor, 1983-84, Department of Chemistry, University of Houston, Houston, TX

Assistant Professor, 1984-1990, Department of Chemistry, Georgia State University, Atlanta, GA

Associate Professor, 1990-2000, Department of Chemistry, Georgia State University, Atlanta, GA

Professor, 2000-present, Department of Chemistry, Georgia State University, Atlanta, GA.

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Sigma Xi
American Biophysical Society

GRADUATE AND POSTGRADUATE SUPERVISORS

Professor J.M. Schurr (graduate supervisor) Department of Chemistry University of Washington, Seattle, Washington 98195

Professor J.A. Schellman (postdoctoral advisor) Institute of Molecular Biology, University of Oregon, Eugene, Oregon 97403

Professor J.A. McCammon (postdoctoral advisor) Department of Chemistry University of Houston, University Park, Houston, Texas 77004

RECENT PUBLICATIONS (since 1990)


69. S.A. Allison and S. Mazur, "Modeling the Free Solution Electrophoretic Mobility of Short...


76. S.A. Allison, Z. Li, D. Reed, and N.C. Stellwagen, AModeling the Gel Electrophoresis of Short Duplex DNA by Brownian Dynamics: Cubic Gel Lattice with Direct Interaction, Electrophoresis, 23, 2678-2689 (2002).


INVITED SEMINARS/PRESENTATIONS (since 1990)

AElectro-Optic Experiments on Wormlike Chains, ≈ Department of Chemistry, University of Washington, Seattle, WA, 4/91

AModeling the Transport of Polyions in External Fields, ≈ Department of Chemistry, University of Wisconsin, Madison, WI, 12/94

AModeling the Electrophoresis of Polyions, ≈ Department of Biochemistry and Molecular Biology, University of New Hampshire, Durham, NH, 10/97

AModeling the Free Solution Electrophoresis of Proteins and Nucleic Acids, ≈ University of
MO, 12/97

Boundary Element Modeling of Biomolecular Transport, University of Glasgow, Glasgow, Scotland, UK, 9/00

“Transport Properties of Colloids and Macroions Using Detailed Models,” University of Goteborg, Goteborg, Sweden, 4/02

“Electrokinetic Modeling of Protein Charge Ladders,” Department of Chemistry and Biochemistry, San Francisco State University, San Francisco, CA, 9/04

PRESENTATIONS AT PROFESSIONAL MEETINGS (since 1990)

Transport of Polyions in Electric Fields, S. Allison & P. Nambi, poster presentation at Biophysical Society Meeting, Houston, TX, 2/92


Modeling the Transport of Charged Biomolecules, S. Allison, S. Mazur, and H. Wang, poster presentation at the Suddath Symposium, Department of Chemistry, Georgia Institute of Technology, Atlanta, GA, 4/99


“Modeling the Free Solution Electrophoresis of T4Lysozyme and Mutants,” C. Chen, S.A. Allison, J. Durant, and T. Laue, poster presentation at Biophysical Society Meeting, San Francisco, CA, 2/02

“Protein Charge and Membrane Confined Electrophoresis (MCE),” J. Durant, T. Moody, T. Laue, S.A. Allison, poster presentation at Biophysical Society Meeting, San Francisco, CA, 2/02

“How Important are Electroviscous Effects in the Characterization of Silica Sols,” S. Wall, M. Rasmusson, and S.A. Allison, poster presentation at International Symposium on Electrokinetic Phenomena, Cracow, Poland, 8/02

“Modeling Studies on the Transport Properties of Pancreatic Lipase,” F.D. Burkes and S.A. Allison, poster presentation for McNair Undergraduate Summer Research Program at Georgia State University, Atlanta, Ga., 8/03
“Primary Electroviscous Effects in Silica Sols,” M. Rasmusson, S. Wall, S.A. Allison, presentation at 11th International Conference on Surface and Colloid Science, Iguassu Falls, Parana, Brazil, 9/03

“Determination of Protein Charge and Folding Using Protein Charge Ladders and Capillary Zone Electrophoresis,” H. Mitchell, N. Raje, E. Breyer, and S. Allison, poster presentation at ABRCMS, San Diego, CA, 10/03

“Determination of Protein Charge and Folding Using Protein Charge Ladders and Capillary Zone Electrophoresis,” H. Mitchell, N. Raje, E. Breyer, and S. Allison, poster presentation at SERMACS, Atlanta, GA, 11/03

“Modeling the Electrophoretic Mobility of Proteins and Peptides,” H. Mitchell, S. Allison, Y. Xin, and H. Cameron, poster presentation for McNair Undergraduate Summer Research Program at Georgia State University, Atlanta, Ga., 8/05

SIGNIFICANT INSTITUTIONAL SERVICE (since 1990)

University Research Grant Review Committee, 1985-1995

Departmental Director of Graduate Studies (PhD), 1993-1997

Graduate Council Standing Committee, 1993-1997

Graduate Petitions Committee, 1994-1997

College Premedical Advisory Committee, 1994-1997

Departmental Curriculum Committee, 1994-present

Departmental Executive Committee, 1999-2002

Departmental Bioinformatics Advisor, 2002-present

College Curriculum Committee, 1996-1999 (Chair, 1998-1999)

College Promotion & Tenure Committee, 2000-2003

RECENT RESEARCH GRANTS (since 1990)

8. ACS-PRF Type AC Grant (approved), amount: $40,000, grant period 9/90-8/93, title: "Light Scattering Studies of Stiff Linear Polymers"

9. NIH Grant (approved), amount: $100,000, grant period 9/91-8/93, title: "DNA Flexibility Probed by Model Physical Studies"

10. NSF Proposal (approved), amount: $180,000, grant period 9/1/98-8/31/03, title: "Transport of Polyions in Electric Fields"
11. GSU QIF Proposal (approved), amount, $15,000, grant period 1999, title: Laser Induced Fluorescence Detection of Biomolecules and Environmental Pollutants Separated by Capillary Electrophoresis, (with S. Shamsi and G. Patonay).


13. NSF Proposal (submitted, but not funded), amount: $480,000, grant period 9/05-8/07, title: “Reaction Engineering of Nanostructured Assemblies,” (with J. Carbeck (PI), and S. Shvartsman – (both Carbeck and Shvartsman are faculty members in the Dept. of Chemical Engineering at Princeton University)
BIOGRAPHICAL INFORMATION

Alfons L. Baumstark
Department of Chemistry
Georgia State University
Atlanta, Georgia 30303
(404) 651-1716
FAX (404) 651-1416
e-mail: chealb@langate.gsu.edu

PERSONAL INFORMATION

Birthplace: Bleiburg, Austria
Birth Date: May 4, 1948
Citizenship: United States of America
Marital Status: Married; two daughters (two grandchildren)

EDUCATION

Ph.D.  1974; Department of Chemistry, Harvard University (Organic Chemistry);
Dissertation Title: The Chemistry of 1,2-Dioxetanes.
Advisor: Professor P.D. Bartlett (deceased)

A.M.  1972; Harvard University (Chemistry)

B.A.  1970; University of California, Riverside (Chemistry), ACS Certified
Degree; Graduated with high honors; elected Phi Beta Kappa

EXPERIENCE AND RESEARCH INTERESTS

1993-Present  Professor and Chair of Chemistry, Georgia State University; Areas of
interest - Reaction mechanisms, oxidation processes, synthesis of
heterocycles, peroxides, and alkenes, chemiluminescent processes

1989  Professor of Chemistry, Georgia State University

1982  Associate Professor of Chemistry, Georgia State University

1976  Assistant Professor of Chemistry, Georgia State University

1974-1976  Research Fellow, Harvard University; Studying chemiluminescence and
bioluminescence with Professor J. W. Hastings and Dr. T. Wilson
Head Teaching Fellow (Org. Lab), Harvard University Extension School

1970-1974  Graduate student at Harvard University in Organic Chemistry

1970-Summer  Singlet Oxygen quenching studies with Prof. J. N. Pitts at University of
California, Riverside

1967-1970  Reactions of dihydroflavins with Prof. M. J. Gibian (deceased) at the
University of California, Riverside (held NSF-URP grant in 1969)

1967-Summer  Assist. technician, Lockheed Propulsion Company, Mentone, CA; Area:
Boron Rocket fuels (Classified Security Clearance)
RESEARCH SUPPORT  (External)

PRF Type G (September 1, 1977 - August 31, 1980) - $9,000
NSF International Travel Grant (August, 1978) Brazil - $1,015
ACS-PRF (Summers, 1978-1979) - Project SEED-Catalyst-78-79 - $1,000
Research Corp (March 14, 1980 - June 1, 1983) - $6,700
PRF Type B (September 1, 1980 - August 31, 1982) - $13,000
NAS National Research Council Travel Award IUPAC (August 1981) - $307
NIH Development Grant (RR 09201) - 1980-1983 - $31,000
Dreyfus Teacher-Scholar Award (1981-1986) - $40,000

PRF Type B (September 1, 1982 - August 31, 1986) - $28,000 + $4,000 supplement
NSF Travel Grant IUPAC (August 1984) New Zealand - $1,000
NSF NMR Equipment Grant (CHE-8409599) (11/84-4/30/86) Co-PI - $81,300
NSF (CHE8506665) 1985-1988 PI - $130,500

PRF Type B (September 1, 1986 - August 31, 1993) - $60,000 + $4,000 supplement
NIH AIDS (1U01AI27196) 1988-1991 - Co-PI - $264,000 (D. W. Boykin, PI)
BRSG (NIH RR07171-07) April 1, 1990-March 31, 1991 - PI - $36,603
NIAID (1-S15-AI30688-01) Small Equipment Grant - PI - $9,124
NSF (CHE-9017230) 1991-1995 - PI - $135,000

BRSG (NSS RR07171-08) April 1, 1991-March 31, 1992 - PI - $18,355
NINDS (1-S15-NS30117-01) Small Equipment Grant - PI - $13,209
PRF Type B - September 1, 1993-August 31, 1996 - PI - $25,000
Georgia Environmental Technology Consortium (GETC) - GRA Award - PI - $79,000
NSF-EHR GIFT Program Supplement - $10,065 - Summer 1994
Solvay Graduate Fellowships - $64,000 - September 1995 - August 1998
Egyptian Graduate Student Supply Fund - $60,000 January 1999 - June 2004
Solvay Graduate Fellowships - $161,000 - September 1998 - August 2005
AMP (NSF: subcontract) $265,000, November 2005 – November 2009

PUBLICATIONS


Submitted


EDITORSHIPS


EDITORIAL BOARDS

1. International Editorial Board, Heterocyclic Communications.

BOOK REVIEWS


PAPERS PRESENTED


WORKSHOPS


SEMINARS GIVEN

1. Applications of the TiCl₃-LiAlH₄ Reagent to Ring synthesis, Department of Chemistry, Georgia State University, Atlanta, Georgia, May 12, 1977.

2. New Applications of the TiCl₃-LiAlH₄ Reagent, Department of Chemistry, Georgia Institute of Technology, Atlanta, Georgia, October, 1977.

3. Dioxetanes: Their Relationship to Bioluminescent and Chemiluminescent Processes, Department of Chemistry, Georgia College, Milledgeville, Georgia, November 15, 1978.

4. The Role of Cyclic Peroxides in Chemiluminescence, American Institute of Chemists, Atlanta Chapter Meeting, December 6, 1978.

5. Chemiluminescent Decomposition of Dioxetanes and Insertion Reactions of Group VA Compounds with Dioxetanes, Department of Chemistry, Georgia State University, Atlanta, Georgia, October 10, 1979.

6. The Reaction of Tetramethyl-1,2-dioxetane with Phosphines, Department of Chemistry, University of Georgia, Athens, Georgia, October 1, 1980.
7. Peroxide Model Systems: Oxygen-Atom Transfer Reactions of α-Azohydroperoxides, Department of Chemistry, Emory University, Atlanta, Georgia, October 19, 1982.

8. Peroxide Models for Biological Systems, Department of Biology, Georgia State University, Atlanta, Georgia, April 28, 1983.


14. Oxygen-Atom Transfer Chemistry of α-Azo Hydroperoxides, Department of Chemistry, Atlanta University, Atlanta, Georgia, October 17, 1986.

15. 17O NMR Spectroscopy as a Structural Probe, Department of Chemistry, Charleston College, Charleston, South Carolina, October 8, 1987.


18. Oxygen-Atom Transfer Chemistry of Peroxides and Hydroperoxides, Department of Chemistry, University of Missouri, St. Louis, Missouri, September 12, 1988.


HONORS AND AWARDS

1. Junior Faculty Teaching Award, College of Arts and Sciences, Georgia State University (1982).


BIOGRAPHICAL INFORMATION

Regents’ Professor Emeritus
Department of Chemistry
Georgia State University
University Plaza
Atlanta, Georgia 30303
(404) 651-3798 (office)
(404) 651-1416 (fax)
(404) 373-4746 (home)
dboykin@gsu.edu

PERSONAL

Birth Date and Place: 6 January 1939; Montgomery, Alabama

EDUCATION

B.S. University of Alabama, 1961, Chemistry
M.S. University of Virginia, 1963, Organic Chemistry
Ph.D. University of Virginia, 1965, Organic Chemistry

PROFESSIONAL EXPERIENCE

Summer 1965 Instructor, University of Virginia
1965-1968 Assistant Professor, Department of Chemistry,
            Georgia State University
1966-1967 Post-doctoral Fellow, University of Virginia, with Dr. Alfred Burger
            and Dr. Robert E. Lutz (on leave from Georgia State University)
1968-1972 Associate Professor, Department of Chemistry,
            Georgia State University
1972-1993 Professor, Department of Chemistry,
            Georgia State University
Spring 1973 Visiting Professor, Agnes Scott College
Fall  1978 Visiting Professor, Agnes Scott College
1974-1992 Chair, Department of Chemistry,
            Georgia State University
1982-1992 Co-Director, Laboratory for Biological and Chemical Sciences,
            Georgia State University
1993-2000 Associate Dean for Mathematics and the Natural Sciences, College of
            Arts and Sciences, Georgia State University
1993-2000 Regents’ Professor of Chemistry
2000- Regents’ Professor of Chemistry Emeritus

FIELDS OF INTEREST

Organic Chemistry: Synthetic medicinals including anti-HIV, anti-OI, antimalarial, antitrypanosomal, antiviral, anticancer and antimicrobial agents. Structure reactivity relationships of small molecule DNA interactions, αβ-unsaturated ketones, small ring compounds including small ring heterocyclics, and 5- and 6- ring heterocyclic compounds. Oxygen-17 and carbon-13 NMR of organic molecules.
PROFESSIONAL ACTIVITIES

Member of American Chemical Society and International Society of Heterocyclic Chemistry
Reviewer of proposals for NIH, NSF, Petroleum Research Fund, and the John Sealy Memorial Fund (Univ. of Texas)
Ad Hoc reviewer for NIH-SBIR program 1993-1995
Advisor to local Student Affiliate American Chemical Society Chapter (1968)
Secretary (1972) and Chairman (1973) for Chemistry Section of the Georgia Academy of Sciences
Counselor-at-Large (1974-77) Georgia Academy of Science
Preceptor for American Chemical Society Catalyst student at Georgia State University (1971)
Director of Cooperative NSF-URP Program between Georgia State University and Agnes Scott College (1972)
Alternate Counselor, Georgia Section of ACS 1978-1981
Chairman Elect, 1986 Southeastern Regional American Chemical Society Steering Committee
Chairman, 1987 Southeastern Regional American Chemical Society Steering Committee
General Chairman, 1988 Southeastern Regional Meeting of the American Chemical Society
Member, University of Virginia Chemists Advisory Council, 1986-1995
Member, Executive Committee, Georgia Section of ACS, 1990-1991
Member, National Advisory Committee, The Association of Minority Health Professions Schools, AIDS Research Consortium (1990-1994)
Member, Advisory Board Microbial Biotechnology Center, Georgia Research Alliance,(1993-1994)
Member, National Advisory Committee, Florida A&M University Research Centers at Minority Institutions (1993-1998)
Member, Editorial Board, Indian J. Heterocyclic Chemistry (1991-)
Member, Editorial Board, Heterocyclic Communications (1994-1995)
Member, NASULGC Commission on Technology Transfer (1994-2000)
Member, Therapeutics Subcommittee of the AIDS Research Advisory Committee, National Institute of Allergy and Infectious Diseases(NIAID) (1994-1995)
Editor for North America, Heterocyclic Communications (1994-2000)
Member, Advisory Board, Georgia Biotechnology Center, Georgia Research Alliance,(1995-2000)
Member, MBRS External Scientific Review Committee, Florida A&M University (1996-8)
Member, Board of Directors, Georgia State University Research Foundation (1998-2000).
Member, Scientific Advisory Board, Immtech International, Inc.(1999-)

GRANTS HELD

U.S. Army Research and Development Command (1 October 1967 to 31 April 1977) Synthesis of Potential Antimalarials, $268,675, Principal Investigator
PRF (1 September 1970 to 31 August 1972) Structure Reactivity Relationships of 2-Unsaturated Ketones, $6,000, Principal Investigator
NSF (1 May 1972 to 1 Oct. 1972) Undergraduate Research Participation Program, $9,600
NIH RR09201 (1 July 1980 to 30 June 1983) "Biomedical Research Development Grant" Total Budget $299,114, W.D. Wilson, Principal Investigator; Sub-project of D.W. Boykin $9,000
NSF PCM 83-09575 (1 August 1983 to 31 July 1986) "Intercalator Substituent Effects: Design, Synthesis, and DNA Binding Studies" $180,656 (Co-Principal Investigator with W.D. Wilson)
NSF CHE-8409599 (Nov. 15, 1984-April 30, 1986) "Purchase of an NMR Spectrometer" (PI and one of four major proposers), $81,300.
PRF 16468-B4 (January 1, 1985-August 31, 1987) "$^{17}$O NMR Spectroscopy of Heterocyclic Systems" $15,000, Principal Investigator.
Department of Education Grant 172AH60017 (Nov. 14, 1986 - April 15, 1988) "Research Facilities (Equipment) Enhancement Award," $500,000 (DOE) + $749,600 (GSU match) (Co-Principal Investigator with A. Abdelal).
PRF 18850-B4-C (Sept. 1, 1987 - Aug. 31, 1989) "$^{17}$O NMR Spectroscopy as a Probe of Steric Interactions," $20,000, Principal Investigator.
PRF 21332-B (Sept. 1, 1989 - Aug. 31, 1991) "$^{17}$O NMR Spectroscopy: Applications to Organic Chemistry" $24,500, Principal Investigator
PRF 24162-B4-C (Sept. 1, 1991 - Aug. 31, 1994) "$^{17}$O NMR Spectroscopy: Hydrogen Bonding Studies," $20,000, Principal Investigator.
GMBC C94.028.G (July 1, 1993 - June 30, 1994) "Synthesis of Heterocyclic Therapeutic Agents," $41,000, Principal Investigator
NIH RO3 TW00249-01 (April 1, 1993 - March 31, 1996) "RNA-DNA Selective Anti-HIV Agents, Fogarty Inter national Research Collaboration Award," $67,008, Principal Investigator
US Army Medical Reseach (4/1/00-3/31/01) “Synthesis of Antileishmaniasis Compounds” $50,000, total.
NIH R44AI40518-02 SBIR (9/1/00-8/31/01) “Novel Prodrugs for Treatment of Opportunistic Infections” (Allen, J. A. , PI )Total Direct Costs $594, 845. Direct Cost to Boykin lab $50,000.
NIH RO1AI46365 (02/01/01 – 01/31/04 ) "Focused Parallel Synthesis of Dication Antfungal Agents" (R.R. Tidwell, UNC-Chapel Hill, P.I.); award to Boykin lab as co-Investigator, $105,000/year direct.
Gates Foundation (12/7/00- 12/31/05) “Development of Novel Drug Candidates the Treatment of Human African Trypanosomias and Leishmaniasis (R.R. Tidwell, UNC PI), Total $15,000,000. $200,000/yr direct to Boykin lab.
Malaria Medicine Ventures (12/15/03-12/14/06) “Lead Optimization of Drug Candidates
For the Treatment of Malaria” (R.R. Tidwell, UNC-Chapel Hill, P.I.); award to Boykin lab as co-Investigator, $90,909/year direct.

NIH SBIR 1R43AI061870-01 (8/01/04 - 04/30/05) “Aromatic Dication Prodrugs for CNS Trypanosomiasis” (J. Allen, Immtech,PI) Award to Boykin lab $15,000

NIH RO1GM61587(7/1/00-3/31/09) “Sequence-specific recognition of DNA by a Novel Dimer Motif (W. D. Wilson, PI,) Award to Boykin lab $80,000/yr direct.

NIH R01 AI064200-01(05/01/05–4/31/10) “Heterocycle Binding and Biology in the DNA Minor Groove” (W. D. Wilson, PI,) Award to Boykin lab $80,000/yr direct

HONORS AND AWARDS

The American Institute of Chemists Award, University of Alabama (1961)

President and Visitors Research Prize of the Univ. of Virginia (1964)

University Alumni Distinguished Professor Award, GSU (1989)

CASE Georgia Professor of the Year (1989)

Mortar Board (GSU Chapter) Community Service Award for Education (1990)

Herty Medalist (1996)

Georgia Section ACS Outstanding Service Award (2004)

RECENT CHAPTERS


RECENT PATENTS


D. W. Boykin, R. R. Tidwell, W. D. Wilson, J. R. Perfect and C. E. Stephens, Synthesis and
antimicrobial activity of novel dicationic “reversed amidines” U.S.Patent No. 6,737,440, May 18, 2004


W. D. Wilson, D. W. Boykin, and R. R. Tidwell “Compounds that exhibit specific molecular recognition of mixed nucleic acid sequences and bind to the DNA minor groove as a dimer, U. S. Patent No. 6,867,227 March 15, 2005


RECENT PUBLICATIONS


260. Janelle Y. Saulter, Joseph R. Kurian, Lauren A. Trepanier, Richard R. Tidwell, Arlene S. Bridges, David W. Boykin, Chad E. Stephens, Mariappan Anbazhagan and James E. Hall Reductive Metabolism of Antimicrobial Amidoxime Prodrugs by Cytochrome b_{5} and NADH Cytochrome b_{5} Reductase. *Drug Metabolism and Disposition*, in press


Curriculum Vitae

Emelita De Guzman Breyer, Ph. D.

Home: 2840 Livsey Trail
Tucker, GA 30084
Tel. No.: 770-491-0158

Work: Department of Chemistry
Georgia State University
MSC 8L0378
33 Gilmer St. SE Unit 8
Atlanta, GA 30303
Tel. No.: 404-651-0291
E-mail: ebreyer@gsu.edu

Citizenship: United States (1992)

Education:

Clinical Fellow
University of North Carolina Hospital
Chapel Hill, North Carolina
July, 1990 – March, 1992

Director: Dr. John Chapman

Ph.D., Analytical Chemistry
University of New Orleans, Louisiana
August, 1985 - December 1988
North Carolina State University

Dissertation: Quantitative Structure-Retention-Activity Relationship Study using Micellar Liquid Chromatography
Advisor: Dr. Morteza Khaledi

B.S. Chemistry
University of Sto. Tomas, Philippines
March, 1982

Thesis: Analyses of Heavy Metals (Lead, Mercury, Cadmium) in Philippine Salt Beds
Advisor: Dr. Fortunato Sevilla
Professional Experience:

7/90-3/92  Fellow, Division of Clinical Chemistry  
University of North Carolina, Chapel Hill

3/92-9/92  Research Chemist, Lipid Standardization Division  
Centers for Disease Control

9/92-5/99  Visiting Assistant Professor (Part-time), Department of Chemistry  
Emory University

Honors

1978  Clark PAF Scholarship Award
1979  College of Science Scholarship Award
1982  Academic Excellence in Chemistry
1989  Phi Lambda Upsilon Honor Society
1990  Dean’s Honor List
1996  Beta Kappa Honorary Society

Professional Activities:

2002 - 2004  Panel Reviewer, Division of Biological Infrastructure,  
National Science Foundation  
(Total Number of Proposals ~ 10-12 proposal/year)

2003  Panel Reviewer, Major Instrumentation Grant, Chemistry  
National Science Foundation (~10 proposals)

2005  Panel Reviewer, National Science Foundation, Chemistry  
Course Curriculum and Laboratory Instrumentation  
(Total Number of proposals ~ 10)

2001  Advisor, Council of Healthcare and Medical Advisors
1998-2003  Member-At-Large, Georgia Section  
American Chemical Society
1985- 2005  Member, American Chemical Society
2000-2003  Fellow, American Heart Association
1998- 2001  Member, Georgia Section of the Women Chemist Group
1991-2000  Member, American Association of Clinical Chemist
1992-2004  Member, American Association for the Advancement of Science
1996  Nominating Committee Member, Molecular Pathology Division  
American Association of Clinical Chemist
Recent Publications:


Recent Presentations at Professional Conferences:


Meeting of the American Chemical Society, Charleston, SC, November 13-16, 2002.


