Department of Medicinal Chemistry- Highlights

We are the only Department of Medicinal Chemistry in the only School of Pharmacy in the State of Kansas. Our successful faculty serve undergraduate pharmacy students, professional pharmacy practitioners, graduate and postdoctoral students, the scientific community, industry and the federal government, international programs, and the University and the State of Kansas. Our internationally renowned faculty is dedicated to the exploration, discovery and development of new drugs from natural and synthetic sources, by explaining how they act through structural studies and by improving them through molecular design. We are a group of 12 men and women with a long history of collegiality who share a common passion for research and teaching with the ultimate goal to discover new medicines for the improvement of human health.
EVALUATION OF THE DEPARTMENT OF MEDICINAL CHEMISTRY

A. Self Study Process

Self study of the academic graduate program in the Department of Medicinal Chemistry is an ongoing, systematic process involving input primarily from five sources:

1. The Department’s Administrative Associate, Program Administrator and Accountant who regularly provide updated data on course offerings, enrollment data, budgetary resources, and other relevant information pertinent to self-study
2. Monthly assessment information from the Director of Graduate Studies
3. Overall program data from the Office of Institutional Research and Planning (AIMS/DEMIS) and the Department
4. Annual faculty reports required for merit and post-tenure review
5. The Department Chair who collected the data and prepared this evaluation

In addition, the contribution of the Department to the professional (undergraduate) teaching mission is periodically reviewed at the School level and made part of the strategic plan for the School and for the Department. The strategic plan is reviewed in depth on a three year basis but is done periodically throughout each year as new issues arise and require action. The last strategic plan was approved in August 2009. The department engages in both internal and external assessment of its graduate program every two years. External assessments include 1) alumni letters evaluating faculty program (Fall 2008); 2) bi-annual meetings with School of Pharmacy External Advisory Council (Fall 2008); 3) assessment surveys to selected alumni (years 08-09, 09-10); contact with alumni via annual Newsletter; 4) keep record of success of majors with respect to awards, fellowships and job placement; 5) administered course evaluation surveys in all courses; 6) exit interviews with graduating students; 7) monitoring of faculty exams, syllabi; 8) annual faculty reviews.

B. Centrality to Mission

The formal mission statement of our Department (last amended in 2009) is given below:

The mission of the Department of Medicinal Chemistry is to serve seven client groups: undergraduate pharmacy students, professional pharmacy practitioners, graduate and postdoctoral students, the scientific community, industry and the federal government, international programs, and the University and the State of Kansas. The Department serves the undergraduate student by providing excellent up to date teaching of basic science courses in the pharmacy curriculum and providing laboratory research opportunities to pharmacy students. The faculty members are available to participate in continuing education programs for pharmacy practitioners. The Department maintains a vigorous and internationally recognized program of research and considers its primary mission to be the education of highly qualified students in medicinal chemistry with emphasis in the areas of design, synthesis, isolation, chemical and biological characterization and analysis of lead substances and their rational elaboration into novel candidate drugs. The education of these M.S., doctoral and postdoctoral students is done by outstanding faculty who are national and international leaders in research, teaching and service in the discipline of medicinal chemistry. All graduate students in the program receive broad-based didactic training in the basic chemical sciences (physical, biophysical, organic, bioorganic, physical organic and analytical) and in the areas of medicinal chemistry emphasized in the Department (natural products chemistry, synthetic chemistry, combinatorial chemistry, neurochemistry, biochemistry and enzymology, molecular biology, metabolism, molecular recognition, molecular graphics, spectroscopy and drug analysis). The areas chosen by the graduate students or postdoctoral students for research topics receive special emphasis during their training and students are expected to demonstrate proficiency, knowledge, originality, and research capabilities in their chosen area of specialization. Upon completion of this program, many graduates
will assume responsible positions in pharmaceutical and biotechnology companies and contribute their scientific expertise to the development of drugs for human and animal use. Some of the graduates of this program will assume academic positions and become future thought-leaders in pharmacy and related academic areas. Faculty members of the Department are active in national and international societies and government agencies and also provide consulting to private industry.

General Contributions

We are the only Department of Medicinal Chemistry in the only School of Pharmacy in the State of Kansas. The Department does not offer an undergraduate degree in medicinal chemistry, but contributes directly to the Doctor of Pharmacy education program of the School of Pharmacy. The Department offers M.S. and Ph.D. degrees in Medicinal Chemistry. The faculty of the Department are a distinguished group (e.g., five Fellows of the American Association for the Advancement of Science, two University Distinguished Professors, one Distinguished Regents Professor, one in American Chemical Society Hall of Fame, two KU Center for teaching Excellence Awards). Four of our faculty are instrumental in bringing to Kansas more than $60 Million to establish the first two NIH Centers for Biomedical Research Excellence (COBRE), the NIH Center of Excellence in Chemical Methodologies and Library Development (CMLD), the NIH Molecular Libraries Probe Production Center Network (MLPCN) and an NIH contract for vaccinogenesis. Most of our M.S. and Ph.D. graduates have a choice of several job offers and all are placed (either upon graduation or following their postdoctoral appointment at another university). Many of our graduates are prominent in our discipline both nationally and internationally.

Integration with other units

In terms of interdisciplinary relationships and service to other programs, our faculty have been prominently involved in joint interdisciplinary teaching and interdisciplinary relationships with faculty and students of other programs at KU. Students are encouraged to foster interdisciplinary interests as well, and take coursework in other programs (e.g., chemistry, molecular biology, etc.) as supportive of their areas of specialization.

C. Faculty Strengths, Productivity and Qualifications

Faculty composition

Since the 2002 Academic Program Review the faculty has grown in size from nine faculty to 12 tenured FTE positions. New additions have either added strength to existing sub-disciplines or added new ones. Three current faculty are women, one of them is Chair of the Department and University Distinguished Professor. There are no minority faculty in our department. At the end of 2009, the mean age of the faculty was 53.5 years. It is anticipated that the expertise and seniority of the faculty will change over the next five years as a result of several upcoming retirements of senior faculty. One faculty member is in its final year of phased retirement and we envision the start of the hiring process for a junior faculty in the fall of 2010. Two members of the Department have courtesy appointments in the Department of Chemistry and one in Molecular Biosciences. We also have seven adjunct faculty and four courtesy professors who are Directors of various service laboratories on campus.

Faculty credentials and experience

All courses in the Department at both undergraduate (professional) and graduate levels are taught by faculty with a Ph.D. degree. The average years of teaching service of our current faculty is 15.8 years. The instructional average for the tenured faculty for AY 2002-2009 was 2,338 hours of which only 121 hours correspond to those taught by guest lecturers during faculty absences due to personal or sabbatical leave. The average tenure/tenure track faculty SCH/FTE ratio for AY2002-2009 was 206.26. The average teaching load per faculty member is approximately 45-55 lectures per year