Professional Service:

NSF Reviewer
- Major Research Instrumentation Panel, Summer, 2003
- Research Enhancement in Undergraduate Education Panel, Fall, 2002, 2003, 2004
- Curriculum, Course and Laboratory Instrumentation Panel, 2005

Journal Reviewer  - Analytical Chemistry (2 manuscripts)
- Electrophoresis (1 manuscripts)
- J. Chromatography (1 manuscript)

Faculty Consultant – Writing Across the Curriculum, GSU, Summer, 2003
P-5 Science Faculty - Physical Science Faculty (P-5 program), USG Science Consortium

Center Co-Director & Evaluation Director - Center for Workshop in Chemical Sciences
- Development of Web-based recruitment and workshop evaluation
- Post-workshop evaluation, Summer, 2004 and 2005 (~2004, 9 workshops, ~180 faculty participants)
  (~2005, 15 workshops, ~250 faculty participants)
- Short-term evaluation, December, 2004 (~148 faculty)
- Development of long-term workshop evaluations for March 2005, (~500 faculty, ~150 institutions, more than 10,000 students nationwide)

Workshop Director - Molecular Genetics and Protein Engineering
Director - Collaborative Approach in Science Education and Research

Faculty Advisor - American Society of Biochemistry and Molecular Biology, GSU

“Exploring Lipid-Protein Interactions”
co-Organizer - Nobel Prize lecture symposium, Pittsburg Conference, March, 2004
       Dr. Kurt Wuthrich – Protein NMR

**External Grants:**

Status: Funded
Role: PI
Grant Type: K25, Biomedical Research Career Award
Title: Study of Dynamic Lipid Binding and Structure-Function of Apolipoprotein CIII
Agency: National Heart Lung and Blood Institute
Period: July 1, 2003 – June 30, 2008

**Project Goals:** Application of factorial design experiment in structure-function study of Apolipoprotein CIII. Development and application of in-vitro model for apolipoprotein-lipoprotein binding process.

Total Cost: $688,757

Status: Funded
Role: co-PI, (PI: Dr. Jerry Smith, co-PI: Dr. Larry Kaplan and Dr. David Collard)
Grant Type: Course Curriculum and Laboratory Improvement Grant
Title: Faculty Enhancement Workshop
Agency: National Science Foundation
Period: July, 2004- April, 2007

**Project Goals:** To direct the evaluation of CWCS and to offer Protein Engineering and Molecular Genetics workshop in EPSCOR states.

Total Cost: $1,620,000
Status: Funded
Role: co-PI, (PI: Dr. Jerry Smith, co-PI: Dr. Larry Kaplan and Dr. David Collard)
Grant Type: Course Curriculum and Laboratory Improvement Grant
Title: Faculty Enhancement Workshop
Agency: National Science Foundation
Period: July, 2001- April, 2004

**Project Goals:** To co-direct the Center for Workshop in Chemical Sciences and to develop a Protein Engineering and Molecular Genetics workshop for faculty from 2- to 4-year colleges.

Total Cost: $1,853,807

Status: Funded
Role: PI
Grant Type: Research in Bioterrorism and Homeland Defense
Title: Identification of Protein Biomarkers of Exposure to Biological/Chemical Agents Using Biochip Technology: An Integrated Approach for Detection and Treatment
Agency: Southeastern Center for Emerging Biological Threats
Period: September 1, 2004 - August, 2006

**Project Goals:** Development of protein biomarkers and fingerprints for identification of the different pathogenic strains of E. coli. in the absence and presence of mammalian host systems.

Total Cost: $100,000

Section F
Status: Funded  
Role: Collaborator  *(PI: Dr. Richard Plemper, Emory University Vaccine Center)*  
Grant Type: Research in Bioterrorism and Homeland Defense  
Title: Template Design of Virus Entry Inhibitors  
Agency: Southeastern Center for Emerging Biological Threats  
Period: July 1, 2004 - June, 2005  
Project Goals: Application of Vesicle Affinity Capillary Electrophoresis in the screening of drugs against Measle virus.

Total Cost: $50,000

Status: Funded  
Role: PI  
Grant Type: Method Development and Industrial Grant  
Title: Biomarkers for Stroke and Cardiovascular Disease  
Agency: Ciphergen, Center for Disease Control, National Institute of Health  
Period: June, 2005 - June, 2007  
Project Goals: Development of chip-MS technology and bioassays for early detection of different types of Stroke. Validation of the bioassays in preparation for clinical epidemiological and prospective studies on Stroke and CVD.

Total Cost: $359,409

Status: Pending  
Role: PI  
Grant Type: R21 Exploratory Biomedical Engineering Grant  
Title: Novel High Throughput Screening Method for Lipoprotein Profile  
Agency: National Institute of Health  
Period: January, 2006 - December, 2007  
Project Goals: Development of high-throughput assay and reference method for lipoprotein and apolipoprotein profiles.

Total Cost: $359,409

Status: Pending  
Role: Collaborator  *(PI: Dr. Richard Compans, Emory Univ. Vaccine Center)*  
Grant Type: RO1  
Title: Integrated Preclinical/Clinical Program for Topical Microbicides  
Agency: NIH  
Project Goals: Application of Vesicle Affinity Capillary Electrophoresis in molecular understanding of the transport and activity of topical microbicides.

Total Cost: $1,218,199
Status: Pending
Role: Collaborating Investigator  (PI: Department of Biology and Chemistry)
Grant Type: Research Infrastructure
Title: Biocontamination Facility for GSU
Agency: National Institute of Health
Period: July, 2005 - June, 2007

**Project Goals:** Acquisition of a building and research facilities for biological research that requires Biosafety level II and above.
Dabney White Dixon

Department of Chemistry       Phone: (404) 658-3908
Georgia State University      Fax: (404) 651-1416
Atlanta, Georgia 30303-4098   email: ddixon@gsu.edu

EDUCATION AND EXPERIENCE:

2002 - present  Professor of Chemistry, Georgia State University
1990 - 2002  Associate Professor of Chemistry, Georgia State University
1992 - 1993  Associate Dean for Mathematics and the Natural Sciences
1986 - 1990  Assistant Professor of Chemistry, Georgia State University
1979 - 1986  Assistant Professor of Chemistry, Washington University
1976 - 1979  Postdoctoral Fellow, University of California at San Diego
1972 - 1976  Ph.D. in Organic Chemistry, Massachusetts Institute of Technology
1971 - 1972  Schering Corporation, Bloomfield, New Jersey
1967 - 1971  A.B. magna cum laude in Chemistry, Brown University, Rhode Island

PROFESSIONAL RECOGNITION AND SERVICE

Fellowships and Awards

Andrews Scholar, Mosler Scholarship, 1967; Sigma Xi, Phi Beta Kappa, 1971; American
Association of University Women Fellow, 1976; Faculty Teaching Award, Washington
University, 1986; Career Enhancement Award, National Science Foundation, 1987;
Outstanding Junior Faculty Award, Georgia State University, 1988; Innovative Teaching Award,
Georgia State University, 1998.

Journal and Grant Review

Referee for: Journal of the American Chemical Society, Biochemistry, Journal of Organic
Chemistry, Biochimica Biophysica Acta, Inorganic Chemistry, New Journal of Chemistry,
Biochemical Pharmacology, Journal of Inorganic Biochemistry, Journal of Chromatography,

Extramural reviewer for: National Science Foundation, National Institutes of Health, Petroleum
Research Fund, Research Corporation, U.S. Civilian Research and Development Foundation.

Study Section/Grant Review Panel: National Science Foundation Ad Hoc Panel, 1989; National
Institutes of Health AIDS NCCDDG Ad Hoc Panel, 1991; National Institutes of Health
Metallobiochemistry Study Section 1994 - 1998, Chair, 1996 - 1998; National Science
Foundation GK-12 Review Panel, 2001; National Science Foundation Graduate Fellowship

Invited Symposia Participation, 1990 - present


Invited Lectures, 1995 - present

The University of Chattanooga at Tennessee, 1995; Department of Chemistry and Biochemistry, California Institute of Technology, 1996; Department of Biochemistry and Biophysics, University of California at Irvine, 1996; Department of Chemistry and Biochemistry, University of California at San Diego, 1997; Department of Biochemistry, University of Mississippi Medical Center, 1997; Department of Chemistry, University of South Carolina, 1998; Department of Chemistry, Auburn University, 1999; The Scripps Research Institute, 1999; Department of Chemistry, Indiana University-Purdue University at Indianapolis, 1999; Department of Chemistry, Clark Atlanta University, 2000; Utah State University, 2000; Washington State University, 2000; University of West Georgia, 2003; University of Tennessee at Chattanooga, 2003; San Francisco State University, 2003; University of Tennessee at Chattanooga, 2004; Colorado State University, 2004; University of New Hampshire, 2004; Northeastern University, 2004.

Professional Affiliations

American Chemical Society

ADMINISTRATION AND SERVICE

Chemistry Department: Chemistry Department Computing Facility Committee, 1988; Seminar Committee, Chemistry (Chair), 1988, 1999; Biochemistry Area Advisor, 1988 - present; Petitions Committee, 1990; Committee to Evaluate the Chemistry Chair, 1991, 1996 (Chair) and 1999; NMR Oversight Committee, 1991 - present; Departmental Self-Study for Programmatic Review, 1995 - 1997; Departmental Executive Committee, 1995 - present; Faculty Search Committees, Biochemistry (Chair) and Analytical Chemistry, 1995 - 2004; New Faculty Advisor, 1998 - present.

College of Arts and Sciences: Committee to Improve Instruction, 1990; Associate Dean for Mathematics and the Natural Sciences, 1992 - 1993; Arts and Sciences Faculty Awards Committee, 1995 - 1997; Faculty Search Committee, Biochemistry and Biophysics (Physics and Astronomy), 1996; Faculty Search Committee, Geology, 2004; College of Arts and Sciences
Promotion and Tenure Committee, 2002 - 2005; College of Arts and Sciences Executive Committee, 2004 - present.

University: University Research Grant Review Committee (service as needed), 1988 - present; University Senate Research Committee 1989 - 1992 (Chair, 1990 - 1991); University Senate Planning and Development Committee, 1989; Ad Hoc Committee to purchase a Minisupercomputer (Chair), 1989; Steering Committee, Office of Information Technology, 1990; Committee on Academic Computing, Chair, 1991; University Senate Library Committee, 1992; University Senate Executive Committee, 1992; Alumni Distinguished Professor Award Committee, 1994; InGear Georgia State University Advisory Board, 1995 - 1998; University Senate, 2001 - 2002 and 2004 - present; Committee of the Advancement of Women, 2004 - present; Profession Education Faculty, 2003-2005.

Georgia Scientific Community: Director, Atlanta High Field NMR Facility, 1994 - present; Faculty Search Committee, Georgia Tech, Structural Biochemistry, 1995; Project Director, Glactone, 1995 - 1998; Faculty Search Committee, University of Georgia, Biological X-Ray Structure Endowed Chair, 1995; Faculty Search Committee, University of Georgia, NMR Endowed Chair, 1996; Faculty Search Committee, Georgia Institute of Technology, Biochemistry, 1996; Oversight Committee, University of Georgia/Georgia Research Alliance High Field NMR Facility, 1998 - present.

CURRENT FUNDING

Agency: United States-Israel Binational Science Foundation (BSF)
Title: Auger Electron Therapy: Metalloporphyrins and Brachytherapy for Improving Cancer Treatment
Amount: $49,000 total costs for the Dixon laboratory
Period: 10/1/04 - 9/30/06
P.I.: Dabney W. Dixon and Brenda H. Laster (Ben Gurion University of the Negev). The goal of this project is to investigate cationic metalloporphyrins as agents which will enhance the efficiency of brachytherapy in an animal model of cancer.

PATENTS


PUBLICATIONS


**PREVIOUS GRANTS FUNDED (EXTERNAL OR ≥ $10,000)**

<table>
<thead>
<tr>
<th>Agency</th>
<th>Title</th>
<th>Amount</th>
<th>Period</th>
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<tbody>
<tr>
<td>Petroleum Research Fund</td>
<td>Cyclic Hyponitrites and N,N'-Dioxyhydrazines: New Chemiluminescent Molecules</td>
<td>$10,000 direct costs</td>
<td>9/1/80 - 8/31/83</td>
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<tr>
<td>Research Corporation</td>
<td>σ and π Amide Radicals</td>
<td>$10,986 direct costs</td>
<td>6/82 - 9/86</td>
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<tr>
<td>National Institutes of Health</td>
<td>Axial Histidine-Heme Interactions in Proteins and Models</td>
<td>$160,839 direct costs</td>
<td>1/1/82 - 12/31/85</td>
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<tr>
<td>National Science Foundation</td>
<td>Electron Transfer in Cytochromes: Controlling Factors</td>
<td>$248,936 total costs</td>
<td>4/1/91 - 3/31/94</td>
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<tr>
<td>National Science Foundation</td>
<td>Undergraduate Faculty Enhancement in Chemistry</td>
<td>$469,700 total costs</td>
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Section F
Period: 7/1/88 - 6/30/91

Agency: National Institutes of Health (1001A127196-04)
Title: National Cooperative Drug Discovery Group/AIDS
Amount: $272,341 direct costs to Dr. Dixon
Period: 9/1/91 - 8/31/96
P.I.: W.D. Wilson; this was a multi-investigator project, total funding $3,322,659 for 5 years

Agency: National Science Foundation
Title: Acquisition of a 500 MHz NMR Spectrometer
Amount: $513,437 direct costs
Period: 9/15/92 - 2/28/95
P.I.: Dabney W. Dixon

Agency: Georgia Research Alliance
Title: Atlanta High Field NMR Core Facility: 600 MHz NMR
Amount: $1,000,000 direct costs
Period: 7/1/93 - 6/31/94
P.I.: Dabney W. Dixon

Agency: Georgia Research Alliance
Title: Drug Discovery for AIDS, Hepatitis B and Cancer
Amount: $51,630 direct costs to Dixon group
Period: 7/1/95 - 6/30/96
P.I.: Chung K. Chu

Agency: Georgia State University Quality Improvement Funds
Title: Capillary Electrophoresis Instrumentation
Amount: $25,000 direct costs
Period: 12/1/95 - 6/30/96
P.I.: Dabney W. Dixon

Agency: Chancellor, University System of Georgia
Title: GLACTONE: A Network of Shared Resources for Chemistry and Biochemistry
Amount: $300,000
Period: 7/1/95 - 6/30/98
P.I.: Dabney W. Dixon. The Chemistry Departments of Georgia State University and six associated colleges collaborating to enhance software and database accessibility for chemistry and biochemistry students.

Agency: Georgia Statewide Academic and Medical System Academic Programming Grant
Title: Three-Dimensional Images in Chemistry and Biochemistry
Amount: $7,500
Period: 5/1/96 - 4/30/97
P.I.: Dabney W. Dixon. This grant was to disseminate software programs that allow students to visualize proteins and nucleic acids to the colleges and high schools in Georgia.

Agency: Connecting Teachers and Technology (Chancellor, University System of Georgia)
Title: Visualization of Structure in Biochemistry
Amount: $20,000
Period: 7/1/96 - 6/30/97

P.I.: Dabney W. Dixon. This proposal used technology and distance learning in the classroom to disseminate chemical curricula in Georgia.

Agency: National Institutes of Health (NIH R21 AI39391)
Title: Nucleic Acids as Targets for Anti-AIDS Drug Design
Amount: $50,000 direct costs to Dr. Dixon
Period: 9/1/96 - 8/31/99

P.I.: W.D. Wilson. This was an extension of AI39391 (one year at $50,000 and one year no cost extension) to develop new anti-HIV agents. The Dixon group developed threading intercalators.

Agency: National Institutes of Health (NIH S10 RR12008)
Title: Departmental Mass Spectrometers
Amount: $285,515 direct

P.I.: J. C. Powers. This was to purchase electrospray and MALDI mass spectrometers for a joint GSU/GT facility located at Georgia Tech.

Agency: National Institutes of Health (NIH P01 AI45883)
Title: Porphyrins as Microbicides for Prevention of STDs/HIV
Amount: $103,986 direct costs to Dr. Dixon
Period: 9/1/99 - 8/31/05

P.I.: Richard W. Compans (Emory University). The goal of this project is to develop inexpensive agents to use in topical preparations directed against STDs/HIV. The Dixon group is synthesizing and analyzing metalloporphyrin-based agents.
Giovanni Gadda, Ph.D.  

Curriculum Vitae

Name: Giovanni Gadda, Ph.D.  
Department of Chemistry  
Georgia State University  
P.O. Box 4098  
Atlanta, Georgia 30302-4098  
Tel.: (404) 651 4737  
Fax: (404) 651 2751 or 651 1416  
Email: ggadda@gsu.edu  
Web: http://chemistry.gsu.edu/faculty/Gadda/Gadda.html  
Home: 644 Wells St. SW #2  
Atlanta, GA 30310

Education:

1990-1995  Dipartimento di Fisiologia e Biochimica Generali  
Università' degli Studi di Milano, Milano, Italy  
Ph.D., Biochemistry, 1995  
Thesis: "Study of the Active Site of D-Amino Acid Oxidase from Rhodotorula gracilis"  
Advisor: Prof. Mirella Pilone Simonetta

1987-1989  Honors  
Dipartimento di Fisiologia e Biochimica Generali  
Università' degli Studi di Milano, Milano, Italy  
Thesis: “Studies of Limited Proteolysis on Spinach Ferredoxin-NADP⁺ Reductase”  
Advisor: Prof. Giuliana Zanetti

1984-1989  Laurea Summa cum Laude 110/110 laude (B.Sc.)– Biological Sciences  
Università' degli Studi di Milano, Milano, Italy

Professional Experience:

2000-present  Assistant Professor, Biochemistry  
Departments of Chemistry and Biology  
Georgia State University  
Atlanta, Georgia  
(Date of appointment: 09-14-2000)

1995-2000  Postdoctoral Research Associate  
Laboratory of Prof. Paul F. Fitzpatrick  
Department of Biochemistry and Biophysics  
Texas A&M University, College Station, Texas  
Project: Mechanistic and Biochemical Studies of Nitroalkane Oxidase  
(From: 06-13-1995 to 09-13-2000)

1995  European Molecular Biology Organization Short Term Fellowship
Laboratory of Prof. Sandro Ghisla
The University of Konstanz, Germany
Project: Biochemical and Kinetic Studies of Cholesterol Oxidase
(From: 02-01-1995 to 05-20-1995)

1995  Co-Advisor of B.Sc./M.S. Thesis Dissertation of Silvia Zucchelli
Dipartimento di Fisiologia e Biochimica Generali
Universita’ degli Studi di Milano, Milano, Italy
Title: "Cholesterol Oxidase from Streptomyces hygroscopicus"

1994  Translation from English to Italian of the Textbook Principles and
Techniques of Practical Biochemistry, Cambridge University Press,
Cambridge, UK

1994  Co-Advisor of B.Sc./M.S. Thesis Dissertation of Giovanni L. Beretta
Dipartimento di Fisiologia e Biochimica Generali
Universita’ degli Studi di Milano, Milano, Italy
Title: "Study of the Active Site of D-Amino Acid Oxidase from Rhodotorula
gracilis by Chemical Modification"

1993-1995  Graduate Teaching Assistant
Universita’ degli Studi di Milano sede di Varese, Varese, Italy (now
Universita’ dell’Insubria, Varese, Italy)

1991  Habilitation to the Biology Italian National Board

1989-1990  Research Assistant
Laboratory of Prof. Giuliana Zanetti
Dipartimento di Fisiologia e Biochimica Generali
Universita’ degli Studi di Milano, Milano, Italy

Grants/Awards:

2005  "Fluorescent Aptamers for Glycoprotein Detection"; Binghe Wang, P.I., Collaborating
Investigators: Giovanni Gadda and Zhen Huang; NIH (CA113917), $291,000, 7/1/05-
6/30/07.

2003  "Biochemical and Mechanistic Investigation of Choline Oxidase, a Bacterial Enzyme
Involved in Tolerance Towards Environmental Stress"; Giovanni Gadda, P.I., Dabney
Dixon, Mentor; Faculty Mentoring Grant, GSU; $ 11,000. From 07/01/03 to 06/31/04.

2003  "Biomolecular interactions"; David D. Wilson, P.I., Collaborating Investigators: Stuart
Allison, Emelita Breyer, Dabney Dixon, Giovanni Gadda, and Tom Netzel; Research
Program Enhancement, GSU; $ 87,000 (cost sharing $ 12,000; total $ 99,000), from
07/01/03 to 06/31/04.

2002  National Science Foundation Travel Grant to attend the 14th International Symposium
on Flavins and Flavoproteins, University of Cambridge, Cambridge, UK.

2002  "Investigation of Carbon-Hydrogen Bond Cleavage of Primary Alcohols Catalyzed by
Flavoprotein Oxidoreductases"; Giovanni Gadda, P.I.; ACS – Petroleum Research Fund –
Type G Grant; $17,500/year, from 07/01/02 to 08/31/05.

2001  “Biochemical and Mechanistic Studies of Flavin-Dependent Enzymes”; Giovanni Gadda, P.I.; Research Initiation Grant, GSU; $10,000/year, from 07/01/01 to 06/30/02.

2000  GSU Start-Up Funds: (09/14/00-06/30/02) $412,000; itemized in: supplies: $40,000; equipment $210,000; support for students: $135,000 (support for 3 Ph.D. students for 3 years at about $15,000/year); summer salary: 20% summer salary for 3 years at $9,000/year.

1999  National Science Foundation Travel Grant to attend the 13th International Symposium on Flavins and Flavoproteins, University of Konstanz, Germany.

1996  National Science Foundation Travel Grant to attend the 12th International Symposium on Flavins and Flavoproteins, University of Calgary, Canada.

1995  Travel Grant from the European Community FLAPS 1 Network to attend the First European Network Meeting at the University of Wageningen, The Netherlands.

1995  Baden-Wurttemberg-Lombardy Cooperation program to study the catalytic mechanism of cholesterol oxidase in the laboratory of Prof. S. Ghisla, University of Konstanz, Germany.

1995  European Molecular Biology Organization Short Term Fellowship to study the catalytic mechanism of cholesterol oxidase in the laboratory of Prof. S. Ghisla, University of Konstanz, Germany.

Services:

2005-present  Editorial Board of Archives of Biochemistry and Biophysics, member


2001-present  Ad hoc Reviewer for:
Biochemistry
Archives of Biochemistry and Biophysics
European Journal of Biochemistry
Journal of Organic Chemistry
Bioorganic Chemistry
Biotechnology and Applied Biochemistry
Biochemical Journal
International Journal of Biological Macromolecules
Central European Journal of Chemistry

1999-present  Ad hoc Reviewer for:
National Science Foundation
Affiliations:

American Society of Biochemistry and Molecular Biology (2001-present)
American Chemical Society (2001-present)
American Society for Microbiology (2003-present)
American Association for the Advancement of Science (1999-present)

Recent Peer-Reviewed Journal Articles:


Recent Conference Proceedings (Contributed Papers):


Recent Invited Seminars:

2004 March 31th – “Structure-Function Studies of FAD-Containing Choline Oxidase: a Bacterial Enzyme Involved in Stress Response”, Department of Chemistry, Clark Atlanta University, Atlanta, Georgia, U.S.A.

2004 March 12th – “Mechanistic and Biochemical Investigation of Choline-Oxidizing Enzymes Involved in Bacterial Stress Response”, Department of Genetics and Microbiology, Universitita’ degli Studi di Milano, Milano, Italy.
2004 March 11th – “Biochemical and Mechanistic Investigation of Choline-Oxidizing Enzymes Involved in Bacterial Stress Response”, Department of Genetics and Microbiology, Università degli Studi di Pavia, Pavia, Italy.

2003 December 5th – “Choline Oxidase and Bacterial Stress Tolerance: Mechanistic and Biochemical Investigation”, Department of Chemistry, University of Wisconsin at Milwaukee, Milwaukee, Wisconsin, U.S.A.

2003 April 3rd – “Mechanistic Studies on Choline Oxidase: a Bacterial Enzyme Involved in Stress Response”, Department of Chemistry, University of Georgia, Athens, Georgia, U.S.A.

2002 May 10th – “Nitroalkane-Oxidizing Flavin-Dependent Enzymes”, Shearwater Corporation, Huntsville, Alabama, U.S.A.

2001 December 21th - “Mechanistic studies on flavoprotein oxidoreductases”, Department of General Physiology and Biochemistry, Università degli Studi di Milano, Milano, Italy.

2001 September 24th - “Biochemical studies on flavin-dependent enzymes: towards a better understanding of flavin reactivity modulation”, 53rd Southeast Regional Meeting of the American Chemical Society, Protein Engineering Session, Savannah, Georgia, U.S.A.

2000 13th April - “Structural and mechanistic characterization of a nitroalkane-oxidizing enzyme from Fusarium oxysporum”, Department of Biochemistry and Microbiology, Rutgers University, New Brunswick, New Jersey, U.S.A.

2000 28th February - “Structural and mechanistic characterization of a nitroalkane-oxidizing enzyme from Fusarium oxysporum”, Departments of Biology and Chemistry, Georgia State University, Atlanta, Georgia, U.S.A.

Conference Abstracts (Posters):


19. **Gadda, G.** (2001) pH and Deuterium Isotope Effects on the Reaction Catalyzed by the FAD-Containing Choline Oxidase, 17th Enzyme Mechanisms Conference, Marco Island, Florida, 01/03/01 to 01/07/01.


32. Daubner, S.C., Gadda, G, and Fitzpatrick, P.F. (2002) Nitroalkane Oxidase from Fusarium oxysporum is a Member of the Acyl-CoA Dehydrogenase Superfamily, Fourteenth
International Symposium on Flavins and Flavoproteins, Cambridge, UK, 07/14/02 to 07/18/02.


Students Seminar Presentations:


2. Russell, B., McAllister, E., and Gadda, G. (2001) Cloning and Expression of the FAD-Containing Choline Dehydrogenase From Different Cellular Sources, November 2nd, Department of Chemistry, Georgia State University, Atlanta, Georgia, U.S.A.


7. Francis, K., Ghanem, M., Powell, N., and Gadda, G. (2003) Characterization of the Active Site Topology of Choline Oxidase, 55th Southeast Regional Meeting of the American Chemical Society, Atlanta, Georgia, 11/16/03 to 11/19/03.

8. Ghanem, M., and Gadda, G. (2003) Biochemical and Kinetic Properties of Choline Oxidase Active Site Mutant His-466-Ala, 55th Southeast Regional Meeting of the American Chemical Society, Atlanta, Georgia, 11/16/03 to 11/19/03.

Students Conference Abstracts (Posters):


Memorial Symposium “A Discussion by Experimentalists of The Origin of Life”, Atlanta, Georgia, U.S.A.


18. Fan, F., and **Gadda, G.** (2005) On the Mechanism of Alcohol Oxidation Catalyzed by Choline Oxidase, 19th Enzyme Mechanisms Conference, Asilomar, California, 01/05/05 to 01/09/05.
Curriculum Vitae

Personal Data

Name: Markus Werner Germann
Date of Birth: 14. 10. 1959
Place of Birth: Moutier (BE), Switzerland
Citizenship: Swiss, Green Card
Present Position: Associate Professor, Georgia State University, Departments of Chemistry and Biology, Atlanta, GA, USA
Languages: English, German
Address: 12390 Edgewater Drive, Hampton, GA 30228
Telephone: (404) 651 1576 (work)
Fax: (413) 480 9167
EMAIL: mwg@gsu.edu

Present Academic Appointments

1994 -2001 Assistant Professor, Kimmel Cancer Institute and Department of Microbiology and Immunology, Thomas Jefferson University, Philadelphia USA.
2000-2001 Assistant Professor, (secondary appointment), Departments of Biochemistry and Molecular Pharmacology, Thomas Jefferson University, Philadelphia USA.
2001 Associate Professor, (Kimmel Cancer Institute and Department of Microbiology and Immunology, Thomas Jefferson University, Philadelphia USA.
2001-present Associate Professor, Departments of Chemistry and Biology, Georgia State University, Atlanta, USA.
2004-present Director Graduate Studies Department of Chemistry, Georgia State University, Atlanta, USA.

Previous Employment

1978-1979 Research Technician, Ciba-Geigy AG, Basel, Switzerland.
1982-1983  Research Assistant, Cell Biology group of the section for Toxicology in the Central Function for Health and Environmental Protection. Ciba-Geigy AG, Basel, Switzerland.


**Education**


1979-1983  Chemiker HTL (Physical Chemistry) Technikum Winterthur Ingenieurschule (Equivalent to a M.S. in Chemical Engineering).


1988  Research Leave. NMR spectroscopy of DNA. January-March. Dr. T. L. James University of California at San Francisco.


**Honors and Awards**

1978  Kommission für die gewerblichen Lehrabschluss Prüfungen des Kt. Basel-Stadt
1982  Auszeichnung des Vereins Ehemaliger des Technikums Winterthur (ETW) für besondere Leistung im Rahmen der Diplomprüfung
1984-1985  Alberta Heritage Foundation For Medical Research Scholarship
1985-1986  William H. Davies Medical Research Scholarship
1985-1989  Alberta Heritage Foundation For Medical Research Scholarship
1989-1990  Alberta Heritage Foundation For Medical Research Post-Doctoral Fellowship
1997-1999  J. A. Shannon Director’s Award. National Institute of General Medical Sciences
2001  Georgia Cancer Coalition Distinguished Cancer Scientist
2002  Phi Beta Delta Honor society

**Editorial Activities**

Associate Editor:  Biochemistry and Cell Biology: NMR thematic issue

Study Section:  NIH Special Study section ZRG1 SSS-H 01B. June 13/14 2002.
Professional Organisation Memberships

American Chemical Society
Biophysical Society
Schweizerische Vereinigung Diplomierter Chemiker HTL
Phi Beta Delta Honor society

Committee Memberships

Computer Facility Committee, Chair, TJU
NMR Facility Committee, Chair, TJU
Structural Biology Committee, TJU
Executive Committee, Department of Chemistry, GSU
NMR Committee, GSU

Research Grants

GRANTS HELD
• U.S. Department of Agriculture. (M. Germann, P.I.) 11/01/96-10/31/97
  Resonance Assignment and Secondary Structural Features of Bovine S1 Casein Peptides
  by 1D and 2D NMR Spectroscopy.
  Total award: $10’000.-

• NIH 1R55 GM55404-01A1 (M. Germann, P.I.) 09/30/97-09/29/99
  NMR Study of DNA/RNA with Inverted Polarity/Anomeric Centers.
  Total award: $100’000.-

• NIH 1RO1 CA76011-01 (M. Germann, P.I.) 01/01/98-2/28/03
  NMR Structures and Functional Analysis of Oncogene Products TCL-1 and MTCP-1
  Total award: $904’706.-

• NIH S10 RR14770-01 (M. Germann, Co-P.I.) 04/01/00-03/31/01
  Jefferson Shared Circular Dichroism Facility
  Total award: $97’226.-

• GSU Research Improvement Funds (M. Germann, P.I.) 2002
  Rapid In-vitro Production of Proteins for Structural and Biochemical Studies
  Total award: $24’550.-

• GSU Research Program Enhancement Grant (P.I.: L. Strekowski, M. Germann, Co-investigator) 7/1/03-6/30/04
  Drug Design and Synthesis
  Total award: $80’000.-

• NIH 2S06/GM08136-26-5 6/1/01-5/31/04
  Charge Transport Through DNA (S. Smirnov, P.I. (NMSU) M. Germann, Contractor)
ACTIVE

• GSU Research Improvement Funds  2004-2005
  (M. Germann, P.I.)
  Biomolecular Fluorescence

  Total award:  $449’000.-

• GSU Research Program Enhancement Grant  7/1/04-6/30/05
  (P.I.: L. Strekowski, M. Germann, Co-investigator)
  Drug Design and Synthesis

  Total award:  $80’000.-

• NIH 1RO1AI/GM47459-01 (M. Germann, P.I.)  01/01/01-12/31/05
  NMR Structure and Activity of Zinc Fingers specific for HIV RRE RNA.

  Total award:  $977’980.-

• NIH 5P30 CA56036 (cancer center core grant)  04/01/01-03/31/06
  X-ray/NMR facility. (M. Germann, facility director)

  Total award:  $75’840.-

• Georgia Cancer Coalition Distinguished Cancer Scientist 2002-2006
  M. Germann, P.I

  Total award:  $500’000.-

• NIH 07/01/02-6/30/07
  (J. Prestegard, P.I. UGA, M. Germann, regional co coordinator)
  Southeastern Collaboratory for High-Field Biomolecular NMR

  Total award:  $5’045’000.-

References

Prof. J. H. van de Sande, Department of Medical Biochemistry
University of Calgary, 3330 Hospital Drive N.W.
Calgary, Alberta, Canada T2N 4N1
Phone 403-2204303

Prof. B. Ramsay Shaw, Department of Chemistry, P.M. Gross Chemical Laboratory
Duke University, Durham, NC 27708-0346.
Phone 919 660-1551

Prof. T. L. James, Chairman, Department of Pharmaceutical Chemistry, University of California
San Francisco, 515 Parnassus, CA 94143-0446
Phone 415 476-1916

Prof. H. J. Vogel, Department of Biological Sciences
University of Calgary, 2500 University Drive N.W.
Calgary, Alberta, Canada T2N 1N4
Phone 403-2206006

Prof. E. Wickstrom, Department of Microbiology and Immunology
Thomas Jefferson University. 233S 10th street
Philadelphia, PA, 19106
Phone 215-9554578
Dr. D. Moskau, Bruker-Spectrospin AG,  
Industriestr. 26, 8117 Fällanden, Switzerland  
Phone 01141-1-825526

Prof. I. T. Weber, Department of Microbiology and Immunology, Thomas Jefferson University  
233S 10th street, Philadelphia, PA, 19107  
Phone 215-5034575

Prof. G. Montelione, Department of Molecular Biology and Biochemistry  
Rutgers University, 679 Hoes Lane  
Piscataway, NJ 08854-5638  
Phone 732-235-5321
Manuscripts in press

54) Mishra, S. M., Shelley, C. M., Darby, M. K. and Germann, M.W. "Solution structures and characterization of HIV RRE IIB RNA targeting zinc finger proteins". (2005) Biochemistry. Accepted for publication (see correspondence with Biochemistry at end of CV)

Recent Publications

54) Yang, H., Johnson, P. M., Ko, K-C., Kamio, M., Germann, M. W., Derby, C. D., & Tai, P. C. "Escapin, a stable and broadly antimicrobial FAD-containing L-amino acid oxidase from ink of the sea hare Aplysia californica, can be functionally expressed in bacteria". J. Exp. Biology 208, 3609-3622.


Recent Selected Oral Presentations (*Student presentation)


DNA Structure and Damage Recognition. Germann, M.W. June 6th 2005. Xi’an Jiaotong University, Pharmacy, Xi’an, China.

Structural Insights into Substrate Recognition by Endonuclease IV. Germann, M.W. June 2th 2005. Peking University, School of Pharmaceutical Science, China.


NMR Spectroscopy. Lectures for the NSF Instructional Workshop in Molecular Genetics, Georgia State University, Atlanta, August 5th, 2002.

*Structural Similarities of Retroviral Long Terminal Repeat. Mishra, S. Georgia State University, Atlanta, November 7, 2002, Graduate Student Seminar.


Recent Selected Abstracts (*Student presentation)


**NMR Study of a DNA Duplex Containing an Abasic Residue.** Portilla, Y. & Germann, M.W. Suddath Symposium, March 19-20, 2004, Atlanta, GA.

**Helical Perturbation Caused by an Alpha Anomeric Lesion.** Cleaver, S.H. & Germann, M.W. Suddath Symposium, March 19-20, 2004, Atlanta, GA.

**Solution Structure of A DNA Duplex Containing an α-Anomeric Adenosine: Insights Into Substrate Recognition By Endonuclease IV.** Germann, M.W., Aramini, J.M., Cleaver, S.H. and Cunningham, R.P.


**Assisted DNA Damage Recognition and Repair.** Germann, M.W., Aramini, J.M., Cleaver, S.H. & Cunningham, R.P. South Eastern Regional Meeting of the American Chemical Society. November 16-19, 2003, Atlanta, GA.


*Evaluation of Minimal Media Preparations for Production of Isotopically Labeled Proteins.* Fountain, M., Portilla, Y. & Germann, M.W. Georgia State Biotech Symposium, June 16, 17, 2003, Atlanta, GA.

**Hantaviral Nucleocapsid-RNA Structural Studies.** Elrod, E., Jonsson, C. and Germann, M.W. Georgia State Biotech Symposium, June 16, 17, 2003, Atlanta, GA.
Heteronuclear Dipolar Coupling Restraints in Nucleic Acids. Germann, M.W. Georgia State Biotech Symposium, June 16, 17, 2003, Atlanta, GA.


*Solution Structures of HIV-I and HTLV-II U5 Long Terminal Repeat DNA. Mishra, S., Cleaver, S. H. & Germann. Suddath Symposium, March 27-29 2003, Atlanta, GA.


Solution Structure and Dynamics of a DNA•RNA Hybrid Containing an Alpha-Anomeric Thymidine and Polarity Reversals: d(ATGG-3’-3’-αT-5’-5’-GCTC) •r(gagaccau). Aramini, J. A. & Germann, M.W. ENC, 9-14 April, 2000.


CURRICULUM VITAE

KATHRYN BETTY GRANT

HOME: 2921 Mitchell Cove
       Atlanta, Georgia 30319
       Telephone: (404) 467-7670

       Married, one daughter

WORK: Department of Chemistry
       Georgia State University
       Atlanta, Georgia 30303
       Telephone: (404) 651-0613
       kbgrant@gsu.edu

EDUCATION

SUNY at Purchase (N.Y.)  B.S.  1989  Chemistry
Columbia University  Ph.D.  1994  Chemistry
California Institute of Technology  Postdoctoral  1994-1997  Chemistry

PROFESSIONAL EXPERIENCE

2003-present  Associate Professor of Chemistry, Georgia State University
1997-2003  Assistant Professor of Chemistry, Georgia State University
1994-1997 Postdoctoral Fellow, California Institute of Technology (Advisor: Prof. Peter B. Dervan)
1990-1994 Graduate Research Assistant, Columbia University (Advisor: Prof. Koji Nakanishi)
Spring '92 Visiting Scholar, Johns Hopkins University School of Medicine (Advisor: Prof. Jeremy Nathans)
1988-1989 Undergraduate Research Assistant, SUNY at Purchase, New York
Summer '88 & Research Assistant, Ciba-Geigy Corporation, New York
Summer '89

HONORS, AWARDS, AND FELLOWSHIPS

2000-2006 NSF CAREER Award (Georgia State)
1994-1997 NIH Postdoctoral Fellowship (Caltech)
1994 Pegram Award for Outstanding Research (CU)
1992-1993 NIH Training Fellowship (CU)
1991-1992 Eli Lilly and Company Fellowship (CU)
1991 J. Malcolm Miller Award for Distinguished Teaching (CU)
1989 Irene Goldring Award For Outstanding Performance in Science (SUNY)
1989 B.S. summa cum laude in Chemistry (SUNY)
1988-1989 Technicon Research Fellowship (SUNY)
1986  Westchester Chemical Society Award Outstanding Performance in Chemistry (SUNY)

PROFESSIONAL AFFILIATIONS

American Chemical Society, Member
Center for Biotechnology and Drug Design, Georgia State University, Faculty Member
Center for Metalloenzyme Studies, University of Georgia, Adjunct Faculty Member
M.D./Ph.D. Program, Medical College of Georgia, Adjunct Faculty Member
Phi Beta Delta Honor Society for International Scholars, Member

RESEARCH SUPPORT

National Agencies
NSF CAREER Award (2/00-1/06) $349,500 (total costs)
CAREER: A Combinatorial Approach to the Discovery of New Metal Complexes for Peptide Cleavage, (K.B. Grant P.I.).

Petroleum Research Fund, Type G Grant (7/98-8/01) $20,000 (direct costs)
A Combinatorial Analysis of Amino Acid Sequence Motifs for the Recognition and Cleavage of Peptides by Metal Complexes, (K.B. Grant P.I.).

NIH, NCRR Shared Instrument Grant (4/98-3/99) $285,500 (direct costs)
Departmental Mass Spectrometers, (J.C. Powers P.I., 15 co-authors including K.B. Grant).

RECENT PUBLICATIONS

Published


6. Wilson, B., Lubin, I.M., & Grant, K.B.* “Allele-Specific Polymerase Chain Reaction-


RECENT PRESENTATIONS AT PROFESSIONAL MEETINGS AND SEMINARS


15. **Wilson, B.,** Fernández, M.-J., Palacios, M., Lorente, A., & Grant, K.B. "Copper-Activated DNA Photocleavage by a Pyridine-Linked Bis-Acridine Intercalator,"


26. **Yang, X.**, Datta, S., Ford, T.W., Grant; R.E., & Grant, K.B. "Are Specific Serotonin Transporter and Monoamine Oxidase B Polymorphisms Associated with Treatment Resistant Depression: a Multigene Hypothesis," Contributed Poster, Georgia State


36. **Powell, N.**, Ford, T.W., Grant; R.E., Yang, X., & Grant, K.B. "The Roles of Cytochrome P450 1A1, 1A2, 2D6 and the GSTM1 Genes in Treatment Resistant Depression," Contributed Poster, "Georgia State University & Morehouse School of Medicine Research Symposium," Atlanta, August 17, 2001.

Section F


**BIOGRAPHICAL SKETCH**

Provide the following information for the key personnel in the order listed for Form Page 2. Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUANG, Zhen</td>
<td>Associate Professor</td>
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**EDUCATION/TRAINING** *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE (if applicable)</th>
<th>YEAR(s)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sichuan University, Sichuan, China</td>
<td>B.S.</td>
<td>1984</td>
<td>Analytical Chemistry</td>
</tr>
<tr>
<td>Peking University, Beijing, China</td>
<td>M.S.</td>
<td>1987</td>
<td>Organic Chemistry</td>
</tr>
<tr>
<td>Swiss Federal Institute of Technology (ETH), Zürich</td>
<td>Dr. Nat. Sc.</td>
<td>1994</td>
<td>Bio-Organic Chemistry</td>
</tr>
<tr>
<td>Harvard Medical School &amp; Massachusetts General Hospital</td>
<td>Post-Doc</td>
<td>1998</td>
<td>Biochemistry &amp; Molecular Biology</td>
</tr>
</tbody>
</table>

**A. Positions and Honors.**

1. **Positions and Employment**
   - 1984 - 1987 M.S. Student (mentor: Prof. Zhong Wen), Department of Chemistry, Peking University, Beijing.
   - 1988 - 1994 Ph.D. Student (mentor: Prof. Steven A. Benner), Organic Chemistry Institute, ETH-Zürich, Switzerland
   - 1994 - 1998 Postdoctoral Fellow (mentor: Prof. Jack W. Szostak), Department of Genetics, Harvard Medical School, and Department of Molecular Biology, Massachusetts General Hospital, MA.
   - 1998 - 04.8 Assistant Professor, Department of Chemistry, Brooklyn College, The City University of New York, Brooklyn, NY.
   - 2004.8 - Associate Professor, Department of Chemistry, Georgia State University, Atlanta, GA.

2. **Other Experience and Professional Memberships**
   - 1984 - 1987 Member, Chinese Chemical Society
   - 1990 - 1994 Member, Swiss Chemical Society
   - 1994 - present Member, American Chemical Society
   - 2000 - present Member, Chinese American Chemical Society
   - 1997 - 1998 President, Chinese Association of Biological Chemistry (ABC), Boston,
   - 02/2002 - 2004 Co-Chair, Younger Chemist Club (YCC) of American Chemical Society (ACS)
   - 04/2002 - present Co-Chair, Chinese Chemistry Professors Association (CCPA)

3. **Awards and Other Professional Activities**
   - 2000 PSC-CUNY Research Award (#62392-00-31)
   - 2000 New Research Dimension Award
   - 2001 PSC-CUNY Research Award (#63193-00-32)
   - 2001 CUNY Collaborative Research Program Award (#92918-0008)
   - 2002 Groundwork CUNY Program Award (#24208-0405)
   - 2004 NIH Research Award (GM069703)
   - 2005 NIH Research Award (AI058051)
   - 2005 SECEBT Research Award (CC423095)
B. Selected recent peer-reviewed publications (in chronological order).


Marianna Teplova, Christopher J. Wilds, Quan Du, Nicolas Carrasco, Zhen Huang, and Martin Egli,* "Covalent Incorporation of Selenium into Oligonucleotides for X-ray Crystal Structure Determination via MAD: Proof of Principle", Biochimie, 2002, 84, 849-858.


Nicolas Carrasco, Julianne Canton-Williams, Gary Brandt, Siming Wang, and Zhen Huang*, "Efficient Enzymatic Synthesis of Phosphoroselenoate RNA Using Adenosine 5’-(α-P-seleno)triphosphate, Angewandte Chemie, 2005, accepted."
**Patent Publications:**


**C. Research Support.** List selected ongoing or completed (during the last three years) research projects (federal and non-federal support). Begin with the projects that are most relevant to the research proposed in this application. Briefly indicate the overall goals of the projects and your role (e.g. PI, Co-Investigator, Consultant) in the research project. Do not list award amounts or percent effort in projects.

**Ongoing Research Support**

**Project Title:** “Bacillus anthracis Detection with RNA Microchip”
**Type:** Research Award (AI058051)
**Role:** Principal Investigator
**Duration:** 07/01/2005-06/30/2007
**Agency:** National Institute of Allergy and Infectious Diseases (NIAID), NIH

The goal of this project is to explore and develop RNA microchip technology for rapid, sensitive, and accurate *Bacillus anthracis* detection. This project includes four specific aims: **Specific Aim #1,** Design of the RNA-DNA templates for *B. anthracis* detection; **Specific Aim #2,** Template optimization for detection of signature RNAs of *B. anthracis;** Specific Aim #3,** Design and preparation of the RNA microchip for *B. anthracis* detection; **Specific Aim #4,** Detection of *B. anthracis* signature RNAs on the RNA microchip.

**Project Title:** “Development of RNA Microarray for Pathogen Detection”
**Type:** Research Award (CC423095)
**Role:** Principal Investigator
**Duration:** 05/01/2005-04/30/2006
**Agency:** Southeastern Center for Emerging Biologic Threats (SECEBT)

The goal of this project is to explore and develop RNA microchip technology for rapid, sensitive, and accurate detection of pathogen detection.

**Project Title:** “Se-Derivatization of Functional RNAs for Structure Study”
**Type:** Research Award (GM069703)
**Role:** Principal Investigator
**Duration:** 1/01/2004 - 12/31/2006
**Agency:** National Institutes of General Medical Sciences (NIGMS), NIH

The goal of this project is to explore the chemical and enzymatic preparation of selenium-containing RNAs, and to demonstrate the usefulness of selenium derivatization in structure-unknown nucleic acids for X-ray crystallography.
Completed Research Support

Project Title: Large-scale Synthesis of Se-Uridine and Se-Cytidine Phosphoramidites
Type: Research Collaboration
Role: Principal Investigator
Duration: 7/01/02 - 12/30/04
Agency: Glen Research, Inc.
The goal of this project is to explore the possibility of large-scale synthesis of Se-Uridine and Se-Cytidine Phosphoramidites for commercialization.

Project Title: Synthesis of the 5'-Silyl-2'-ACE Phosphoramidites Containing Selenium Labels
Type: Research Collaboration
Role: Principal Investigator
Duration: 12/01/03 - 12/30/04
Agency: Dharmacon Research, Inc.
The goal of this project is to explore the synthesis of the 2'-ACE Se-phosphoramidite for chemically synthesizing relatively long Se-RNA (40-100nt).

Project Title: "Direct RNA Detection and Quantitation via Chemiluminescence"
Type: PSC-CUNY Research Award
Role: Principal Investigator
Duration: 07/01/01-06/30/03
Agency: The City University of New York
The objective of this project is to explore a chemiluminescent method for directly quantifying gene expression from mRNAs.

Project Title: "Development of Novel Method for Gene Expression Quantitation"
Type: Collaborative Program Grant
Role: Principal Investigator
Duration: 12/01/99-11/30/02
Agency: New Dimension Research, Inc.
The goal of this project is to develop bio-probes and new methods for gene expression quantitation.
G. Davon Kennedy, Ph.D.
e-mail: davon@gsu.edu
work telephone: 404-651-1989

Personal: Date of Birth: January 17, 1954
SSN: 248-04-1414

Professional: 1996-present Associate Professor of Chemistry, Georgia State University
1989-1996 Assistant Professor of Chemistry, Georgia State University
1987-1989 Associate Professor of Chemistry, Morehouse College

Education: 1979-1983 Emory University, Atlanta, GA
Awarded Ph.D. Degree, December, 1983
Research Director: Professor Albert Padwa
Research Topic: Cycloaddition Reactions of Strained Ring Systems

1978-1979 S.U.N.Y. & Buffalo, Buffalo, NY
Awarded M.A. Degree, August, 1979
Research Director: Professor Albert Padwa
Research Topic: Photochemistry of Small Ring Heterocyclic Compounds

1974-1978 Ithaca College, Ithaca, NY
Awarded B.A. Degree, June, 1978
Major in Chemistry

NIH, “Bridges to the Future,” $600,894, 9/1/01-8/31/05.
DOE, "GAANN," $629,586, 8/1/04-7/31/07

Honors:
"Outstanding Faculty Advisor," sponsored by Division of Student Life and Enrollment Services, October 20, 1994.
"Honorary Member of the Golden Key International Honor Society" of Georgia State University, 2004

Teaching Experience:
General Chemistry: Morehouse College Health Careers Summer Program
Organic Chemistry: Lecture, Recitation and Laboratory, Advanced Organic Chemistry Lecture

Professional Organizations:
American Chemical Society (national organization)
American Chemical Society (Georgia Section), Chairman-Elect, 1989-90
National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCCHE), 1980 - present
--Founding President, Indianapolis Chapter, 1986
--Successfully obtained a $1000 undergraduate scholarship for NOBCCHE sponsored by Eli Lilly and Company, 1985

Professional:
Chemistry tutor for undergraduate minority chemistry students (1979 - 1983)

BASIS (Black American Success in Science). Co-organizer of a pilot program for career exploration for ten junior high school students, staffed by volunteers, 1984-85. The program gave the students an opportunity to observe minority scientists and engineers in their respective workplaces. The program's goal was to provide role models for these young people and stimulate a positive interest in a broad spectrum of potential scientific careers.

Session Chairman of the The Tenth Gulf Coast Chemistry Conference, Pensacola, Florida (September 17-19, 1987).

Session Chairman of the The Twelfth Gulf Coast Chemistry Conference, Pensacola, Florida (September 17-19, 1987).

Organizer Organic Division 40th ACS Southeast Regional Meeting, Atlanta, Georgia (September 7-9, 1989).
Meeting Presentations:


Publications:


Presentations at Professional Meetings:


CURRICULUM VITA
OF
GABOR PATONAY

Work: Georgia State University
Department of Chemistry
Atlanta, Georgia 30303
(404) 651-3856
Fax: (404) 651-1416

Home: 5607 Boggs Drive
Stone Mountain, Georgia 30087
(404) 879-9035

Citizenship: U.S. Citizen

EDUCATION

Ph.D., (1979) and M.Sc. (1973) from faculty of Chemistry of the Technical University of Budapest, Hungary.

POSITIONS HELD

1996-present Professor, Georgia State University, Department of Chemistry, Atlanta, Georgia 30303
1992-1996 Associate Professor, Georgia State University, Department of Chemistry, Atlanta, Georgia 30303
1987-1992 Assistant Professor, Georgia State University, Department of Chemistry, Atlanta, Georgia 30303
1982-1987 Visiting Associate Professor, Emory University, Department of Chemistry, Atlanta, Georgia 30322.
1979-1982 Technical University of Budapest, Department of Chemical Engineering, Budapest, Hungary

PROFESSIONAL ACTIVITIES

Proposal Reviewer for National Institutes of Health, National Science Foundation, Petroleum Research Fund and Research Corporation.
Study Section Member, NIH, STRR and SBIR Programs, 1995
Technical Reviewer for National Cancer Institute.
Consultant for Coca Cola Company on "Process Analytical Chemistry," (1984) and Orange Juice
Adulteration (1984/85).
Consultant for Optical Radiation Corporation on enhancement of arc lamp stability, 1989.
Consultant for Radiometer Copenhagen, Denmark on use of near-infrared fluorophores for analytical applications, 1990.
Chaired afternoon session of Multidimensional Fluorescence Measurements Symposium at FACSS 13th Annual Meeting, 1986, St. Louis, Missouri.
Chaired afternoon technical session of Analytical Chemistry at 40th ACS Southeast Regional Meeting, 1988, Atlanta, Georgia.
Organized and taught chromatography workshop for southeastern college teachers, 1988-1990, Georgia State University, Atlanta, Georgia.
Organized and chaired the Symposium of "Near Infrared Fluorescence/Absorbance" at the XVI Annual FACSS Meeting, 1989, Chicago, Illinois.
Organized and chaired the Symposium of "Molecular Spectroscopy in the Near -IR," at the FACSS XXI Annual Meeting, 1994, St. Louis, Missouri.
Editor of serial publication of "Advances in Near IR Measurements," JAI Press, 1993-
Petitions Committee 1988-
University Senate 1990-1999 (Chair of Faculty Affairs Committee 1994-1999)
College Executive Committee Member 1994-
Editorial Board Member, Microchemical Journal 1991-
Editorial Advisory Board Member, Talanta, 1994-
Center for Fluorescence Spectroscopy, Advisory Board Member, University of Maryland, Baltimore, MD, 1994-
Tour Speaker for Society of Applied Spectroscopy (Chicago, Dayton, Reading St. Louis Sections), Spring 1994
Academic Panel Member for the State Senate of Georgia on Soil Erosion & Water Quality, 1994
Organized, "Advances in Fluorescence Sensing Technology III: Red and NIR Probes," at the SPIE Biomedical Optics Conferences, 1997, San Jose, CA
Organized "Near-Infrared Fluorescence" Symposium at PITTCON '97, Atlanta, GA
Organized and chaired “long wavelength spectroscopy” symposium at FACSS >98, Austin, Texas
Chaired “Spectroscopic Instrumentation” Symposium at FACSS 2000, Nashville, Tennessee
Member of National Society for Applied Spectroscopy, 1998-2000

RESEARCH EXPERIENCE

Research on applications of near infrared spectroscopy in analytical chemistry; applications of tunable near infrared semiconductor laser excitation sources; from 1987 to present.
Research on application of near infrared laser dyes in analytical chemistry; application of near infrared laser dyes as labels for detecting biomolecules and environmentally important compounds; from 1987 to present.
Development of novel LC detector system using photodiode array fluorometer; application of ternary cyclodextrin complexes in LC separations; from 1985 to present.
Research on applications of molecular absorption and luminescence spectroscopy in analytical chemistry; multidimensional luminescence measurements; application of cyclodextrins and micelles in luminescence spectroscopy; from 1982 to present.
Rapid acquisition and interpretation of circular dichroic spectra generated through fluorescence detection, and acousti-optical tunable filters for rapid generation of circularly polarized light; from 1982 to 1988.
Development of microprocessor systems and their peripheral devices for use in analytical instruments; hardware and software experience in assembly and machine languages; from 1978 to present.
Research on membrane permeation; examination of mechanisms, selectivity and development of methods for membrane preparation; use of several kinds of membranes in analytical instruments; 1976 to present.
Micro- and minicomputer applications in analytical chemistry and construction of peripheral electrical circuits for analytical purposes; interfacing computers for analytical application; from 1975 to present.
Development of several kinds of analytical instruments such as: a hydrogen generator, air pollution monitors for organic and inorganic compounds, car exhaust gas measurement, chromatographic integrators, selective acid amounts measurement, BET surface meters, enzyme kinetics measurement, sulphur compounds measurement with flame photometric detectors, fluorescence detected circular dichroism instrumentation,
Novel LC separation methods, automatic sample deoxygenation systems, arc
Lamp stabilization methods, multidimensional LC detector systems, experience in designing and assembling laboratory instruments; from 1970 to present.
Development of analog and digital electronic circuits for use in analytical instruments; construction of analog and digital integrated circuits, amplifiers, signal conditioners, TTL circuits, etc. in analytical chemistry; experience in designing and building electronic circuits; from 1970 to present.
Irreversible processes of electrokinetic phenomena; automatic measurement of electrokinetic parameters; theoretical study of irreversible processes of electrokinetic phenomena; examination of the structure of aqueous solutions and glass surfaces by measuring streaming potential; 1970-1978.
INDUSTRIAL EXPERIENCE

Development of special analytical instrumentation for pharmaceutical and chemical industry at the University of Budapest on a contractual basis; 1978-1982.

RECENT PUBLICATIONS


**BOOKS**


**PATENTS**

Noszticzius, Z., **Patonay, G.**, Olah, K., Langer, K. Sommer, F., Vajta, Zs., and Gaspar, Gy; "Process and Apparatus for the Determination of the Total Organic Substance Content of Gases by a Flame Ionization Detector;" Patent Numbers USA 4 201 550; BRD 2 757 699; DDR 133 718. Application Numbers Hungary CE 1114; Yugoslavia P 3060; Poland P 203 194; USSR 2 557 601; Austria A 7419.

Patonay, G., Olah, K. and Noszticzius, Z.; "Circuit for Sensing of the Flame Burning of Flame Ionization Detectors;" Hungarian Application Number CE 1175.

Olah, K., Noszticzius, Z., **Patonay, G.**, Langer, K. and Sommer, F.; "Electrolytic Cell for Supplying Gas in a Portable Instrument;" Hungarian Patent Number 176 070. US 4332664; DDR 220 435; BRD P 301 3711-2; USSR 2 907 402; Austria 918/80; Poland P 223 868; Yugoslavia P 298.


RECENT INVITED PRESENTATIONS


RECENT PAPERS PRESENTED


PROFESSIONAL SOCIETIES

American Chemical Society (ACS)
American Association for the Advancement of Science (AAAS)
Society for Applied Spectroscopy (SAS)
Sigma Xi Scientific Research Society
National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE)
Council for Near-Infrared Spectroscopy
Society of Fluorescence (membership by invitation)

GRANTS

Petroleum Research Fund (20099-B4) "A Study of the Microenvironmental Effects on Near-Infrared Fluorescence Labels," 03/01/88 - 08/31/90, $20,000.


National Science Foundation (CHE-8920456) "Laser Diode Intracavity Spectrometry," 02/01/90 - 07/31/93, $179,000.

National Science Foundation (USE-9051730), "Improvements in the Physical-Analytical Sequence. Thermodynamic and Chromatographic Studies on Biological Systems," 03/15/90 - 08/31/92, $142,024, H. P. Hopkins and G. Patonay.

Petroleum Research Fund (23217-B6), "Structural Dependence of Electronic Energy Levels of NIR Dyes and Dye Complexes," 09/01/90 - 08/31/93, $20,000.

Eastman Chemical Company, "Detection of Near-Infrared Dyes in Polymers or on Polymer Surfaces," 12/01/90 - 12/31/99, $286,817.

Hybritech, Inc., "Near-Infrared Immunochemistry," 05/01/91 - 04/30/93, $120,000.

NASA-AMES, "Metal Ion and pH Determination Using New Near-Infrared Fluorophore Probes," 08/15/91 - 02/14/92, $20,000.

NIH (1 R01 AI28903-01A2), "NIR Dyes as Labels for Immunoassays in AIDS and Other Infectious Diseases," 09/15/91 - 08/31/94, $440,300.

EPA (CR 818696-01-0), "Presence and Activity of Fungi in Indoor Air and Water Supplies," 09/09/91 -


GRA, "Purchase of various Analytical Instruments," 07/94 - 06/95, $255,000.

NSF-SSTR Grant, (DMI-9413641) "HPLC Detection Using Near-IR Laser Diodes," with LI-COR, Inc., 08/01/94 - 07/31/95, $100,000


GRA, "Purchase of Various Analytical Instruments," 7/95-6/96, $85,000.


NIH-SBIR, “NIR Fluorescent Labels for Biomedical Applications,” with KPS Technologies, LLC, $57,139, 9/00-12/01 (with L. Strekowski, Co-PI).


FBI, “Development of NIR Dye Composition for the FBI,” $379,000, 9/01-8/03, CLF78 (with L. Strekowski, Co-PI).

BNL-NIH, “NIR Intercalators,” $37,176, DLK37, 10/02-9/03 (with L. Strekowski, Co-PI).


FBI, “Development of NIR Dye Uplowverting and Dowconverting Methods for the FBI,” $299,000, 12/03-1/05, RITIG (with L. Strekowski).

GRA-KPS, "Development of New Latent Blood Detection Technologies," $200,000, 12/04-12/05 (with L. Strekowski).

FBI, "Design and Synthesis of Novel Chemical Compositions," FLT 92, $136,000, 05/05-04/06 (with L. Strekowski).
Curriculum Vitae of Thomas L. Netzel

Work Address
Georgia State University
Department of Chemistry
P.O. Box 4098
Atlanta, Georgia 30302-4098
Phone (404) 651-3129; FAX (same)
email: tnetzel@gsu.edu
http://chemistry.gsu.edu/faculty/Netzel/Netzel.html

Education
Yale University  Ph.D. - Chemical Physics  1973
Yale University  M.Phil. - Chemical Physics  1970
Univ. of Wisconsin  B.Sc. - Chemistry  1968

Overview
My research subjects have included benzene crystals, reaction center proteins, chemically modified DNA duplexes, and organometallic catalysts. I measured the temperature-independent density-of-states for the lowest excited singlet state of crystalline benzene and showed that a Green's function expansion of the Hamiltonian successfully modeled exciton band mixing in isotopically doped benzene crystals. I measured and assigned the primary electron-transfer steps in photosynthetic bacteria. I also explored light-driven electron-transfer reactions and other radiationless decay processes in porphyrin, chlorophyll, and inorganic supramolecules. Much of this work required developing new picosecond spectroscopic instrumentation and measurement techniques. My absorption kinetics experiments cover the near-UV to near-IR spectral and 10^-11 to 10^-1 s temporal ranges with exceptionally small ∆A errors. This powerful instrumental capability makes it possible to investigate light-driven chemical reactions in both chemical and biochemical systems. My recent research encompasses the synthesis and physical characterization of covalently modified DNA nucleosides and duplexes. This work is focused on understanding the mechanisms of electron and hole transport through DNA duplexes and hairpins as functions of the number and type of bases separating covalently attached donors and acceptors. In January of 2001, GSU was granted a patent on the use of photoinduced charge separation in DNA as a detection method for biological and medical assays. We are currently consulting with viral immunologists and electrical engineers to develop photonic viral sensors based on this detection technology.

Work Experience
Georgia State University
Department of Chemistry
Atlanta, Georgia 30303-3083

1989-present  Professor of Chemistry. Present research activities concentrate on synthesizing, characterizing, and modeling covalently modified DNA nucleosides, oligonucleotides and duplexes. In this work DNA is labeled with redox active substituents to explore fundamental aspects of both primary photoinduced electron transfer reactions in nucleosides and subsequent secondary electron and hole transport in DNA duplexes. Today these studies are motivated by a desire to advance our understanding of the molecular basis of DNA damage due to ionizing radiation and to improve nucleic acid-based medical diagnostics assays. However, in the future they are also likely to be relevant to the DNA engineering of molecular-electronic and nanomechanical devices. Another initiative in this area involves both semi-
empirical and *ab initio* quantum mechanical studies of the electronic properties of solvated electron transfer products in nucleoside conjugates and duplexes.

Amoco Technology Company, Amoco Research Center
Naperville, IL 60566

1985-1989 **Staff Chemist - Physical Technology Division.** Demonstrated that the hybridization specificity of short DNA oligomers allows them to function as templates for assembling covalently attached molecular labels. Thus chemically modified DNA duplexes can, in principle, now be constructed with specifically located molecular subunits to carry out energy, electron, and proton transfer reactions.

Directly observed the key intermediate (likely a $\sigma$-complex) which leads to alkyl hydride formation after photoactivation of RhCl(CO)(PMe$_3$)$_2$ in hydrocarbon solvents. This project used picosecond optical and FT-IR spectroscopies to explore the reaction mechanisms of organometallic and inorganic catalysts. In particular, I studied intramolecular charge-transfer processes in Os and Re complexes and C-H activation chemistry in Rh, Ir, Ni, Pd, and Pt complexes. My strategy was to combine synthesis, reactivity screening, and mechanistic studies to develop strongly oxidizing inorganic complexes and homogeneous organometallic catalysts.

Brookhaven National Laboratory
Upton, New York 11973

1977-1985 **Chemist.** Showed that cofacial diporphyrins mimicked the primary charge separation in Photosystem II reaction centers and developed an automated picosecond absorption spectrometer capable of observing chemical intermediates from $10^{-11}$ to $10^{-3}$ s in the near-UV to near-IR spectral range. This project required coordinating synthetic, electrochemical, and spectroscopic work among a number of laboratories in the U.S., Canada, and England with the objective of developing porphyrin, chlorophyll, and inorganic supramolecules capable of transforming sunlight into chemical energy.

Bell Laboratories
Murray Hill, New Jersey 07974

1974-1977 **Member of Technical Staff (MTS) - Economics Analysis Group.**
Quantified the regulatory, economic, and financial impacts of the Bell System's tax choices with respect to long-term debt refunding opportunities.

1972-1974 **MTS - Chemical Physics Group.** Measured and assigned the primary electron-transfer steps in reaction centers isolated from photosynthetic bacteria; developed the first double-beam picosecond spectrometer; created software for the simultaneous operation of three laser spectrometers with one Data General computer; and mentored scientists new to the field of picosecond spectroscopy.
Curriculum Vitae of Thomas L. Netzel

Professional Society Memberships

American Chemical Society (ACS)
Inter-American Photochemical Society (IAPS)

Patents and Patent Filings

Template Directed Ligation of Probes, describes a new diagnostic test for infectious diseases and genetic defects. Cruickshank-Netzel-Telser Amoco Corporation Case 27459, Serial No. 444,021, U.S. filed 11/30/89; continued 9/16/91 and 9/7/93; abandoned 1994 due to business interest changes.


Awards, Community Service, and University Activities

Member (elected by the Chemistry Department) of the Georgia State University Senate, Fall 1999 – Spring 2005 (three two-year terms).

Committee Assignments: Member of the Senate Budget (Fall 2000 – Spring 2005), Research (Fall 1999 – Spring 2004), Information Systems and Technology (IS&T) (Fall 2002 – Spring 2005), Commencement (Fall 2002 – Spring 2003), and Cultural Diversity Committees (Fall 1999 – Spring 2000).

Subcommittee Assignments: Chair (Fall 2002 – Spring 2004) and Member (Fall 2004 – Spring 2005) of the GSU Joint Major Renovation and Repair (MRR) Subcommittee of the University Senate Planning & Development (P&D) and Budget Committees. Member of the Internal Grants Subcommittee of the Senate Research Committee (Fall 2002 – Spring 2004). Chair of the IS&T Ad Hoc Network Notification Policy Subcommittee (Fall 2004).

Member of the Academic Program Review Committee (APRC) of APACE as part of normal cycle of reviews for all GSU academic centers and departments (Fall 2004 and Spring 2005): member of two review subcommittees, Counseling and Psychological Services (CPS) and Public Administration and Urban Studies (PAUS).

Member of the Chemistry Department’s Faculty and Staff Accounting Oversight Committee (acting organizer and secretary) 2003 – 2005.

Member of the Chemistry Department’s Curriculum Committee, GSU, 2000-2005.

Outstanding Service Award for 2004 presented by the American Chemical Society’s Georgia Section for outstanding professional service as General Chair of the unusually successful and record-breaking 2003 Southeast Regional Meeting of ACS, May 24, 2004.
Curriculum Vitae of Thomas L. Netzel

Member of the three-person Administrative Support Unit Review (ASUR) panel for the Library Support & Technology Initiatives (LSTI) division of GSU’s Information System & Technology (IS&T) area (Spring 2004).

Member of the GSU Provost’s Ad Hoc committee to review academic programs for their viability, in particular, the B.S. and M.S. programs in the College of Education dealing with Recreation Therapy and Sports Management (Spring 2004).

American Chemical Society Certificate of Recognition to Thomas L. Netzel, General Chair, for Extraordinary Contributions to the Success of the 55th Southeast Regional Meeting, Atlanta, GA, November 16-19, 2003.

Service Award Plaque presented by the American Chemical Society’s Georgia Section for Outstanding Service as an Officer and Founder of the Committee on Legislative and Government Relations, May 18, 1999.

Member (elected) of the three-person Executive Committee of the Department of Chemistry, GSU (Fall 1997 – Spring 2001).

Departmental Representative on the College of Arts and Sciences Writing Across the Curriculum (WAC) Committee, GSU.

Member of the Graduate Faculty, GSU.

Member of the Advisement Committee for Chemistry Majors, GSU, 1990-1998.

Member of the Research Initiation Grant Review Panel for Natural Sciences - FY 97 Competition – GSU, April, 1996.

Certificate of Appreciation, GSU Student Government Handicapped Services Committee.

President of the Wildcliff Homeowners’ Association, Atlanta, GA.

Member of the Advisory Committee to the Dean of the Yale Graduate School.

President and Vice-President of the Yale Graduate-Professional Student Senate, Inc.

NIH Pre-Doctoral and NDEA Fellowships.

Certificate of Appreciation, GSU Student Government Handicapped Services Committee.

University of Wisconsin House-Fellowship (in charge of Adams Hall).

Professional Service Activities

Member of the Southeast Regional Meeting of the American Chemical Society (SERMACS) Steering Committee Executive Board, 2002-2004 and the American Chemical Society, Georgia
Curriculum Vitae of Thomas L. Netz

Section’s voting delegate to the SERMACS Steering Committee.

General Chair of the 55th Annual Southeast Regional Meeting of the American Chemical Society (SERMACS 2003) held November 16-19, 2003 at the Renaissance Hotel in Atlanta, GA. (1,626 registered attendees; 1,100 abstracts of presentations published and now archived by ACS Chemical Abstract Services; $155,000 gross revenue; $95,000 net income to ACS)

Alternate Councilor and Executive Board Member of the American Chemical Society, Georgia Section in 2001-2003.

Founding Chair (1998-2003) and Member (2004-2005) of the American Chemical Society, Georgia Section’s Committee on Legislative and Governmental Relations. On September 9, 2003, the Georgia Section was awarded the 2002 ACS President's Award for Local Section Government Affairs Activities at the ChemLuminary Awards Ceremony during the 226th national ACS meeting in New York City. (Established and presented by the ACS Board Committee on Chemistry and Public Affairs, this public outreach award recognizes outstanding efforts by an ACS Local Section to advance public policy to benefit science and society and increase member involvement in government affairs. In December 2003, the ACS GA Local Section Board presented this award statue to me.)

Member of the June 23-24, 2003 National Institutes of Health (NIH) Metalllobiochemistry Study Section.

Invited by the American Chemical Society to travel to Washington, DC on May 1 and 2, 2001 to speak to congressional representatives and senators on federal science policy issues as part of the American Chemical Society’s annual Visit Congress Program.

Chair-Elect, Chair, and Past-Chair of the American Chemical Society, Georgia Section, respectively, in 1998, 1999, and 2000.

Invited on February 15, 1996 to serve on the organizing committee of the IX Annual Inter-American Photochemical Society Conference held January 1-5, 1997 in Clearwater Beach, FL.

Invited on December 4, 1995 to organize the February 26, 1996 meeting of the Atlanta-Athens Chemical Physics Research Meeting held at Georgia State University, Atlanta, GA.

Invited on August 7, 1995 to speak at and organize a symposium on the subject of "Mechanisms of Electron Transfer in Biological Systems" held at the Annual National Meeting of the American Society for Photobiology the week of June 14-19, 1996 in Atlanta, GA.

Consultant for the Annual Science Fair of the Torah Day School of Atlanta, December 12, 1995.

Upper Division Science Fair Judge, Yeshiva High School, Atlanta, GA, April 2, 1995.

Member of the Four-person Site-visit Review Panel for the U. S. Department of Energy at New York University, New York, NY, September 29 and 30, 1994.
Curriculum Vitae of Thomas L. Netzel

Member of the Yeshiva High School of Atlanta Science Facilities Advisory Committee, 1993.

Member of the Advisory Committee for the Center for Fast Kinetics Research of the University of Texas at Austin, 1989-1991.

Recent Publication List


Curriculum Vitae of Thomas L. Netzel


Recent Seminars and Invited Presentations

Bar Ilan University, Tel Aviv, Israel, December 13, 2000.
Oakland University, Rochester, MI, March 12, 2001.
Washington University, St. Louis, MO, April 3, 2001.
University of California, San Diego, CA, March 4, 2002.

Research Symposia Organized

"Mechanisms of Electron Transfer in Biological Systems," June 18, 1996 at the Annual Meeting of the American Society for Photobiology in Atlanta, GA
Curriculum Vitae of Thomas L. Netz

"Picosecond Spectroscopic Research at GSU," February 26, 1996 at the Atlanta-Athens Chemical Physics Research Meeting in Atlanta, GA.

“Experimental Studies of Electron and Energy Transfer in DNA (and Related Systems),” a double session symposium at the 55th Southeast Regional Meeting of the America Chemical Society (SERMACS) November 18-19, 2003 at the Renaissance Hotel in Atlanta, GA.

Recent Published Abstracts and Poster Presentations


Curriculum Vitae of Thomas L. Netzel


Early Events in the Photoassisted Dehydrogenation of Unactivated Hydrocarbons by [W_{10}O_{32}]^{4-}. D. C. Duncan, M. A. Fox, C. L. Hill, and T. L. Netzel, 36th Great Lakes Regional Meeting of the American Chemical Society, Peoria, IL, October 17-20, 2004.


Funded Research Grants

“Spectroscopic Evidence for the Mechanism of Hydrocarbon Activation by Rhodium Bisphosphine Complexes at Room Temperature in Fluid Hydrocarbon Solutions,” a proposal accepted by NSF for funds to cover travel and lodging expenses to participate in the 16th NSF Organometallic Workshop, May 7-10, 1992, Snowbird, Utah: $1,500.

“An Exploration of Sequence Specific DNA-duplex/Pyrene Interactions for Intercalated and Surface-associated Pyrene Species: Forward and Reverse dG/Pyrene Electron Transfer Quenching Dynamics,” a proposal accepted by the U. S. Department of Energy, Office of Radiological and Chemical Physics Research for research which seeks to understand how base composition and sequence influence DNA oxidation (or ionization) by powerful photooxidants. May 1993 - December 1996: $222,000 (amount approved), $184,840 (amount disbursed).

“Capped Colloidal Quantum-dot Semiconductor Particles with Monomer Functionality for Use in Layered Processing Technologies,” a joint proposal submitted by Dr. Robert Schwerzel of the Georgia Institute of Technology Research Institute and accepted by the U. S. Office of Naval Research, for research which seeks to develop semiconductor particles with molecular coatings for nonlinear optical applications in communication. January 1994 - December 1996: $315,511. [Over the three year life of the contract, ca. $10,300.00 in equipment and supplies was purchased on behalf of GSU as partial support for the GSU picosecond laser laboratory.]

“Biomolecular Interactions,” a request co-authored by ten faculty members that was submitted by Dr. W. David Wilson and accepted by the GSU Chancellor's Initiative Fund (CIF) for support of graduate student research in biology, physical chemistry, and biophysical chemistry. July 1994 - June 1997: $255,000.

“Instrumentation for Laser Spectroscopy,” a joint proposal submitted by Dr. Lauren Tolbert of
Curriculum Vitae of Thomas L. Netzel

the Department of Chemistry and Biochemistry of the Georgia Institute of Technology and accepted by the U. S. National Science Foundation (Academic Research Infrastructure - Instrumentation Program) for funding to purchase femtosecond laser equipment which will be housed at GA Tech for use by the four authors of the proposal, Drs. L. M. Tolbert, M. A. El-Sayed, G. B. Schuster, and T. L. Netzel. July 1995 - June 1996: $400,000.

“Development of Project-Oriented Lower Division Chemistry Lab Courses About Solving Real World Problems,” a joint proposal submitted by Drs. Donald G. Hicks, H. Frederick Henneike, and Thomas L. Netzel and accepted by the Provost of GSU for work to revise some existing projects in the current project-oriented curriculum and to develop other projects for the general chemistry laboratory courses at GSU. January 1, 1997 - June 30, 1997: $7,700.

“Spectrophotometer Purchase for Chem 310 and Chem 403/603,” a proposal accepted by the Provost of GSU for the purchase of a UV-vis spectrophotometer for use in upper division chemistry laboratory courses. January 1, 1997 - June 30, 1997: $8,000.

“Theoretical Studies of Covalently Modified DNA Nucleosides and B-Form DNA Base Stacks: Ab Initio and Semiempirical Electronic Structure Calculations,” a proposal submitted by Dr. Thomas L. Netzel and accepted by the GSU Research and Sponsored Programs office as a Research Initiation Grant to learn about both primary photoinduced electron transfer reactions in pyrene-labeled nucleosides and subsequent secondary electron and hole translocations in DNA duplexes. July 1, 1997 - June 30, 1998: $7,000.

“Quantum Mechanical and Molecular Mechanical Computations of Biomolecules and Drug/Biomolecular Interactions,” a proposal submitted by Drs. Thomas L. Netzel, Kathryn B. Grant, and W. David Wilson and accepted by the GSU Office of Research and Sponsored Programs as a Quality Improvement Award for the purchase of a workstation and a multiprocessor server to be used for chemical computations of molecular and biomolecular properties. December 11, 1997 - June 30, 1998: $36,000.


“Molecular Mechanisms Underlying Photo-Induced Electron Transfer in Covalently Modified DNA Complexes,” a funded Research Team Grant to Dr. Gary Hastings (Physics & Astronomy) and Dr. Thomas L. Netzel (Chemistry) from the GSU Office of Research and Sponsored Programs. July 1, 1999 – June 30, 2000: $7,500.


“Photoinduced Electron Transfer Mechanisms in Covalently Labeled DNA Oligomers,” a
Curriculum Vitae of Thomas L. Netzel

proposal submitted by Dr. Thomas L. Netzel (prime contractor) and Dr. Bruce E. Eaton (subcontractor) of the Department of Chemistry of Washington State University and accepted by the U. S. National Science Foundation (Chemistry Division, Organic Dynamics Program) for the synthesis and optical spectroscopic study of covalently modified deoxyribonucleosides and oligonucleotides. (CHE-9709318) August 1997 - July 2001: $315,000.

“Research Supplies for Two Ph.D. Graduate Students,” funds provided the Egyptian Embassy in Washington, DC for Samir Gaballah and Yasser Hussein during their Ph.D. training with Dr. T. L. Netzel.
Amount Funded in July 1997 - June 1998: $12,000
Amount Funded in July 1998 - June 1999: $12,000
Amount Funded in July 2000 - June 2001: $12,000
Amount Funded in July 2001 - June 2002: $12,000
Amount Funded in July 2002 - June 2003: $12,000

“Photonic Viral Sensor Development,” a proposal submitted by Drs. T. L. Netzel and J. Hilliard that was funded by the Georgia Research Alliance to apply a newly patented GSU invention to the detection of viral pathogens. This invention uses the differing photoinduced charge separating properties of single strand and duplex DNA to detect hybridization of a signal DNA (RNA) strand to a covalently labeled sensing DNA strand. A transient-absorbance laser kinetics system was purchased to optimize the charge separation properties of labeled-DNA duplexes in solution. Amount funded in July 2001 - June 2002: $211,604.

"Biomolecular Interactions,” a proposal submitted by Drs. S. Allison, D. Dixon, T. L. Netzel, E. Breyer, G. Gadda, and W. D. Wilson that was funded as a GSU Research Program Enhancement (RPE) grant to support graduate student research in biophysical chemistry: $12,000 per co-PI and $13,000 for equipment maintenance each year.
Amount Funded in July 2003 - June 2004: $85,000.
Amount Funded in July 2004 - June 2005: $85,000.

“Fundamental Studies of Excess Electron Transport in Covalently Modified DNA Duplexes,” a proposal funded by the Petroleum Research Foundation to make the first, real-time measurements of the dynamics of excess electron transport in DNA duplexes at room temperature. May 2002 – August 2006: $120,000 (direct costs)

“55th Annual Southeast Regional Meeting of the American Chemical Society,” a proposal funded by the Regional Meeting Subcommittee of the Committee on Meetings and Expositions of the ACS to support SERMACS 2003 in Atlanta, GA, November 16-19, 2003: $2,500 (direct costs)

“55th Annual Southeast Regional Meeting of the American Chemical Society,” a proposal funded by the Georgia State University Research Foundation to support in part the 100th Anniversary Banquet of the GA ACS Local Section at GSU, November 18, 2003: $2,500 (direct costs)
Curriculum Vitae of Thomas L. Netzel

“55th Annual Southeast Regional Meeting of the American Chemical Society,” a proposal funded by the Office of the President of the ACS to support Chemical Education Programming at SERMACS 2003 in Atlanta, GA, November 16-19, 2003: $1,500 (direct costs)

“Financial Support for SERMACS 2003 in Atlanta, GA”, meeting support requests funded by the following ten sponsors: Holland and Knight, ACS GA Local Section, CDC/ATSDR, ACS Division of Small Chemical Businesses, ACS Industry Members Programs, Department of Chemistry and Biochemistry at Ga Tech, Chemical Computing Group, Ga Tech Research Institute, Department of Chemistry at Emory, and Eastman Chemical: $13,100 (direct costs)

Curriculum Vitae
Shahab A. Shamsi
Associate Professor
Department of Chemistry
Georgia State University
Atlanta, GA 30302-4098

I. EDUCATION

<table>
<thead>
<tr>
<th>Institution</th>
<th>Degree</th>
<th>Years</th>
<th>Field</th>
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<tbody>
<tr>
<td>Karachi University, Karachi Pakistan</td>
<td>B.Sc/M.S (Hons)</td>
<td>1982-1987</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Eastern Illinois University, Charleston, IL</td>
<td>M.S.</td>
<td>1988-1990</td>
<td>Analytical Chemistry</td>
</tr>
<tr>
<td>Advisor: Blair E. Miller</td>
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<tr>
<td>Advisor: Neil Danielson</td>
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<tr>
<td>Louisiana State University, Baton Rouge, LA</td>
<td>Postdoc</td>
<td>1995-1998</td>
<td>Analytical Chemistry</td>
</tr>
<tr>
<td>Advisor: Isiah M. Warner</td>
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</tbody>
</table>

II. PROFESSIONAL EXPERIENCE

8/01/05-Present     Associate Professor of Analytical Chemistry, Georgia State University
8/15/00-7/31/05     Assistant Professor of Analytical Chemistry, Georgia State University
8/15/98-5/15/99     *Assistant Professor of Analytical Chemistry, Georgia State University
1995-1998           Postdoctoral Fellow, Louisiana State University
1991-1995           Graduate Research Assistant, (Ph.D candidate) Miami University
1990-1991           Teaching Associate, Wayne State University
1988-1990           Teaching Assistant, Eastern Illinois University

*Note: S. Shamsi was on partial leave/reduce EFT from May 99-July 2000 due to visa problems.

III. INTELLECTUAL CONTRIBUTIONS

A. Recent Publications-Journal Articles (Published or In Press)


B1. Invited Book Chapters


B2. Invited Review Articles


C. Patent


D. Professional Presentations

D.1 Recent Presentations at Professional Meetings:


- “Simultaneous enantioseparation and detection of beta-blockers using chiral capillary
electrochromatography coupled to electrospray ionization mass spectrometry.”


“Micellar Electrokinetic Chromatography mass spectroscopy using chiral micelle polymer” Syed Asad Ali Rizvi, Anila F. Gill and Shahab A. Shamsi. Pittsburgh conference, 2002, Poster # 1729 March 18, New Orleans, LA,


D.2. Colloquia and Seminar Presentations (Invited Talks Only):

“Chiral Separations Using MEKC-MS and CEC-MS”: Al-Tayabi University, Medina Saudi Arabia, June 16, 2005


E. Editorial/Reviewer Projects
E.1 Member of the Editorial Board
Electrophoresis (Jan 2005-Present)

E.1 Reviewer for Federal Funding Agency
International Science and Technology Center (US Civilian Research and Development Foundation) Spring-2005
National Institute of Health (Shared Instrument Grant Study Section) July 2005-Present
National Science Foundation (Separation and Surface Science Group) 2002-Present
American Chemical Society (Petroleum Research Fund) Spring 2004, Spring 2005

E.2 Reviewers for Professional Journals
Analytical Chemistry
Electrophoresis
Journal of Chromatography
Journal of Separation Science
Chemical Communications
Analytica Chim Acta
Journal of Pharmaceutical and Biomedical Analysis

F. Grants and External Funding
F.1 Current Grant Support (External)

1. Title: “CE-MS of Biological Substances Using Chiral Polymers.”
   PI: Shahab A. Shamsi    Type: R01
   Period: 12/1/01-11/30/06    Amount: $625,000 (direct cost)
   Agency: The National Institute of Health (NIH)
   The purpose of this grant is to develop new hyphenated technology for the analysis of chiral compound.

2. Title: “HPLC and HPLC-MS of Lamotrigine”
   PI: Shahab A. Shamsi
   Period: 02/01/03-02/28/05
   Amount: $5,000
   Agency: Mercer University, Southern School of Pharmacy
   The purpose of this grant is to develop analytical assay of the drug lamotrigine in human plasma.

F.2 Past Grant Support
F.2.1 (External)

1. Title: “Chiral CE for Non Peptide Somatostatin Drugs”
   PI: Gideon Shapiro, Co-PI: Shahab A. Shamsi
   Type: SBTTR    Period 11/01/03-10/31/04
   Amount, $100,000 (GSU-share: $40,000)
   Agency: The National Institute of Health (NIH)
   The purpose of this grant is to develop new CE methods for analysis of non-peptide drugs
2. Title: "Synthesis, Characterization and Fundamental Studies with Polymerized Surfactant Aggregates."
   PI: Shahab A. Shamsi Type: The Petroleum Research Fund (Type G)
   Period: 8/1/00-9/30/03

F.2.2 (Internal)

1. Title: "Laser Induced Fluorescence Detection of Biomolecules and Environmental Pollutants Separated by Capillary Electrophoresis."
   PI: Shahab A. Shamsi (submitted with two co-authors)
   Type: GSU Quality Improvement Fund, Proposal for Research Equipment
   Period: 1/1/99-6/199 Amount: $15,000
   Agency: Georgia State University
   The purpose of this proposal was to obtain a LIF detector for sensitive detection of inorganic anions, organic acids and aliphatic surfactants using indirect fluorescence detection, developing micellar techniques for fluorescence detection of biomolecules and environmental pollutants using sensitive LIF detection.

2. Title: “Capillary Electrophoresis-Mass Spectrometry of Mirror Image Drugs Using a Chiral Micelle Polymer.”
   PI: Shahab A. Shamsi Type: Research Initiation Grant
   Period: 7/01/99-6/01/00 Amount: $5,000
   Agency: Georgia State University
   The purpose of this grant was to perform experiments to collect preliminary data for the proposal submitted to NIH

3. Title: “Micellar Electrokinetic Chromatography-Mass Spectrometry (MEKC-MS): Approaches for Enhanced Separation and Detection of Chiral Analytes.”
   PI: Shahab A. Shamsi Type: Faculty Mentory Grant
   Period: 7/01/01-6/01/02 Amount: $10,000
   Agency: Georgia State University
   The purpose of this grant was to perform experiment to collect preliminary data for the proposal submitted to NIH

IV. PROFESSIONAL AND HONOR ORGANIZATION ACTIVITIES

A. Membership in Professional Societies:
   American Chemical Society
   Sigma Xi
   Gamma Theta Phi
   American Chemical Society (Division of Separation Science)
   Connecticut Separation Science Council (CSSC)
V. HONORS, AWARDS AND RECOGNITION

Southern School of Pharmacy Grant-2003
National Institute of Health Award-2002-2007
Research Mentoring Grant, Georgia State University-2001
American Chemical Society Petroleum Research Fund Starter Grant-2000
Research Initiation Grant, Georgia State University-1999
Quality Improvement Grant, Georgia State University-1998
Isiah M. Warner Award for Outstanding Research-1997
Miami U. Chemistry Graduate Scholarship for Excellence in Research-1994
Miami U. Gamma Theta Phi Award-1993
Miami U. Graduate Student Achievement Award-1992
Eastern Illinois U. Sigma Chi Chemical Award-1990
BIOGRAPHICAL INFORMATION

Jerry C. Smith,
Associate Professor
Department of Chemistry,
Georgia State University
University Plaza, Atlanta Ga 30303
(404) 651-3120

Citizenship: United States

Education:

B. S. in chemistry from the University of Mississippi, 1965;

Ph. D. in physical chemistry from the University of North Carolina at Chapel Hill, 1971
[Thesis: The Electronic Structure of Phthalaldehyde and 10-Methylene Anthrone;
The Induced Circular Dichroism of Acrindine Orange Bound to Poly(L-Glutamic Acid)]

Professional Associations:

Membership in The American Physical Society, The Society of Sigma Xi, the Biophysical Society, The American Chemical Society

Employment:

<table>
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<th>Dates</th>
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<tr>
<td>10/71 - 6/74</td>
<td>Department of Chemistry</td>
<td>postdoctoral</td>
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<tr>
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<td>Arizona State University</td>
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<tr>
<td>7/74 - 9/79</td>
<td>Johnson Research Foundation School of Medicine</td>
<td>NIH postdoctoral fellow/ research associate</td>
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<tr>
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<td>University of Pennsylvania</td>
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<tr>
<td>9/79 - 9/86</td>
<td>Department of Chemistry</td>
<td>assistant professor</td>
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<td>Georgia State University</td>
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<tr>
<td>9/86 - pres.</td>
<td>Department of Chemistry</td>
<td>associate professor</td>
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Publications:


Optical and Other Properties of a Hydrocarbon-Soluble Polypeptide, Poly-(n-dodecyl)-L-Glutamate, J. C. Smith and R. W. Woody, Biopolymers 12, q 2657 (1973)


The Nature of the Copper Atoms of Cytochrome Oxidase as Studied by Optical and X-Ray Absorption Edge Spectroscopy, L. Powers, C.H. Barlow, B. Chance, J. S. Leigh, J. C. Smith, and


Mechanism of Intercalation: Ion Effects on the Equilibrium and Kinetic Constants for the


Location Models for the Potential-Sensitive Molecular Probe Oxonol V in 1,2-Dimyristoyl-sn-


**Selected Abstracts:**

*Membrane Potential Indication by Extrinsic or Intrinsic Probes, B. Chance, J. C. Smith, Y. Ching, and P. Mueller, Fifth International Biophysics Congress, Copenhagen, 1975, p. 33


*Oxonol Dyes as Indicators of Membrane Potential, Proceedings of the Sixth International Biophysics Congress, Kyoto, Japan, 1978, p. 145


*Fluorescence Lifetime and Polarization Behavior of Potential-Sensitive Oxonol Dyes in Beef


*Location Models for the Probe Oxonol V in 1,2-Dimyristoyl-sn-Glycerro-3-Phosphocholine, J.C. Smith and S. Chandrasekaran, Biophysical Society Meeting, New Orleans, LA, March 2-6, 1997; this is a national scientific meeting.


* meeting abstracts

Grants:
NIH, (IRO1GM30552), Molecular Probes of Charge Separation in Membranes, 8/82-7/85, 6/86-10/89, $296,500 plus GSU matching funds for equipment and postdoctoral salary
NIH, (IRO1GM30552), 9/85-9/88, $195,000 (indirect costs only)

NIH, Interaction of Intercalating Drugs with DNA, 1/82-12/85, $105,000 + matching, W.D. Wilson, Principal Investigator

NSF (DMB-8500319), Purchase of a Batch and Flow Calorimeter, 6/1/85-6/1/86, $35,000 (NSF) + $34,100 (GSU) (co-principal investigator)

NSF (CHE-8409599) Proposal for Purchase of an NMR Spectrometer, 5/84-4/30/86, $81,300, (co-principal investigator)

NSF (ORPM), CDP-7924747, Proposal for Purchase of Ultracentrifuge, 1/80-9/81, $17,000 + GSU matching (coprinciple investigator)

NIH, Renovation of Biology Animal Facility, 7/1/87-6/30/88, $169,626

NSF, USE-9054168, Undergraduate Faculty Enhancement in Chemistry: A Series of Regional Workshops, 7/1/91-10/30/93 (includes 6 months, no cost extension), $242,033 (total award)


NSF, PCM-8200262, Proposal for Purchase of Transmission Electron Microscope, 6/82-6/83, $67,375 plus GSU matching funds, co-principal investigator

GSU Quality Improvement Fund, Development of a High Resolution Graphics and Computational Laboratory for Computer-Aided Instruction, 6/1/92-1/30/93, $44,617

NSF, DUE-9554624, A Series of Regional Workshops in Chemistry, J.C. Smith, P.I., 5/1/96-4/30/99, $299,808, $699,880 (total costs)

NSF, DUE-0089417 “A Series of Workshops in the Chemical Sciences,” 4/30/01-4/30/04, proposed duration, $1,853,807

NSF, DUE-0341138 “A Series of Workshops in the Chemical Sciences,” start date: 6/7/04 – 6/7/07, $1,620,000, $540,000 per year (CWCS Program)
CURRICULUM VITAE

updated 08/29/05

Lucjan STREKOWSKI
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EDUCATION

1976  D.Sc. in Chemistry.  Adam Mickiewicz University, Poznan, Poland.
1967  M.S. in Polymer Chemistry (with Distinction).  Mendeleev Institute of Chemistry, Moscow, USSR; Institute of Organometallic Compounds, Moscow, USSR.

HONORS AND AWARDS

1993  Outstanding Faculty Award, College of Arts and Sciences, GSU
1977  Award of the Ministry of Science (Poland)
1973  Award of the Polish Chemical Society
1972  Award of the Polish Academy of Sciences

MEMBERSHIPS IN PROFESSIONAL ASSOCIATIONS

1995-date  International Academy of Sciences of Nature and Society -- office: Varshavskoye shosse 8, Moscow 113105, Russia (full member of the Academy; member of the presidium of the Academy).
1990-date  International Society of Heterocyclic Chemistry
1986-date  American Chemical Society
1972-1982  Polish Chemical Society

DETAILS OF APPOINTMENTS

1996-date  Professor.  Department of Chemistry, Georgia State University, Atlanta, Georgia 30303
1989-96  Associate Professor (tenure).  Department of Chemistry, Georgia State University, Atlanta, Georgia 30303.
1984-89  Assistant Professor.  Department of Chemistry, Georgia State University, Atlanta, Georgia 30303.
1978-81  Associate Professor (tenure).  Department of Chemistry, Adam Mickiewicz University, 60-780 Poznan, Poland.
1972-78  Assistant Professor.  Department of Chemistry, Adam Mickiewicz University, 60-780 Poznan, Poland.
1971-72  Instructor in Organic Chemistry.  Department of Chemistry, Adam Mickiewicz University, 60-780 Poznan, Poland.

VISITING PROFESSORSHIPS (LEAVE OF ABSENCE FROM A. MICKIEWICZ UNIV.)

1981  Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611.
1980  Medical Chemistry Group, John Curtin School of Medical Research, Australian National University, Canberra 2601, Australia.
1979-80  Department of Chemistry, University of Florida, Gainesville, FL 32611
1972-73  Department of Chemistry, University of Kansas, Lawrence, KS 66045

EXTRAMURAL RESEARCH SUPPORT (L.S. - Principal Investigator)

1)  FBI, GSU #FLT-92, “Fluorescence Control of Mechanisms in Forensic Sciences,” $136,000, 05/01/05 – 04/30/06 (Patonay/Strekowski, PI’s).
2)  Georgia Research Alliance, “Development of Novel Leuco Dye Bloodstain Detection Technology,” $37,500, 01/03/05 – 06/30/05.
3)  KPS Technologies, LLC, $40,000, 01/03/05 – 12/31/05, matching funds for the GRA grant (see above).
4)  FBI, GSU #ELT-03, “Prototype Detection Systems,” $131,601, 06/24/03 – 08/31/04 (Patonay/Strekowski, PI’s).
5)  FBI, GSU #ELT-16, “Novel Chemical Compositions,” $299,876, 10/01/03 – 03/30/05 (Strekowski/Patonay, PI’s).
6)  Coley Pharmaceutical Group, GSU #ELK79, “Synthesis of Novel CpG Inhibitors,” $89,918, 05/06/03 – 12/31/04.
7)  ACS-PRF, Grant #37714-AC1, “Novel Long-Wavelength NIR Heptamethine Cyanines,” $80,000, 01/01/02 – 08/31/05.
8)  NIH Subcontract from Brookhaven National Laboratory, “Near-Infrared Intercalating Detection of DNA,” $42,000, 01/01/02 – 10/31/03 (Strekowski/Patonay, PI’s).
9)  FBI (CLF-78), “Synthesis of Cyanine Dyes with Expected Absorption and Fluorescence in the Region of 800-1400 nm” $379,000, 11/01/01 – 05/30/03 (Strekowski/Patonay, PI’s).
10) FBI (CLF-67), “New Detection Methods for Latent Blood Stains,” $125,000, 06/01/01 – 09/30/02, (Strekowski/Patonay, PI’s).
11) NIH/SBRI, Grant #1 R43 GM62049-01, “NIR Fluorescent Labels for Biomedical Applications,” $57,139, 2000/2001, (Strekowski/Patonay, PI’s).
12) ACS-PRF, Grant #33990-B1, "Chiral Stationary Phases Based on Novel Molecular Propellers and Derivatives Thereof," $30,000, 2/1/99 - 8/31/02.
13) The Arab Republic of Egypt, Grant for Training a Graduate Student, $12,000, 11/1/97 - 10/30/99.
14) Biological Evaluation Agreement with DuPont (GSU #611), $10,125, 11/2/96 - 11/1/99.
15) Compound Screening Agreement with Dow Elanco (GSU #741), $2,700, 4/2/97 - 12/31/99.
16) DuPont Educational Aid Program, $10,000, 7/1/98-6/30/99.
17) DuPont Educational Aid Program, $10,000, 7/1/97-6/30/98.
18) DuPont Educational Aid Program, $10,000, 7/1/96-6/30/97.
20) Solvay Pharmaceuticals, Inc., "Grant for Training a Graduate Student," $6,000, 9/1/95 - 8/31/96.
21) GAANN, "Grant for Training a Graduate Student," $4,621, 7/1/95 - 6/30/96.
22) ACS-PRF, Grant #30598-B, "Triplex DNA Specific Intercalators," $25,000, 2/1/96-8/31/98.
26) Solvay Pharmaceuticals, "Development of Practical Synthetic Routes to a Racemic Mixture of DU 125012 and the 3R(+)-Enantiomer," $62,000, 10/01/92 - 12/31/95.
27) NIH-NIAID, Grant #AI27196 (renewal), $454,702, 9/1/91 - 8/30/96.
28) NIH-NIAID, Grant #1U01AI27196, "Chiral Unfused Heteropolyarenes Anti-HIV Agents," $301,180, 9/30/88 - 9/30/91.
29) NIH-NIAID, Grant # 1U01AI27196, "Chiral Unfused Heteropolyarenes Anti-HIV Agents," $301,180, 9/30/88 - 9/30/91.
30) NIH-NIAID, Grant #AI27196 (renewal), $454,702, 9/1/91 - 8/30/96.
31) NIH-NIAID, Grant #1U01AI27196, "Chiral Unfused Heteropolyarenes Anti-HIV Agents," $301,180, 9/30/88 - 9/30/91.
32) NIH-NIAID, Grant #AI27196 (renewal), $454,702, 9/1/91 - 8/30/96.
33) NIH-NIAID, Grant #AI27196 (renewal), $454,702, 9/1/91 - 8/30/96.
34) NIH-NIAID, Grant #AI27196 (renewal), $454,702, 9/1/91 - 8/30/96.
35) NIH-NIAID, Grant #AI27196 (renewal), $454,702, 9/1/91 - 8/30/96.
36) NIH-NIAID, Grant #AI27196 (renewal), $454,702, 9/1/91 - 8/30/96.
37) NIH-NIAID, Grant #AI27196 (renewal), $454,702, 9/1/91 - 8/30/96.

EXTRAMURAL RESEARCH SUPPORT (L.S. - Co-investigator)

3) NIH, #AI39391, "Nucleic Acids as Targets for Anti-AIDS Drug Design," $70,328 for L.S., 9/1/96-8/31/99 (W.D. Wilson, P.I.)
4) Georgia Research Alliance, "Development of Antigene Therapy for Commercialization," $112,189, 7/1/94-6/30/95 (W.D. Wilson, P.I.)
7) Georgia Research Alliance, "Near-IR Cyanine Dyes for Bioanalytical Applications," $41,000, 7/1/93 - 6/30/94 (G. Patonay, P.I.)
8) NIH, "NIR Dyes as Labels for Immunoassays in AIDS and Other Infectious Diseases," $343,258 total direct costs, 9/1/91 - 8/31/94 (G. Patonay, P.I.)

FEDERAL GOVERNMENT ADVISORY REVIEW COMMITTEES

2) RFA-NIH-NIAID 90-AI-10, April, 1991.

RECENT PUBLICATIONS


**EDITORSHIPS**


4. Member of the editorial board of *ARKIVOC* (an international journal of organic chemistry), 1999-present.


**PATENTS**

PRESENTATIONS

Over 20 papers at international meetings; over 70 papers at national meetings; and over 20 invited seminars in academia and industry.

PH.D. DISSERTATIONS

Research advisor of 15 Ph.D. dissertations (completed) and 1 in progress.

TRAINING OF POSTDOCTORAL STUDENTS

Over thirty (30) postdoctoral research associates have been trained in the Strekowski laboratories at Georgia State.

MISCELLANEOUS

7) 1996 Man of the Year, Commemorative Medal, American Biographical Institute, Inc.
Curriculum Vitae

Binghe Wang

Current position: Professor of Chemistry, Georgia Research Alliance Eminent Scholar in Drug Discovery, and Georgia Cancer Coalition Distinguished Cancer Scientist

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Web site: http://chemistry.gsu.edu/faculty/Wang/Wang.html

Personal

Citizenship: USA

Education

Ph.D. May 1991, Department of Medicinal Chemistry, School of Pharmacy, The University of Kansas.

B.S. July 1982, Department of Medicinal Chemistry, College of Pharmacy, Beijing Medical University, Beijing, China.

Research Interests

1) Organic/Medicinal chemistry: Design and synthesis of new imaging and therapeutic agents targeted on cancer and microbial pathogens;

2) Peptide chemistry: Development of novel linkers for solid phase peptide synthesis;

3) Pharmaceutical Chemistry: Design and synthesis of novel prodrugs of peptides and peptide mimetics aimed at enhancing their bioavailability and target selectivity; design and synthesis of substrates for the intestinal small peptide transporter as potential vectors for drug delivery;

4) Bioorganic chemistry/molecular recognition: Development of fluorescent sensors for the recognition and analysis of molecules of biological importance.
Experiences

July 2003-present  
Professor and Georgia Research Alliance Eminent Scholar in Drug Discovery, Georgia Cancer Coalition Distinguished Cancer Scientist, Department of Chemistry, Georgia State University

2003-present:  
Member, Center for Drug Discovery, University of Georgia.

June 2000-June 2003:  
Associate Professor, Department of Chemistry, North Carolina State University.

August 1998-June 2003  
Genomic Science Faculty and Biotech faculty, North Carolina State University.

August 1996 to June 2000  
Assistant Professor, Department of Chemistry, North Carolina State University.

January 1994 to July 1996:  
Assistant Professor, Department of Medicinal Chemistry and Pharmaceutics, University of Oklahoma Health Sciences Center, College of Pharmacy.

August 1992 to Dec. 1993:  
Post-doctoral research associate with Professor Ronald T. Borchardt, Department of Pharmaceutical Chemistry, School of Pharmacy, University of Kansas.

January 1992 to July 1992:  
Post-Doctoral research associate with Professor Victor J. Hruby, Department of Chemistry, University of Arizona.

May 1991 to Dec. 1991:  
Post-doctoral research associate with Professor Kristin Bowman-James, Department of Chemistry, University of Kansas.

August 1985-May 1991:  
Graduate research assistant with the late Professor Mathias P. Mertes and Professor Kristin Bowman-James, Department of Medicinal Chemistry, School of Pharmacy, University of Kansas.

August 1984-August 1985:  
Graduate Teaching and Research Assistant, Department of Chemistry, University of British Columbia, Vancouver, Canada.

August 1982-July 1984:  
Research Assistant, Department of Medicinal Chemistry, Institute of Materia Medica, Chinese Academy of Medical Sciences, Beijing, China.

Currently Active Research Funding
1) Developing New Cancer Therapies and Diagnostics, Georgia Cancer Coalition, $750,000, July 1, 2003-June 30, 2008.

2) Fluorescent Aptamers for Glycoprotein Detection, PI, NIH (CA113917), $291,000, 7/1/05-6/30/07

3) Minority Training Supplement, Preceptor (Trainee: Janet Jones), NIH, $79,749, 7/1/05-6/30/07

4) PDE4 Inhibitor Studies, Co-PI with Jim Prestegard of the University of Georgia, Georgia Research Alliance, $25,000, 7/1/05-6/30/06

Pending Funding

1) A Structure-based Approach to Selective PDE4 Inhibitors, Co-PI with Hengming Ke of UNC-CH, NIH, $983,088 (GSU portion)

2) Targeting Glioblastoma Using Novel Small-molecule HIF-1 Pathway Inhibitors, Sub-contract PI (PI-Erwin Van Meir of Emory University), NIH, $220,000 (GSU portion)

3) Biomarker-based MRI Contrast Agents, PI, NIH, about $1,000,000, to be submitted October 16.

4) Identification and Synthesis of Sea Hare Defensive Compounds, Co-PI with Chuck Derby, Brains and Behavior Research Program, GSU-Internal, $25,444 (Wang’s Portion: $16,444).

Past Research Funding

1) Inhibitors of 5-Enolpyruvylshikimate-3-phosphate Synthase and Chorismate Synthase, PI, Oklahoma Center for the Advancement of Science and Technology, $87,344 (direct cost only), September 1, 1994-August 31, 1997 (Third year declined).

2) NMR Spectrometer (300 MHz), PI, NIH, $197,300 (direct cost only), April 1, 1996 - March 31, 1997 (Funded, but transferred PI position to Garo Basmadjian because of my move from University of Oklahoma to North Carolina State University.).

3) Cyclic Prodrugs of RGD Analogs, PI, American Heart Association, Oklahoma Affiliate, $95,700 (including 10% indirect cost), July 1, 1996-June 30, 1999 (Funded, but declined).

4) Coumarin-Based Cyclic Prodrugs of Opioid Peptides, PI, Presbyterian Health Foundation (#987), $24,950 (direct cost only), April 1, 1995-March 31, 1996.

5) Acquisition of Instrumentation for an Oklahoma Statewide Shared NMR Facility, Co-Investigator (PI: Warren Ford of Oklahoma State University, Total Number of Investigators: 13 from The University of Oklahoma, Oklahoma State University, and The University of Oklahoma Health Sciences Center), NSF: $535,000 (direct cost only); Oklahoma State Regents for Higher Education Competitive Challenge Grant: $500,000 (direct cost only); Educational Research Foundation: $300,000 (direct cost only), September 1, 1995 - August 31, 1996 (all funded).


10) Thrombus-specific MRI Contrast Agents, PI (Co-PI: David Sane), North Carolina Biotechnology Center (98005-ARG-0008), $40,000 (direct cost only), August 1, 1998-July 31, 2000.


11) NMR Spectrometer (400 MHz), PI, NIH (S10RR14731), $330,000, April 1, 2001-March 31, 2002 (Funded but declined because an overlapping application submitted to the NSF by the Chemistry Department was also funded and the Department decided to accept the NSF one).


14) Neuroprotective Apolipoprotein-E Analogs, Collaborator (PI: Mike Vitek), NIH-SBIR (phase 1), $181,236.


17) Biotechnology Training at North Carolina State University, Participant/preceptor (PI: Bob Kelly), NIH, $1,370,894, July 1, 2000-June 30, 2005.

18) Fluorescent Tags Targeted on Cell Surface Carbohydrates, PI, NIH (CA88343), $889,951, July 1, 2000-June 30, 2005.

19) Boronic Acid-based Sensors for Cell-surface Carbohydrates, PI, NIH (NO1-CO-27184), $1,556,839, 3/1/02-2/28/05.

20) Small-molecule Inhibitors of DNA Repair as Radiosensitizers, Co-PI with Bill Dynan of Medical College of Georgia, Georgia Research Alliance, $25,000, 7/1/04-6/30/05
Honors, Awards, and Recognitions

1) Editor-in-Chief, Medicinal Research Reviews, since January 1, 2001 (The impact factor of the journal has risen from 2.56 in 1999 to 8.41 in 2004 since I took over the operations of the editorial office.)


3) Member of Editorial Advisory Board, Chemical Biology and Drug Design (Formerly J. Peptide Res.), Since June 2005

4) Member of Editorial Advisory Board, Letters in Drug Design & Discovery, September 2002-Present.


7) Member, Long-rang Planning Committee, American Chemical Society, Division of Medicinal Chemistry, Since 2002.


10) Oklahoma Society of Hospital Pharmacists Outstanding Faculty Award, 1995-1996 (for teaching).

11) Kappa Psi Outstanding Faculty Award, College of Pharmacy, University of Oklahoma Health Sciences Center, 1995-1996 (for teaching).

12) Kappa Epsilon Outstanding Faculty Award, College of Pharmacy, University of Oklahoma Health Sciences Center, 1995-1996 (for teaching).

13) Chairman, American Chemical Society, Oklahoma Section, 1995.

14) Graduation with Honors, Ph.D., May 1991, University of Kansas.

15) Irsay-Dahle award for outstanding graduate student, Department of Medicinal Chemistry, University of Kansas, October 1990.


17) Honor student, May 1982, School of Pharmacy, Beijing Medical University.

Recent Invited Lectures

17) College of Pharmacy, University of Illinois at Chicago, April 14, 2000.


19) Beijing Medical University, School of Pharmaceutical Sciences, Beijing, China, May 31, 2000.

20) Institute of Materia Medica, Chinese Academy of Medical Sciences, Beijing, China, June 1, 2000.

21) Beijing Institute of Pharmacology and Toxicology, Beijing, China, June 2, 2000.

22) Department of Chemistry, Peking University, Beijing, China, June 2, 2000.

23) Peking University Health Sciences Center, Beijing, China, June 13, 2001.

24) Shanghai Institute of Materia Medica, China, June 14, 2001.

25) Institute of Materia Medica, Chinese Academy of Medical Sciences, Beijing, China, June 18, 2001.


30) Department of Chemistry and Biochemistry, Georgia State University, Atlanta GA, September 6, 2002.

31) College of Pharmacy, Campbell University, Buies Creek, NC, September 20, 2002.


34) Department of Chemistry, Tulane University, March 31, 2003.


36) Department of Chemistry, Texas A&M University, September 25, 2003.

37) Department of Chemistry, Purdue University, October 9, 2003.

38) Department of Chemistry and Biochemistry, Utah State University, November 12, 2003.

40) Department of Chemistry and Biochemistry, Auburn University, February 19, 2004

41) Department of Chemistry, University of Virginia, March 5, 2004.

42) Georgia Cancer Coalition Cancer Research Conference (Drug Discovery session) at Chateau Elan Resort, May 6-7, 2004

43) Department of Chemistry, and Complex Carbohydrate Research Center, University of Georgia, September 30, 2004

44) Enplas Lecture, Kennesaw State University, October 12, 2004

45) Department of Biology, Clark Atlanta University, October 29, 2004

46) Institute of Materia Medica, Chinese Academy of Medical Sciences, May 31, 2005.

47) Department of Chemistry, Sichuan University, China, June 7, 2005

48) Department of Chemistry, Lanzhou University, Lanzhou, China, June 9, 2005

49) Frontiers of Organic and Bioorganic Chemistry, June 13, 2005, Tianjin, China

50) Carbohydrate Gordon Conferences, Tilton, NH, June 19-24, 2005

51) Emory University Winship Cancer Center-Brain Cancer Group, August 24, 2005.

52) Emory University Winship Cancer Center Elkin Lecture series, September 16, 2005


Recent Publications


**Books Edited**


**Books Edited as a Series Editor**


**Patents**


**Recent Meeting Presentations**

(presenter underlined)


42) Wang, B. and Springsteen, G. “Boronic acid/diol binding strengths determined by Alizarin Red S” Presented at the 53rd Annual Meeting of the Southeastern Region of the American Chemical Society (SERMACS), September 23-26, 2001


56) Wang, B. “Fluorescent Sensors Targeted on Cell-Surface Saccharide Biomarkers” Presented at the 36th Higuchi Research Seminar, May 4-7, 2003, Lawrence, KS


61) Yang, W.; Gao, X.; Ni, W.; Yan, J.; and Wang, B. “Water Soluble Boronic Acid-based Spectroscopic Reporters for the Synthesis of Sensors for Cell-surface Carbohydrates” Presented at


68) Wang, B. “Sensors for Cell Surface Carbohydrate Biomarkers” Presented at the joint NASA-NCI FTBS meeting, Monterey, CA, August 2-4, 2004


75) Wang, B. “Boronic Acid-based Sugar Recognition” Frontiers of Organic and Bioorganic Chemistry, June 13, 2005, Tianjin, China

76) Wang, B. “Lectin Mimics” Carbohydrate Gordon Conferences, Tilton, NH, June 19-24, 2005


Professional Membership

1) American Chemical Society
2) American Association for the Advancement of Sciences
4) American Peptide Society
5) Kappa Psi Pharmaceutical Fraternity
6) Psi Lambda Upsilon Honor Society in Chemistry
7) Rho Chi Pharmacy Honor Society
8) Sigma Xi
9) Phi Kappa Phi Honor Society

Other Experiences

Departmental/College Level Services

1) 1995-96, Member of Pharmacology & Toxicology New Faculty Search Committee, College of Pharmacy, University of Oklahoma Health Sciences Center.
2) 1995-96, Member of Medicinal Chemistry New Faculty Search Committee, College of Pharmacy, University of Oklahoma Health Sciences Center.
3) 1994, Member of University of Oklahoma College of Pharmacy Curriculum Committee, Electives Subcommittee.
4) 1995-1996, Member of University of Oklahoma College of Pharmacy Dissertation Review Committee.
5) 1996-2001, Member of Graduate Recruitment & Admissions Committee, Department of Chemistry, North Carolina State University.
6) 1996-1997, Member of Seminar Committee, Department of Chemistry, North Carolina State University.
7) 1996-1998, Member of Graduate Awards & Faculty Nomination Committee, Department of Chemistry, North Carolina State University.
8) 1996-1998, Member of X-Ray Users Committee, Department of Chemistry, North Carolina State University.
10) 1998-Present, Teaching Resources Committee, Department of Chemistry, North Carolina State University.

11) 1998-Present, Undergraduate Scholarships and Awards Committee, Department of Chemistry, North Carolina State University.

12) 1998-2000, member of the College of Physical and Mathematical Sciences Dean's Advisory Council.

13) 1999-2002, Director, Honors Program, Department of Chemistry, North Carolina State University.

14) 2002-2003, Member, Faculty Search Committee, Department of Chemistry, North Carolina State University.

15) 2003-2004 (chair), 2004-2005 (Chair), Faculty Search Committee Chair, Department of Chemistry, Georgia State University.

**University Level Services**

1) 1995-1996, Member of University Research Council, University of Oklahoma Health Sciences Center.

2) 1995-1998, Member of Graduate College Graduate Faculty Appointments Committee, University of Oklahoma Health Sciences Center.

3) 1995, Member of University of Oklahoma Health Sciences Center Multi-Culture Award Selection Committee.

4) 1995-1996, Member of the University of Oklahoma Health Sciences Center Graduate Education and Research Day Committee

5) 1996, Member of Summer Undergraduate Research & Education Program Selection Committee, University of Oklahoma Health Sciences Center.

6) 1994-1996, Faculty Leadership Program, College of Pharmacy, University of Oklahoma Health Sciences Center.

7) 1997-1998, University-Wide Genomic Science Center Steering Committee, North Carolina State University.

8) 2000-2003, University Standing Committee on International Programs, North Carolina State University.

**Professional Services**

1) Officers and Advisory boards: (1) 1995, Chairman, American Chemical Society, Oklahoma Section; (2) 2002-2004, Member, Long-rang Planning Committee, American Chemical Society,
Division of Medicinal Chemistry; (3) 2004-present, Advisory Committee member, Center for Cancer Research and Therapeutic Development (CCRTD), Clark Atlanta University.


3) Grant reviewer for (1) Research Corporation; (2) Petroleum Research Fund (American Chemical Society); (3) National Science Foundation; (4) National Institutes of Health (Study Section on Innovative Technologies for the Molecular Analysis of Cancer, March and November 2002, March 2005, November 2005; Study Section on Novel Technologies for the Noninvasive Detection, Diagnosis and Treatment of Cancer, May 2002; Postdoctoral Fellowship, May 2003; Study Section on Drug Development and Delivery (Biophysical and Chemical Sciences), November 2003 and November 2004; Study Section on Cooperative Research for the Development of Vaccines, Adjuvants, Therapeutics, Immunotherapeutics and Diagnostics for Biodefense and SARS, February 3-5, 2004; Study Section on Synthetic and Biological Chemistry (BCMB), July 2005. (5) Research Council of Canada.

4) Editorial board services: (1) 2001-present, Editor-in-Chief, Medicinal Research Reviews; (2) 1999-2002, Member of Editorial Advisory Board, Current Medicinal Chemistry; (3) September 2002-present, Member, Editorial Board, Letters in Drug Design & Discovery; (4) Since January 2005, Member of Editorial Board, Acta Pharmaceutica Sinica; (5) Editorial Board member, Chemical Biology and Drug Design, Since June 2005.

5) Meeting and symposium organization and services: (1) September 2001, Chair, Symposium on Biosensor, 53rd Annual Meeting of the Southeastern Region of the American Chemical Society (SERMACS), September 23-26, 2001; (2) 2002, Chair, Chemical Sensors in Drug Discovery, 28th National Medicinal Chemistry Symposium, June 8-12, 2002, San Diego, CA; 2002, (3) Session Chair on Kinases, Phosphatases, and Integrins, Division of Medicinal Chemistry, 224th ACS National Meeting, Boston, August 18-22, 2002; (4) Member, Organizing Committee (The other members are Chris Lipinski, Ed Kerns, Ron Borchardt, Dhiren Thakker), Workshop on Pharmaceutical Profiling in Drug Discovery for Lead Selection, jointly sponsored by the American Association of Pharmaceutical Scientists and the American Chemical Society-Medicinal Chemistry Division, May 2003; (5) 2004 SERMACS undergraduate presentation judge, November 16, 2003; (6) Co-Organizer and Co-chair, Progress of Chinese American Chemists in Academia, at the 226th American Chemical Society National Meeting, New York, September 2003; (7) Organizer and Chair, Recent Progress in Diabetes Research, 227th American Chemical Society National Meeting, Anaheim, March 2004; (8) Organizing Committee, 2nd Georgia State University Biotechnology Symposium, 2004; (9) Organizing Committee, the First Joint Meeting between Chinese-American Chemistry Professors and Chinese Chemistry Professors, Tianjin, China, June 13-14, 2005; (10) Chair and Organizing Committee member, Symposium on Boronic Acid to be held at the 2005 Pacifichem, December 13-19, Hawaii; (11) Co-chair and Co-organizer (with
Geert-Jan Boons of UGA), Symposium on Carbohydrate Recognition to be held at the 231st ACS National Meeting, March 26-30, 2006, Atlanta, GA
CURRICULUM VITAE

Name: Irene T. Weber, Ph.D.
Rank: Professor
Department: Biology

I. EDUCATIONAL/PROFESSIONAL CREDENTIALS

B.A., Physics, Cambridge University, Cambridge, England, 1974

II. TEACHING EXPERIENCE (ACADEMIC)

Tutorials and Laboratory assistance in: Mathematics and Physics for Biologists; Mathematics for Biochemists; Macromolecular Structure and Model Building, Oxford University, 1974-1977.

The European Molecular Biology Organization Workshop on the Structure of Fibrous Proteins, Oxford University, August 1975.

Course on Protein Structure and Function, University of Lausanne, Les Diablerets, Switzerland, October, 1985.


FAES Graduate School Course on DNA-Binding Proteins, NIH, Bethesda, MD, May 1990.

Graduate Courses, Department of Microbiology and Immunology, Thomas Jefferson University, Philadelphia, PA, 1991-2000.

Graduate Courses, Departments of Biology, Chemistry and Computer Science, Georgia State University, Atlanta, GA, January 2001-present.
III. ADMINISTRATIVE EXPERIENCE (ACADEMIC)

University Organizations

Graduate Representative for Molecular Biophysics on the Joint Consultative Committee for the Biological and Agricultural Sciences Faculty Board of Oxford University, October 1975 - 1976.

Member, University Committee on Student Promotion, Thomas Jefferson University, Philadelphia PA, 1993-1998.


Leader, Structural Biology and Bioinformatics Program of Kimmel Cancer Center, Thomas Jefferson University, Philadelphia PA, 1994-2000.

Member, Atlanta Structural Biology Core, 2001-present.

Member, Molecular Genetics and Biochemistry Graduate Program, Biology Department, Georgia State University, Atlanta GA, 2001-present.

Member, GRID Group @ GSU, for Georgia State University participation in the NSF Middleware Initiative (NMI) Integration Testbed Program, Feb. 2003-present.

Co-Director, Biomedical Computing Center, Georgia State University, Atlanta GA, June 2003-present.

Member, Executive Committee, Biomedical Computing Center, Georgia State University, Atlanta GA, June 2003-present.

Member, Scientific Review Committee, Biomedical Computing Center, Georgia State University, Atlanta GA, Sept. 2003-present.

Member, Seminar Committee, Biology Department, Georgia State University, Atlanta GA, Oct. 2003-Sept. 2004.

Member, Internal Grants Program Faculty Peer Review Committee, Georgia State University, Jan. 2004-present.

Director, Structural Biology Collaboratory, Molecular Basis of Disease Area of Focus, Georgia State University, July 2004-present.
Recent Conference Organization

Member, Organizing Committee for University System Symposium, Applying Bioinformatics: From Genes to Systems, Georgia State University, Atlanta GA, Oct. 2002.

Session Chair, “Applying Bioinformatics: from Genes to Systems” Symposium Session on Molecular Structure, Georgia State University, Atlanta GA, Oct. 2002.

Member, Organizing Committee for SECABC Biotech/Biocomputing Symposium, Georgia State University, Atlanta GA, May 24-25, 2004.

Member, Organizing Committee for Winter Workshop on Biocomputing, SECABC, Georgia State University, Atlanta GA, Jan. 4, 2005.

Member, Organizing Committee for Boykin-Biotech Symposium, Georgia State University, Atlanta GA, June 9-10, 2005.

Member, Steering Committee for Fall Biocomputing Workshop, Georgia State University, Atlanta GA, Oct. 27, 2005.
IV. BUSINESS AND PROFESSIONAL EXPERIENCE

2001-pres. Professor, Biology and Chemistry Departments, Georgia State University, Atlanta, GA.

1991 - 2000 Associate Professor, Department of Microbiology and Immunology, Kimmel Cancer Center, Thomas Jefferson University, Jefferson Medical College, Philadelphia, PA.

1987 - 1991 Staff Scientist, Head of Protein-Nucleic Acid Interactions Group, Basic Research Program, NCI-Frederick Cancer Research Facility, Frederick, MD.

1986 - 1987 Physicist, Macromolecular Structure Group, Center for Chemical Physics, National Bureau of Standards, Gaithersburg, MD.

1984 - 1986 Guest Worker, National Bureau of Standards, Gaithersburg, MD.

1985 - 1986 Research Associate, Center for Advanced Research in Biotechnology, National Bureau of Standards, Gaithersburg, MD.

1984 - 1985 Research Associate, Chemistry Department, University of Maryland, College Park, MD.

1978 - 1984 Postdoctoral Associate and Research Associate, Department of Molecular Biophysics and Biochemistry, Yale University, New Haven, CT.

V. INTELLECTUAL CONTRIBUTIONS

A. Recent Publications – Journal Articles


B. Publications - Book Chapters and Reviews


C. **Recent Proceedings (Refereed)**


D. Professional Presentations

Recent Talks and Seminars


Structural Bioinformatics Applied to Leukemia and HIV Drug Resistance. Departments of Biology and Chemistry, Georgia State University, Atlanta GA, Mar. 23, 2000.


Structural Studies of HIV Protease and Tcl1 Oncoproteins. Chemistry Department, Emory University, Atlanta GA, Sept. 23, 2002.


Crystallographic studies of HIV Protease and Tcl1 Oncoproteins. Biology Department, Georgia State University, Atlanta, GA 30303, Oct. 11, 2002.

Crystallographic studies of HIV Protease and Tcl1 Oncoproteins. Chemistry Department, University of Illinois at Chicago, Chicago IL, Oct. 17, 2002.


High Resolution Crystal Structures of HIV Protease Mutants and Implications for Drug Resistance. Pediatric AIDS Group and Department of Structural Biology, St. Jude Children’s Research Hospital, Memphis, TN, March 17, 2005.


**Poster presentations**

Presenter’s name is **bold**,

* indicates one of my graduate students,

# indicates one of my postdoctoral associates.


Biology Department Student Day, Georgia State University, Atlanta, GA, Feb 21, 2004.


Recent Talks by Students or Postdoctoral Associates at Professional Meetings

Presenter’s name is bold,
* indicates one of my graduate students,
# indicates one of my postdoctoral associates.


E. Editorial/Reviewer Projects

Grant Reviews


Ad Hoc Reviewer for the Research Corporation, 2005.
Ad Hoc Reviewer for the Frontier Science Research, 2005.

**Journal Reviews**


**F. Patents**


**VI. PROFESSIONAL AND HONOR ORGANIZATION ACTIVITIES**

**A. Membership**

Member, American Crystallographic Association, 1988-present.


Member, American Association for the Advancement of Science, 1998-present.

Member, Comparative Modeling Consultancy Group for Critical Assessment of Structure Prediction (CASP); an International experiment, 1996-present.

Member and Representative for Georgia State University, Southeast Regional Collaborative Access Team (SER-CAT) 22-ID (or 22-BM) beamline at the Advanced Photon Source, Argonne National Laboratory, 2001-present.

VII. HONORS, AWARDS AND RECOGNITION

Gwendoline Crewdson Prize for Natural Sciences, 1974.

Medical Research Council Scholarship, 1974-1977.


National Cancer Institute R01 CA59832: Fine Mapping of TNF Receptor Binding Domain(s). Co-P.I. (P.I. M.-J. Chen) 4/1/93 to 3/31/97, total direct cost $423,000.


American Diabetes Association: Molecular Model of Human Glucokinase: An Enzyme Implicated in Type II Diabetes. P.I. Research Grant 7/1/93 to 6/30/95, total cost $80,000 (direct cost $78,366).


Cure for Lymphoma Foundation Fellowship: Crystal Structures of MTCP1 and TCL1 Oncogene Products. 7/1/97-6/30/98 (sponsor for Dr. Zheng-qing Fu), direct costs $30,000.

National Institutes of Health R01 AI/GM41380: Activity of Resistant Variants of HIV Protease. P.I. 7/1/97 to 8/31/00, total costs $676,848 ($427,276 direct costs).

National Institutes of Health Fellowship 1F32 GM19736: Structural studies of ion channel cGMP binding domain, 8/17/98-8/16/01 (sponsor for Dr. Sean P. Scott), total costs $131,236.

AIDS-Fogarty International Research Collaboration Award R03 TW01001: Specificity Studies of HIV and HTLV Proteases, 7/1/99-6/30/02 (with Dr. Jozsef Tozser, University of Debrecen, Hungary), total costs $118,358 ($95,322 direct).


National Institutes of Health R01-GM62920: Activity of Resistant Variants of HIV Protease. P.I. 9/1/00-8/31/03, $715,486 total costs ($500,340 direct costs).
National Institutes of Health R01-GM62920/Minority Supplement: Activity of Resistant Variants of HIV Protease. P.I. (sponsor for graduate student Augustine Iro), 9/1/01-8/31/03, $96,832 total costs, $67,714 (direct costs).

University of Georgia, Consultant for Southeast Collaboratory for Structural Genomics. P.I., 9/01/01-8/31/06, $31,200 total costs.

AIDS-Fogarty International Research Collaboration Award R03 TW01001: Specificity Studies of HIV and HTLV Proteases, 7/1/02-6/30/05 (with Dr. Jozsef Tozser, University of Debrecen, Hungary), total costs $119,140 ($96,000 direct).

Georgia Cancer Coalition, Distinguished Cancer Scientist Award: Structural studies of cancer-related proteins, 8/1/02-9/30/07, total costs $750,000.

National Institutes of Health P20 GM065762. Georgia State University Biomedical Computing Center, P.I. R.W. Harrison, Co-P.I. I.T. Weber, 6/1/03-5/31/06, $250,000 (direct costs per year), total costs $1,091,250, ($750,000 direct costs).

National Institutes of Health R01-GM62920: Activity of Resistant Variants of HIV Protease. P.I. 9/1/04-8/31/08, $1,245,480 total costs ($856,000 direct costs).

BIOGRAPHICAL INFORMATION

W. David Wilson
Regents Professor of Chemistry
Department of Chemistry
Georgia State University
Atlanta, Georgia  30303
(404) 651-3903  wdw@gsu.edu

EDUCATION:

B.S.  1966, University of North Carolina, Chemistry
Ph.D.  1970, Purdue University; Physical Biochemistry

FIELDS OF INTEREST:

Biophysical Chemistry; interaction of small molecules with nucleic acids and
nucleic acid molecular recognition; thermodynamic analysis of nucleic acid
complexes, structure-activity relationships; binding, kinetic, and conformational
analyses of drug, peptide, and protein complexes with DNA and RNA,
experimental and molecular modeling methods in nucleic acid conformational
analysis and in drug design.

EXPERIENCE AND POSITIONS:

9/84-pres  Regents Professor of Chemistry, Georgia State University
Continuing  Editorial Board Member, Biochemistry
Continuing  Scientific Board Member, Immtech International, Inc.
Continuing  Chair, Awards Committee of the Biophysical Society
2001  INSERM Senior Scientist Award, Visiting Scientist at the
      Institute of Cancer Research, Lille France
1992-1996  Member NIH Molecular and Cellular Biophysics Study Section
6/88-8/88  Visiting Scientist (NATO Travel Grant) at the Institute for
          Cancer Research, London, with Professor Stephen Neidle
4/88  Visiting Professor, Dept. of Chemistry, Univ. of Puerto Rico
1983-1988  American Cancer Society Faculty Research Award
9/81-8/84  Professor of Chemistry, Georgia State University
9/79-7/82  Director, Laboratory for Microbial and Biochemical Sciences,
           Georgia State University
12/79-3/80  Visiting Faculty Member, Department of Chemistry,
           University of Florida, Gainesville, Florida.
9/75-9/81  Associate Professor of Chemistry, Georgia State University
9/74-8/75  Research Leave (NSF and NIH supported), Dept. of Chemistry,
          University of Florida, with Professor E.J. Gabbay
9/70-9/74  Assistant Professor of Chemistry, Georgia State University
6/71-9/71  Postdoctoral Fellow (NIH supported), Dept. of Chemistry,
          Purdue University
9/66-8/70  Graduate Student (NIH Fellowship), Department of
          Chemistry, Purdue Univ., with Professor J.F. Foster. Thesis
          research on conformational analysis of proteins
RESEARCH EXPERTISE:
NMR, absorption, fluorescence and circular dichroism spectroscopy of nucleic acids and complexes; molecular dynamics methods for nucleic acid investigations; fast kinetic analysis of biopolymer reactions; thermodynamic analysis of DNA conformational transitions and DNA-small molecule interactions; surface plasmon resonance (BIACore) and calorimetric analysis of nucleic acid interactions; nucleic acid and peptide synthesis and modification; 3D molecular modeling methods in drug design.

SOCIETY MEMBERSHIPS AND RECENT MAJOR ACTIVITIES:
American Chemical Society (Organizer for a Symposium on Nucleic Acid Structure and Interaction at the 2003 SE ACS Meeting; Editorial Board for BIOCHEMISTRY; Member of the Biochemistry Division), Biophysical Society (Chairman of the Society Awards Committee; Member of the Molecular Biophysics Division), American Association for the Advancement of Science.

PATENTS:


D. W. Boykin, R. R. Tidwell, W. D. Wilson, and I. Francesconi, "2,4-Bis(4-Amidino)Phenylfurans as Anti-Pneumocystis Carinii Agents; US Patent 6,008,247; December 28, 1999.


D. W. Boykin, R. R. Tidwell, W. D. Wilson, and I. Francesconi, "2,4-Bis(4-Amidino)Phenylfurans as Anti-Pneumocystis Carinii Agents; United Kingdom Patent 9816054.2; 2000.


RECENT PUBLICATIONS


CURRENT RESEARCH GRANT SUPPORT:

National Institutes of Health: GM-61587;
"Sequence-Specific Recognition of DNA by a Dimer Motif."

Gates Foundation:
"DNA Targeted Drug Design for Infectious Diseases."

National Science Foundation: CHE-0414231;
"Tuning the Thermodynamic and Kinetic Properties of Polyamides to DNA."

National Institutes of Health: AI-064200;
"Heterocycle Binding and Biology in the DNA Minor Groove."

RECENT PAPERS PRESENTED:


"Physical Basis for the Strong Interactions Between the Polyamide, f-ImPyIm, and its Cognate DNA, ACGCGT." Karen Buchmueller, S. Bailey, D. Matthews, C. Bruce, J. Register, Z. Davis, John A. Hartley, D. Hochhauser, M. Kotecha, C. O'Hare, David Wilson, Binh Nguyen, Moses Lee, 57th Southeast/61st Southwest Meeting of the American Chemical Society, Memphis, TN, Nov., 2005.


SEMINARS (recent):
University of Paris, March, 2001
Institute of Cancer Research, London, April, 2001
University of Liege, Belgium, May, 2001
Joseph Fourier University, Grenoble, France, June, 2001
Institute of Cancer Research, Lille, France, June, 2001
Georgia State University, November, 2001
Florida State University, December, 2002
Carnegie Mellon University, February, 2003
University of Arizona and Arizona Cancer Center, April, 2003
University of Medicine and Dentistry of New Jersey, Robert Wood Johnson Medical School, April, 2004
Rutgers University, April, 2004
Wake Forest University, October, 2004
Furman University, November, 2004
University of Delaware, May, 2005
University of Toronto, October, 2005

RECENT INVITED SYMPOSIUM PRESENTATIONS:


CURRICULUM VITAE

NAME: JENNY J. YANG, Ph.D.

RANK: Associate Professor

ADDRESS: Department of Chemistry
Florida State University
50 Decatur Street, NSC 552
PO Box 4098
Atlanta, GA 30302-4098
Tel: 404-651-4620, Fax: 404-651-2751
E-mail: chejjy@panther.gsu.edu
http://chemistry.gsu.edu/faculty/Yang/Yang.html

I. EDUCATION

1992 Ph.D. Biochemistry (Distinguished), Florida State University, Tallahassee, FL
Graduate Research Advisor: Dr. Harold Van Wart
Dissertation Title: Kinetic Studies of the Catalytic Pathway of Thermolysin

1985 M.S. Analytical Chemistry (Honors), Xiangtan University, Xiangtan, Hunan, China
Graduate Research Advisor: Professor Shiling Tang
Thesis Title: Electro-analysis of Trace Zinc and Copper

1982 B.S. Chemistry with High Honors, Xiangtan University, Xiangtan, Hunan, China
Undergraduate Research Advisor: Professor Weikuan Yao
Research Project: Detection and Analysis of Biological Elements

II. PROFESSIONAL CREDENTIALS

2004-Present Georgia State University, Department of Chemistry, Atlanta, GA
Associate Professor of Biochemistry and Biophysics (Tenured)
University of Georgia, Adjunct Professor, Center for Metalloenzyme Studies
Centers for Disease Control and Prevention: Guest Researcher

1997-2001 Georgia State University, Department of Chemistry, Atlanta, GA
Assistant Professor of Biochemistry

1995-1997 Yale University, Department of Molecular Biophysics & Biochemistry, New Haven
Hardford Postdoctoral Research Associate
Advisor: Professor Lynne Regan

1993-1995 University of Oxford, Oxford Center for Molecular Sciences (OCMS), UK
OCMS Postdoctoral Research Fellow
Advisors: Professor Chris M. Dobson (FRS) and Professor Sheena E. Radford

1992-1993 Syntex Discovery Research (Roche Biosciences)
Institute of Biochemistry and Cell Biology, Palo Alto, CA
Postdoctoral Research Fellow
Advisor: Professor Harold E. Van Wart

1982-1987 Xiangtan University, Department of Chemistry, Hunan, China
Faculty of Analytical Chemistry
III. TEACHING EXPERIENCE
2002-Present  **Georgia State University**, Department of Chemistry, Atlanta, GA
Associate Professor of Biochemistry and Biophysics (Tenured)
**University of Georgia**, Adjunct Professor, Center for Metalloenzyme Studies
1997-2001  **Georgia State University**, Department of Chemistry, Atlanta, GA
Assistant Professor of Biochemistry
1982-1987  **Xiangtan University**, Department of Chemistry, Hunan, China
Faculty of Analytical Chemistry

IV ADMINISTRATIVE EXPERIENCE

<table>
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<tr>
<th>Role</th>
<th>Committee/Role</th>
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<tr>
<td>Chemistry M.S. Curriculum Committee</td>
<td>Fall 1999</td>
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<td>Chemistry Curriculum Committee</td>
<td>2004 - present</td>
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<tr>
<td>Chemistry Atlanta NMR Facility Committee</td>
<td>1997- present</td>
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<tr>
<td>Chemistry M.S. Graduate Admission Committee</td>
<td>~90 Spring 1999- 2003</td>
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<td>Chemistry B.S. Honors and Awards Committee</td>
<td>~60 Spring 1999- present</td>
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<tr>
<td>Chemistry Ph.D. Dissertation Committees</td>
<td>12 1997- present</td>
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<td>Chemistry Ph.D. Qualifying Examination Committee</td>
<td>30 1997- present</td>
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<tr>
<td>Chemistry Faculty Search Committee</td>
<td>2003- present</td>
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<tr>
<td>Chemistry Chair of the Biochemistry Ph.D. Qualifying Examination Committee</td>
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<td>Chemistry Seminar Speaker invited</td>
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<tr>
<td>GSU Asian American Studies Research Center Committee</td>
<td>2002- present</td>
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<td>GSU Internal Grants Review Committee</td>
<td>2001- present</td>
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<tr>
<td>GSU University Biosafety Committee</td>
<td>2001- present</td>
<td></td>
</tr>
</tbody>
</table>

V. BUSINESS AND PROFESSIONAL EXPERIENCE
2002-Present  **Georgia State University**, Department of Chemistry, Atlanta, GA
Associate Professor of Biochemistry
**University of Georgia**, Adjunct Professor, Center for Metalloenzyme Studies
**Centers for Disease Control and Prevention**: Guest Researcher
**Journal of Calcium Binding Protein**: Associate Editor
**Journal of Protein & Peptide Letters (PPL)**: Editorial Board Member
1997-2001  **Georgia State University**, Department of Chemistry, Atlanta, GA
Assistant Professor of Biochemistry
2004  Speaker at the Gordon Conference of Biomineralization
2004  Panel Grant Reviewer of National Science Foundation (NSF-MCB)
2003  Honor from McNair Program for outstanding achievement in training minority undergraduate researchers
2002-2004  Panel Grant Reviewer of the Study Session of National Institute of Health for Predoctoral Fellowship (F31)
2005  Panel Grant Reviewer of the Study Session of National Institute of Health (National Cancer Institute)
VI. COURSES TAUGHT

1985  Undergraduate   Analytical Chemistry
1986  Undergraduate   Instrumental Analysis
1987  Undergraduate   Inorganic Chemistry Labs
1987-89 Undergraduate   Analytical Chemistry Labs
Winter 98 Graduate/Undergraduate   Biochemistry I Chem 460/660
Fall 97 Graduate   Advanced Protein Chemistry Chem 862
Spring 97 Graduate/Undergraduate   Biochemistry I Chem 460/660
Winter 98 Graduate/Undergraduate   Biochemistry I Chem 460/660
Spring 98 Graduate/Undergraduate   Biochemistry I Chem 4600/6600
Spring 98 Graduate   From DNA to Protein (Topics) Bio 896
Fall 98 Graduate/Undergraduate   Protein Structure & Functions Chem 8360
Fall 98 Graduate   Biomolecular NMR Chem 8900P
Spring 99 Graduate/Undergraduate   Biochemistry II Chem 4610/6610
Fall 99 Graduate   Biomolecular NMR Chem 8500
Spring 00 Graduate/Undergraduate   Biochemistry II Chem 4610/6610
Fall 00 Graduate   Protein Structure & Functions Chem 8360
Spring 01 Graduate/Undergraduate   Biochemistry II Chem 4610/6610
Fall 01 Graduate   Biomolecular NMR Chem 8500
Spring 02 Graduate/Undergraduate   Biochemistry II & molecular Basis for Diseases Chem 4610/6610
Fall 02 Graduate   Protein Structure & Functions Chem 8360
Biomolecular NMR Chem 8500
Spring 03 Graduate/Undergraduate   Biochemistry II & molecular Basis for Diseases Chem 4610/6610
Fall 03 Graduate   Protein Structure & Functions Chem 8360
Spring 04 Graduate/Undergraduate   Biochemistry II & molecular Basis for Diseases Chem 4610/6610
Biomolecular NMR Chem 8500 for GSU, UGA
Georgia Tech, and Emory
Fall 04 Graduate/Undergraduate   Enzymology Bio/Chem 4630/6630
Fall 04 Graduate/Undergraduate   Molecular Interaction-Protein and Enzyme Chem 8540/6540
Fall 04 Graduate/Undergraduate   Current Topics in Chemistry-seminar Chem8800
Spring 05 Graduate/Undergraduate   Molecular Interaction-Protein and Enzyme Chem 8540/6540
Spring 05 Graduate   Biomolecular NMR Chem 8500

VII. INTELLECTUAL CONTRIBUTIONS

A-C PUBLICATIONS (*After position at GSU)


(36)* Jin Zou, Yiming Ye, Kristy Welshhans, Monica Lurtz, April Ellis, Charles Louis, Vincent Rehder and Jenny J. Yang. Expression and Optical Properties of Green Fluorescent Protein


(31)* Liuqing Yang, Jenny Yang, Youliang Huang, and Zhi-Ren Liu, Phosphorylation of p68 RNA helicase regulates RNA binding by the C-terminal domain of the protein. *BBRC* (2004), 314 (2), 622-630.


(20)* Yiming Ye, Hsiau-Wei Lee, Wei Yang, Sarah J. Shealy, Anna L. Wilkins, Zhi-ren Liu, Ivan Torshin, Robert Harrison, Robert Wohlhueter and Jenny J. Yang. Metal Binding Affinity and


D. PROFESSIONAL PRESENTATIONS

RECENT INVITED TALKS

63. Winship Cancer Institute, Emory University, Atlanta, GA, January, 26, 2006.
62. Symposium of Southeast NMR, Section chair and speaker, Atlanta, GA, November 12, 2005.
60. Regional Center for Biodefense and Emerging Infectious Diseases Research, University of Chap Hill, NC, October 10, 2005.
58. Pox Virus Branch, Centers for Disease Control and Prevention, September 8, 2005.
57. Metalloprotein and Protein Design Conference, Section chair and speaker, Chicago, IL, July 28-30, 2005.
56. Second Annual Meeting of Regional Center for Biodefense and Emerging Infectious Diseases Research, Galveston, TX, March 14, 2005.
54. Atlanta Calcium Signaling Symposium, Atlanta, April 23, 2005.
52. Department of Chemistry, Syracuse University, Syracuse, NY, September 16, 2004.
51. Harvard Medical School, VA Hospital, Boston, MA, August 16, 2004.
47. Department of Pharmacy, Emory University, School of Medicine, Atlanta, GA, Oct.20, 2003.
46. Department of Biochemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA, Oct., 2003
45. Symposium Chair of Calcium Signaling at American Chemistry Society Southeastern Regional Meeting, Atlanta, GA, November, 03.

RECENT PRESENTATIONS, PROCEEDINGS AND ABSTRACTS AT PROFESSIONAL MEETINGS


5. Shunyi Li, Wei Yang, Anna Wilkins, and Jenny Yang, “In-cell NMR and Calcium-Dependent Proteins by Design,” 11th Suddath Symposium of Fluorescence Imaging of Life Sciences. Atlanta, Georgia 2005.


10. Hai Deng, Guangtao Chen & Jenny Yang. “Predicting Calcium Binding Sites -- A Graph Theory Approach Post day, Biology Department, Georgia State University, Atlanta, Georgia 2005.


15. Yiming Ye, Joseph Esposito, Vladimir Loparev, Mike Frace, Robert M. Wohlhueter, Inger K. Damon and Jenny J. Yang. “Understanding Molecular Recognition of the TNF Receptor Encoded by Variola Virus (smallpox) and Orthopoxvirus.” Southeast Regional Center of Excellence for Emerging Infections and Biodefense, Galveston, TX, 2005.


Fluorescence Imaging of Life Sciences. Atlanta, Georgia 2005 (Awarded First Prize for Poster Presentation).


27. Shunyi Li, Wei Yang, Anna Wilkins, and Jenny Yang, “In-cell NMR and Calcium-Dependent Proteins by Design,” 11th Suddath Symposium of Fluorescence Imaging of Life Sciences. Atlanta, Georgia 2005.


32. Lisa Jones, Wei Yang, Anna Wilkins, Kendra Hubbard, Daniel Spratt, and Jenny J. Yang, Understanding the Effect of Electrostatic Interactions on Calcium Binding Affinity: Proteins by Design Atlanta Calcium Signaling Symposium, Atlanta, GA, 2005.

33. Shunyi Li, Wei Yang, and Jenny J. Yang, “Rational Design a Calcium-binding Trigger,” Atlanta Calcium Signaling Symposium, Atlanta, GA, 2005.

34. April Ellis and Jenny J Yang “Rational Design of Calcium Biosensor-pH and Metal binding properties,” Atlanta Calcium Signaling Symposium, Atlanta, GA, 2005.


37. Anna Wilkins, Wei Yang, Julian Johnson, and Jenny J Yang, “Analyzing the effects of net charge and ligand type to the metal binding affinities for designed calcium binding proteins,” Atlanta Calcium Signaling Symposium, Atlanta, GA, 2005.

38. Angela Holder, April Ellis and Jenny J Yang, “Fluorescent Proteins: Mutation, Expression, Purification, and Analysis,” Atlanta Calcium Signaling Symposium, Atlanta, GA, 2005.


41. Nancy Huang, and Jenny J. Yang, “Comparison between DsRed and GFP Mutants,” Atlanta Calcium Signaling Symposium, Atlanta, GA, 2005.


45. April Ellis and Jenny J Yang “Rational Design of Calcium Biosensor-pH and Metal binding properties,” 5th Southeast Multiphoton Confocal Conference, Atlanta, Georgia 2005.


47. Yiming Ye, Joseph Esposito, Vladimir Loparev, Mike Frace, Robert M. Wohlhueter, Inger K. Damon and Jenny J. Yang, “Understanding Molecular Recognition of the TNF Receptor Encoded by Variola Virus (smallpox) and Orthopoxvirus,” Southeast Regional Center of Excellence for Emerging Infections and Biodefense, Chapel Hill , NC, 2005.


**EDITORIAL/REVIEWER PROJECTS**

- Associate Editor of *Journal of Calcium Binding Protein* (2004-present)
- Editorial Board Member of *Journal of Protein & Peptide Letters (PPL)* (2005-present)
- Reviewer of Grant Proposals:
  - National Institute of Health/ National Cancer Institute (Study Session of STTR/SBIR, 2005)
  - National Institute of Health (Study Session of Biophysics-Postdoctoral Fellowship, 2005)
  - National Science Foundation (Panel of MCB, 2001-2004)
National Institute of Health (Study Session for Predoctoral Fellowship 2002-present)
National Science Foundation (Ad Hoc Instrumentation)
Research Cooperation (Ad Hoc)
Hong Kong Research Grants Council (Ad Hoc)
The Welcome Trust-International Research fellowship UK (Ad Hoc)
Israel Science Foundation (ISF) (Ad Hoc)

- Ad Hoc Reviewer of Scientific Articles:
  Proceeding of National Academic Proceedings
  Journal of the American Chemical Society
  Journal of Biological Chemistry
  Biochemistry
  Protein Science
  BBA
  Biological Inorganic Chemistry
  FEBS Letter
  Current Opinions for Structural Biology
  Talanta
  Biomacromolecules
  Archives of Biochemistry and Biophysics
  Protein Engineering
  Journal of Inorganic Biochemistry
  Journal of Bacteriology
  Journal of Biological Inorganic Chemistry
  Bioorganic & Medicinal Chemistry

- Grant Review Consultant for the MORE Program at California State University
- Lectured at the NSF-sponsored Workshop of Molecular Genetics and Protein Engineering 2001, 2002
- Wrote sections in proposal to obtain Mass spectrometry instruments for Georgia State University and Georgia Institute of Technology from National Institute of Health (Direct costs: $400,000)
- Wrote sections in proposal to obtain high-field biomolecular NMR (900 MHz) for Southeast Collaboratory from National Institute of Health (Direct costs: $5,045,000.00)
- Wrote sections in proposal to support Biocontainment Laboratory at GSU from National Institute of Health, 2004
- Section Chair “Calcium Signaling” Section at American Chemistry Society Southeastern Regional Meeting, GA, November, 2003.
- Organizing Calcium Club at Southeast Region
- Organizing and Chairing Atlanta Calcium Signaling Symposium 2005
- Section chair of Metalloprotein and Protein Design Conference Chicago, IL, July 28-30, 2005.
- Section Chair of Symposium of Southeast NMR, Atlanta, GA, November 12, 2005.
F. GRANTS AND EXTERNAL FUNDING

CURRENT ACTIVE EXTERNAL SUPPORT

1. Title: Rational Design and Analysis of Calcium Binding Proteins
Source: National Institute of Health/GM 1RO1GM62999-01
PI: Dr. Jenny J. Yang
Period: 07/01/01 – 06/30/06
Direct costs: $1,272,500

2. Title: Design of Calcium Sensors to Monitor Calcium Signaling in ER
Source: National Institutes of Health/GM 1R21GM070555-01
PI: Dr. Jenny J. Yang
Co-PI: Dr. Charles Louis
Period: 06/01/04 - 5/31/06
Direct costs: $363,750

3. Title: Regulation of Lens Gap Junctions
Source: National Institute of Health/Eye Institute 5R01AI021389
PI: Dr. Charles Louis
Co-PI: Dr. Jenny J. Yang
Period: 09/01/04- 08/31/08
Direct costs: $1,250,000

4. Title: Molecular Biology of Rubella Virus
Source: NIH/NIAID 5R01AI021389
Period: 04/01/03 - 03/31/08
PI: Dr. Teryl K. Frey
Co-PI: Dr. Jenny J. Yang
Direct costs: $1,150,000

5. Title: Developing Protein-Based Sensor for Diagnosing Poxviruses
Source: NIH, Southeast Research Center for Emerging Diseases and Biodefense (SERCEB)
PI: Dr. Jenny J. Yang
Period: 01/01/05- 12/31/08
Direct costs: $50,000

6. Title: Supplemental Award for Minority Undergraduate Student Research
Source: National Institute of Health
PI: Dr. Jenny J. Yang
Period: 03/01/04 – 06/30/06
Total costs: $114,385

7. Title: GANN Minority Pre-doctoral Fellowship for Graduate Research (Sponsor)
Source: Grants in Areas of National Need (GANN)
Awar:er Ms. Lisa Jones (PI: Davon Kennedy)
Period: 07/01/04-06/30/07
CURRENT INTERNAL SUPPORT

1. Title: Monitoring Calcium Signaling in Brains and Neurons
Source: GSU Research Program
Period: 07/01/04– 06/30/06
PI: Dr. Jenny J Yang
Co-PI: Vincent Rehder
Direct costs: $30,000

2. Title: Predicting Calcium Binding Sites with Graphing Theory Algorithm
Source: GSU/National Institutes of Health P20
Period: 1/01/04 -12/31/06
PI: Guantao Chen
Co-PI: Jenny J. Yang
Direct costs: $20,000

3. Title: Molecular Basis of Diseases
Awarder: Mr. Hsau-wei Lee (Pre-doctoral Fellowship)
Period: 3/1/04-2/30/07
Stipend: $66,000

4. Title: Brains and Behavior
Awarder: Ms. April Ellis (Pre-doctoral Fellowship)
Period: 3/1/05-2/30/07
Stipend: $30,000

PROPOSALS PENDING

1. Title: Design of Protein-Based MRI Contrast Agents for Molecular Imaging of Cancers
Source: National Institutes of Health/NCI
Period: 12/01/05 - 11/30/07
PI: Dr. Jenny J. Yang
Co-PI: Dr. Zhi-ren Liu
Collaborators: Drs. Xiaoping Hu, Eirik Krogstad and Delon Barfuss
Direct costs: $436,125

2. Title: Rational Design and Analysis of Calcium Binding Proteins
Source: National Institute of Health/GM
PI: Dr. Jenny J. Yang
Co-PI: Edward Brown (Harvard Medical School)
Period: 07/01/2006 – 06/30/2011
Direct costs: $1,250,000

PROPOSALS FUNDED SINCE 2001

EXTERNAL

1. Title: Key Determinants of Calcium-Binding Affinity of EF-hand Proteins
Source: National Science Foundation MCB0092486
PI: Dr. Jenny J. Yang
Period: 04/01/01 - 03/31/05
Award: $300,000

2. Title: Molecular Recognition of the TNF Receptor Encoded by Variola Virus
<table>
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<tr>
<th>Source</th>
<th>The Southeastern Center for Emerging Biological Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period:</td>
<td>9/1/03– 8/31/05</td>
</tr>
<tr>
<td>PI:</td>
<td>Dr. Jenny J. Yang</td>
</tr>
<tr>
<td>Direct costs:</td>
<td>$50,000</td>
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</table>

**3. Title: Supplemental Award for Undergraduate Research**

<table>
<thead>
<tr>
<th>Source</th>
<th>National Science Foundation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI:</td>
<td>Dr. Jenny J. Yang</td>
</tr>
<tr>
<td>Period:</td>
<td>04/01/01 - 05/31/05</td>
</tr>
<tr>
<td>Total costs:</td>
<td>$7,500</td>
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**4. Title: Conformational Change of EF-hand Proteins by Grafting**

<table>
<thead>
<tr>
<th>Source</th>
<th>NSF for Minority Graduate Student</th>
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</thead>
<tbody>
<tr>
<td>PI:</td>
<td>Dr. Jenny J. Yang</td>
</tr>
<tr>
<td>Period:</td>
<td>10/01/02 - 3/30/05</td>
</tr>
<tr>
<td>Direct costs:</td>
<td>$33,000</td>
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**5. Title: Supplemental Award for Minority Graduate Student Research**

<table>
<thead>
<tr>
<th>Source</th>
<th>National Institute of Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI:</td>
<td>Dr. Jenny J. Yang</td>
</tr>
<tr>
<td>Period:</td>
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</tr>
<tr>
<td>Total costs:</td>
<td>$37,500</td>
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</table>

**6. Title: NIH Pre-doctoral Fellowship for Graduate Research (Sponsor)**

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<tr>
<th>Source</th>
<th>National Institute of Health</th>
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</thead>
<tbody>
<tr>
<td>PI:</td>
<td>Ms. Anna Wilkins</td>
</tr>
<tr>
<td>Period:</td>
<td>01/01/03-09/30/05</td>
</tr>
<tr>
<td>Direct costs:</td>
<td>$72,000</td>
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**7. Title: AHA Pre-doctoral Fellowship for Graduate Research (Sponsor)**

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<thead>
<tr>
<th>Source</th>
<th>American Heart Association</th>
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</thead>
<tbody>
<tr>
<td>PI:</td>
<td>Ms. April Ellis</td>
</tr>
<tr>
<td>Period:</td>
<td>07/01/03-06/30/05</td>
</tr>
<tr>
<td>Direct costs:</td>
<td>$36,000</td>
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**8. Title: Mass Spectrometry Instruments at Atlanta**

<table>
<thead>
<tr>
<th>Source</th>
<th>National Institutes of Health</th>
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</thead>
<tbody>
<tr>
<td>PI:</td>
<td>James Power (The Georgia Institute of Technology)</td>
</tr>
<tr>
<td>Direct costs:</td>
<td>$400,000</td>
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</table>

**9. Title: Southeast Collaboratory for High-Field Biomolecular NMR (900 MHz)**

<table>
<thead>
<tr>
<th>Source</th>
<th>National Institutes of Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI:</td>
<td>James Prestegard (The University of Georgia)</td>
</tr>
<tr>
<td>Direct costs:</td>
<td>$5,045,000</td>
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</table>

**10. Title: NSF-Atlanta Undergraduate Research Alliance (Sponsor)**

<table>
<thead>
<tr>
<th>Source</th>
<th>AURA</th>
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<tbody>
<tr>
<td>Period:</td>
<td>09/01/04-06/30/05</td>
</tr>
<tr>
<td>PI:</td>
<td>Alice Luo (Georgia Institute of Technology)</td>
</tr>
</tbody>
</table>
Direct costs: $2500

VIII. PROFESSIONAL AND HONOR ORGANIZATION ACTIVITIES
Adjunct Professor at the Center for Metalloenzyme Studies, University of Georgia, Athens, GA
Guest Researcher at Centers for Disease Control and Prevention, Atlanta, GA
Associate Editor of Journal of Calcium Binding Protein
Editorial Board Member of Journal of Protein & Peptide Letters (PPL)
Biomolecular Computing Resources (BIMCORE). Emory University, Atlanta, GA
Center for Drug Design and Advanced Biotechnology, Georgia State University, Atlanta, GA
European Calcium Society
The Royal Society of Chemistry
The American Chemical Society
The American Peptide Society
The Biophysical Society
The Chinese Americans in Academia Society
The Atlanta Calcium Club (Organizer)
GSU Brains and Behavior Neuron Science
GSU Molecular Basis of Diseases

IX. HONORS, AWARDS AND RECOGNITION
2004-2005 Medical research award from NIH, Southeast Research Center for Emerging Diseases and Biodefense (SERCEB)
2003 Outstanding Faculty Achievement Award, Georgia State University
2003 Featuring Recognition for Outstanding Contribution to McNair Minority Undergraduate Research Program
2001 Outstanding Junior Faculty Award, Georgia State University, Arts and Sciences
1996 Donahue Foundation Research Award
1995 –1996 Hartford Research Award
1993 –1995 Oxford Center for Molecular Sciences Fellowship
1992 Distinguished Graduate Student at Florida State University
1992 Best Presentation at the Florida American Chemistry Society meeting
1992 Sigma Xi
1986 Outstanding Instruction Award, Xiangtan University
1985 Outstanding Graduate Student Award, Xiangtan University
1982 Outstanding Undergraduate Student Award, Xiangtan University
The Chemistry Faculty were involved in all steps of the self-study process. The first step was election of a Self Study Committee composed of members with a broad set of backgrounds (Dixon, Franklin, German, Patonay, Wang, Wilson) with Wilson as the committee chair. The election was in a called faculty meeting with all faculty eligible to vote. As the Committee organized, requests were sent to the faculty for suggestions and data in a variety of areas. The requests were made for information both in a faculty meeting and by general faculty email requests. Information requested included items such as major accomplishments, student success, Departmental problems, and related matters. Faculty members were also requested by the same mechanism to provide suggestions for focus areas and development areas of the Department in the next five year period. General and specific comments and suggestions were received from a number of faculty members in response to these requests. In summary, as the self study report and appendices were being prepared, the Chemistry faculty were given several specific opportunities to contribute to the process.

As soon as a reasonable draft of the report was completed, it was given in hard and electronic copy to all faculty members. They were given from November, 11 until November 21, 2005 to reply and again, comments, corrections and any additional information for the report were requested. The final document was presented to the faculty for review on November, 21 and it was unanimously approved on November 28.
## Appendix G-1

**Student / Faculty Ratios**  
**FY 2003- FY 2005**  
**Chemistry Department**  
**Self Study 2005**

<table>
<thead>
<tr>
<th></th>
<th>FY 2003</th>
<th>FY 2004</th>
<th>FY 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td># TT Faculty</td>
<td>17*</td>
<td>18*</td>
<td>19*</td>
</tr>
<tr>
<td># Undergraduate Majors</td>
<td>189</td>
<td>217</td>
<td>261</td>
</tr>
<tr>
<td># Graduate Majors (All)</td>
<td>84</td>
<td>88</td>
<td>98</td>
</tr>
<tr>
<td>UG/TT Ratio</td>
<td>11.8</td>
<td>12.8</td>
<td>14.5</td>
</tr>
<tr>
<td>Grad/TT Ratio</td>
<td>5.3</td>
<td>5.2</td>
<td>5.4</td>
</tr>
<tr>
<td># Graduate Faculty</td>
<td>17*</td>
<td>18*</td>
<td>19*</td>
</tr>
<tr>
<td># Ph.D. Students</td>
<td>49</td>
<td>51</td>
<td>59</td>
</tr>
<tr>
<td>Ph.D./Grad Faculty Ratio</td>
<td>3.1</td>
<td>3.0</td>
<td>3.3</td>
</tr>
</tbody>
</table>

These numbers include Dr. Irene Weber, who is jointed with Biology. Her primary appointment is in Biology and we have not used her in the UG/TT Ratio, Grad/TT Ratio or Ph.D./Grad Faculty Ratio calculations.
Appendix G-2
University Library Report
Chemistry Department Review Library Resources
Self Study 2005

Summary: Strengths and Weaknesses of the University Library Collection and Services

Currently, the University Library’s Chemistry holdings adequately support the research areas of the faculty as well as Masters of Science (M.S.) and Doctor of Philosophy (Ph.D.) degree candidates in that discipline. Strengths in the Chemistry monographs include Organic Chemistry (i.e., synthetic methods and laboratory techniques, heterocyclic systems, natural products), Analytical Chemistry (i.e., concepts as applied to biologically-oriented problems, chromatographic methods, spectroscopic techniques), Physical and Theoretical Chemistry (i.e., molecular structure, kinetics, quantum mechanics, molecular spectra, phase equilibrium, electrochemistry), and instrumental analysis (i.e., NMR, infra-red and Ramen, chromatography, X-ray crystallography). The collection’s strengths complement the areas of concentration in the M.S. and Ph.D. programs, which fall within major four areas-Biochemistry, Organic Chemistry, Biophysical Chemistry and Analytical Chemistry. The library holdings for the academic needs of undergraduate Chemistry majors focus also on General Chemistry, Organic Chemistry, and Physical & Theoretical Chemistry. Overlap between the Departments of Chemistry and Biology offers strengths in biochemistry (i.e., proteins, enzymes, vitamins, carbohydrates, lipids, nucleic acids, DNA, RNA, and metabolism).

Faculty book requests and firm order purchases by the Chemistry Liaison Librarian address faculty research needs. The University Library maintains a well-rounded collection of journals in Chemistry, which include online access to articles from the American Chemical Society journals from 1996 to present\(^1\) and Royal Society of Chemistry journals from 1997 to present\(^2\). It would, however, be of further research and
educational benefit to have full access to all back issues from ACS and RSC.

1. The entire RSC collection is searchable, and GSU patrons can retrieve abstracts from most articles from the mid-1990's to present, as well as many articles published before 2000. Access to recent articles is limited to certain titles from 1997 to present.

2. The entire ACS Journal collection is searchable, and GSU patrons can retrieve abstracts from any article from 1879 to present. Access to articles is limited to certain titles from 1996 to present.

The library subscribes to two major chemistry databases, SciFinder Scholar (3 seats) and MDL Crossfire (unlimited seats), which offer current and archival coverage of chemistry research. The MDL Crossfire database, Beilstein (i.e., Organic Chemistry) subscription reflects the research needs in the Chemistry Department, while the Gmelin (i.e., Inorganic Chemistry) database is not subscribed. In addition, multidisciplinary databases such as ISI Web of Science (Journal Citation Reports is not subscribed), and Current Contents are also used by the department’s faculty and students. With certain Consortial arrangement databases such as Science Direct (i.e., provides access to many electronic journals published under the Elsevier Science imprint), it is recommended that the University may need to maintain its own access in order to manage costs in the face of changing budget realities and manage content to meet the teaching and research needs of faculty.

Although there are budget limitations, it is recommended that the library acquire the following in the future to further help, improve, and develop the education needs of faculty and students with research and teaching:

1. Full access to all electronic back file archives of the ACS and RSC journals.
2. Subscription to ISI, Journal Citation Reports (i.e., includes impact factors), and Essential Science Indicators (i.e., provides citation analyses and commentary for selected scientific research areas).
3. Increase in number of database access to online handbooks and synthetic tools (e.g., CRC Handbook of Chemistry & Physics, Merck Index Online,

4. Increase in number of new journals online that are related to Chemistry Department’s research (e.g., Nature Chemical Biology).

5. Site License subscription to a Spectroscopy software/database (e.g., ACD/I-labs NMR prediction for almost any organic molecule).

Funding collaborations between the Library and Department could provide a faster avenue to attaining the above resources. It is also recommended that the Department continue to take advantage of the Library’s current print and electronic resources with the help of the Chemistry Librarian via class-instruction and one-to-one consultations.

**Relevant Library Statistics**

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>STATISTICS</th>
<th>COMMENTS/NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of journal titles supporting program</td>
<td>208</td>
<td>Library-funded subscriptions.</td>
</tr>
<tr>
<td>Number of related journal titles added in last three fiscal years</td>
<td>9</td>
<td>Library-funded subscriptions.</td>
</tr>
<tr>
<td>Number of related journal titles cancelled in last three fiscal years</td>
<td>33</td>
<td>Canceled in the serials review process 2002.</td>
</tr>
<tr>
<td>Number of related databases added in last three years</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Number of related databases cancelled in last three years</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
| Number or monograph titles supporting program          | 6,608      | QD1-65 General Chemistry (including textbooks) [789 titles]  
QD71-142 Analytical Chemistry [997 titles]  
QD146-197 Inorganic Chemistry [384 titles]  
QD241-441 Organic Chemistry [1,883 titles]  
QD450-801 Physical & Theoretical |
Chemistry [2,143 titles]
QD901-999 Crystallography [412 titles]

| Number of monograph titles in key call number ranges added in last two years (01/2002-01/2004) | 323 | Titles from QD call number ranges. |
| Percentage of available universe of related monograph titles purchased through approval plan during previous fiscal year. | 85% | Titles were added in the QD call number ranges QD 1-65; QD 71-142; QD 146-197; QD 241-441; QD 450-801. |

**Services**

| Number of library instruction courses taught for department during previous fiscal year. | 5 |
| Number of library consultations held with students from department during previous fiscal year. | 9 |

**Electronic Resources**

Students and faculty in the Department of Chemistry rely heavily on journals, major reference works and databases to conduct research and complete assignments. The following section provides an overview of some of the major electronic resources available for Chemistry research.

**GSU Library Subscription Databases**

<table>
<thead>
<tr>
<th>Database</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SciFinder Scholar (Chem Abstracts)</strong></td>
<td>Provides access to Chemical Abstracts references (1907-present), including searches by CAS Registry No., author, topic, molecular formula, and structure. Also includes CASReact reaction database and Registry File compound information. Links to full-text of many articles and patents is also available.</td>
</tr>
<tr>
<td><strong>MDL CrossFire (Beilstein)</strong></td>
<td>Provides access to Beilstein Handbook of Organic Chemistry compound data and reactions. Especially good for coverage prior to 1967. Information on organic compounds: structures, reactions, spectroscopy and physical properties.</td>
</tr>
<tr>
<td>Database</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Web of Science</td>
<td>Bibliographic data, searchable author abstracts, and cited references to journals in the sciences. Provides access to the ISI citation databases, including Science Citation Index Expanded. Coverage is from 1945 to current.  Links to full-text of journals is also available. Documentation for citation searching in this database is available.</td>
</tr>
<tr>
<td>Current Contents Connect</td>
<td>Citations and abstracts in numerous disciplines, including the medical and natural sciences. Lists tables of contents for over 6500 journals. Includes bibliographic data for each article, and abstracts for about 85% of the articles.</td>
</tr>
<tr>
<td>Biological Abstracts</td>
<td>Journal articles in all areas of the life sciences, including biology, biochemistry, biotechnology, preclinical and experimental medicine, agriculture, medicine.</td>
</tr>
<tr>
<td>Science Direct</td>
<td>Web database for scientific research that contains full text Science journals in the physical, life, medical, technical sciences.</td>
</tr>
<tr>
<td>Wiley InterScience</td>
<td>Scientific, technical, medical, and professional journals.</td>
</tr>
<tr>
<td><strong>GALILEO Databases</strong></td>
<td></td>
</tr>
<tr>
<td>Database</td>
<td>Description</td>
</tr>
<tr>
<td>MEDLINE (at EBSCOhost)</td>
<td>Journals related to medicine, as well as preclinical sciences from The National Library of Medicine's bibliographic database.</td>
</tr>
<tr>
<td>Environmental Sciences and Pollution Management Set</td>
<td>Provides unparalleled and comprehensive coverage of the environmental sciences (Coverage from 1967-). Abstracts and citations are drawn from over 6000 serials including scientific journals, conference proceedings, reports, monographs, books and government publications. Major areas of coverage include Environmental biotechnology and engineering, Environmental impact statements (U.S.), Hazardous waste, Industrial hygiene, pollution and water resource issues.</td>
</tr>
</tbody>
</table>
Appendix G-3
Multi-User Major Research Instrumentation
Chemistry Department
Self Study 2005

NMR Instruments: GSU has two high resolution Bruker NMR Spectrometers, Avance 500 MHz and Avance 600 MHz instruments that are under the direction of Dr. Germann and are used for projects on biological samples only. The instruments are equipped for variable temperature work. The 500MHz instrument (4 channels) is equipped with a TXI (1H, 15N, 13C) cryo probe (4100:1 SN). In addition to the cryo probe an additional TBI probehead is available (1H, 15N, X), X ranges from Ag to 31P. Both probes can be used for gradient spectroscopy. The 600MHz instrument (3 channels) is equipped with an 8mm QXI (1H, 13C, 15N, 31P), 5mm, QXI (1H, 13C, 15N, 31P) and an IDT probe head. All of these are capable of gradient experiments. In addition, there are several legacy probe heads as well: BBI, 19F1H dual and a TXI probehead. The 600 MHz instrument is also equipped with a micro imaging accessory (3x40A GREAT gradient amplifiers) and a micro imaging probe head with variable inserts. The 500MHz instrument is primarily used for heteronuclear multidimensional experiments and proton work for very dilute samples and metabolic profiling. In that capacity, it serves primarily the Departments of Chemistry and Biology. The 600 MHz instrument is used for 1H multidimensional NMR work used for nucleic acids and protein structural work. In addition, the 600MHz instrument is dedicated to 1 week of micro imaging per month.

The NMR facilities in the Chemistry Department at Georgia State University house four additional high-resolution FT-NMR spectrometers, a Varian Unity plus 300 MHz, Bruker Avance 400 MHz, Varian Unity Inova 500 MHz and Unity Inova 600 NMR MHz spectrometers. The 300 MHz and 400 MHz NMR spectrometers are primarily used by synthetic chemists in the drug design and preparation area for obtaining routine proton and carbon NMR spectra on small molecules. The capabilities of the two spectrometers allow obtaining data on any nucleus in the frequency range N15 to P31. Both the 300 and 400 NMR spectrometers are equipped with sample changers which permit obtaining data on many samples at one setting and the ease of providing data to the synthetic laboratories is a significant benefit. The 500 and 600 NMR spectrometers are used by the biomolecular structure groups. Biology department personnel are also using the spectrometers to obtain data on biological metabolites. The spectrometers have three RF channels, gradients, and pulse-shaping capabilities which have greatly helped to determine the structure and conformation of biomolecules and to study the interaction of synthetic potential drugs and model compounds with biomolecules. The 500 MHz Varian spectrometer has a broadband probe which is used by synthetic chemists to obtain carbon and phosphorus NMR data on samples of low concentration.

Mass Spectroscopy Facility: This is a core facility with a primary mission to provide modern instrumentation and expertise for mass spectrometric analysis. The Facility operates five instruments including a Waters Micromass LC-Q-TOF micro (ESI), an ABI Voyager-DE™ Pro Workstation (MALDI), a Shimadzu QP5050A GC-MS (EI, NCI and PCI), an Agilent 1100 series II LC-MSD (ESI) and an Agilent 1100 series II LC-CE-
MSD. The Facility can usually perform routine low-resolution analysis by EI, PCI, NCI, ESI, APCI and MALDI of small organic molecules and large biological molecules such as peptides, proteins, nucleic acids, polymers etc. The Facility also routinely conducts exact mass and elemental composition determination, tandem (MS/MS) experiments and HPLC separations with MS detection as requested by researchers.

The Micromass Q-Tof micro mass spectrometer coupled with Waters 2695 HPLC can provide both structural elucidation of small molecules and large biomolecules and exact mass measurement with both Electrospray Ionization (ESI) and Atmospheric Pressure Chemical Ionization (APCI) techniques. With the lockspray technique, the instrument is calibrated constantly during the analysis, which is used for exact mass measurement with better than 5ppm accuracy. The instrument also features a quadrupole mass filter and collision cell for MS/MS analyses. The instrument is equipped with a ProteinLynx Glober Server which provides tools for protein identification and characterization.

The Voyager-DE™ PRO Workstation is a compact benchtop MALDI-TOF mass spectrometer that includes a linear and reflector analyzer. It is routinely used for identification of a wide range of biomolecules as well as small organic molecules. With post-source decay experiments, it provides for peptide sequencing. This instrument also has the Proteomics Solution 1 (PS1) Data Station for automated database search.

Shimadzu's GCMS-QP5050A is a benchtop quadrupole mass spectrometer paired with GC-17A gas chromatograph. This instrument ionizes the molecules by electron ionization (EI) and chemical ionization (positive CI and negative CI) techniques with high sensitivity. It is mainly used for analyzing molecules with mass range less than 900 daltons, especially for the compounds which don’t have the functional groups to form positive or negative charges. The inclusion of DI-50 direct insertion probe in all ionization modes helps to analyze the molecules with limited vaporization.

Agilent's 1100 series II LC-MSD (ESI) is equipped with a single quadrupole analyzer and ESI source and coupled with 1100 series II HPLC with UV detector. It is used for routine analysis of organic and biological molecules. Agilent 1100 series II LC-CE-MSD is equipped with interchangeable electrospray ionization (ESI) and atmospheric pressure chemical ionization (APCI) source with a mass range of 50-1500 Da. The SIM sensitivity is 10 pg reserpine at 50:1 RMS. The LC-MS mode is well suited for simple and rapid analysis of combinatorial libraries of small drug molecules, pesticides, herbicides and other samples with a linear response over 3 orders of magnitude. The CE-MS mode, which is also equipped with a syringe pump, a sprayer needle and a specifically designed CE cartridge for simultaneous UV and MS detection, is more useful for analysis of chiral drugs and metabolites as well as other biological compounds.

**Combinatorial Chemistry Center:** The Combinatorial Chemistry Center is equipped with two 2 Quest 210 organic synthesizers, an Advanced ChemTech 396 HTS and a 496 MOS synthesizers for parallel organic synthesis/combinatorial chemistry work. For preparatory work following synthesis the Center has a COPAS™ bead sorter by Union.
Biometrica, a fluorescence microscope, a total reflection IR, several HPLCs, SpeedVacs, an LC-MS, and a GC-MS.

**Circular Dichroism Spectroscopy:** JASCO J-810 circular dichroism spectrometer with a dedicated temperature control unit for cell temperature control, computer and JASCO software for data collection, processing and display.

**Fluorescence Spectroscopy:** Photon Technologies Inc. QMI spectrofluorometer with PTI software for data collection and processing. The instrument has a dedicated temperature control unit for cell temperature control. The instrument is also equipped with the PTI Quantum Master fluorescence lifetime accessory. An Olis spectrofluorometer with rapid scanning and global fitting capability is also available.

**Absorption Spectroscopy:** A number of Cary-Varian UV-visible spectrophotometers with six-position thermostatted cell holders with excellent temperature stability over time and minimal cell to cell variation (Peltier heat exchangers with built-in water reservoirs for efficient heat transfer) are available. The experimental temperature inside of the cuvettes is monitored with a computer controlled temperature probe accessory. The thermostatted cell holder is equipped with an automated cell changer for multiple simultaneous kinetics and biopolymer unfolding experiments. The instruments operate with Cary software for data collection, processing and display.

**Biological Microcalorimetry:** MicroCal VP-ITC (isothermal titration calorimeter) and VP-DSC (differential scanning calorimeter) microcalorimeters are interfaced to computers with ORIGIN software for instrument operation, data collection, processing and display. These are very sensitive instruments: the ITC can determine both interaction heats and equilibrium constants for many biological reactions and the DSC can determine the heat and equilibrium constant for protein, nucleic acid and other biopolymer folding/denaturation processes.

**BIACore 2000 and BIACore 3000 Surface Plasmon Resonance Instruments:** The BIACore 2000 and 3000 are high throughput, fully automated four channel instruments for measurement of molecular interaction energetics, kinetics, stoichiometry and cooperativity without the requirement of any sample labeling. The instrument uses user-defined, replaceable biosensor chips to which one component of the reaction is attached. The other components(s) are passed over the biosensor surface in appropriate buffer solutions for analysis of binding at user selected temperatures. Detection of the interaction is by surface plasmon resonance. All measurements are automated under computer control and generally require only a few microliters of dilute sample.

**Computational Capability:** The Department has several small SGI (Unix) and Linux Clusters with 2 to 8 processors available for relatively small computational projects as well as for visualization of structures and calculation results. These are particularly useful for calculations such as 2D and 3D QSAR calculations that are not processor intensive. Through the Molecular Basis of Disease initiative the Department has access
to an 80 processor Linux system that is used for major computational projects such as
those involving molecular dynamics calculations on biopolymer systems and quantum
mechanics calculations.

**Elemental Analysis:** The Chemistry Department has two Perkin-Elmer's 2400 Series II
CHN analyzers which can be used for the determination of carbon, hydrogen, nitrogen,
sulfur and oxygen content in organic and other types of materials. This instrument is
equipped with 60 position autosampler and AD-6 Ultra Microbalance.

**Biochemical Core Facilities:** The Department has access to core facilities that house
standard centrifuges, protein and DNA synthesizers, plate readers, AFM and TEM
microscopy equipment and other general types of standard equipment for research in
chemical biology.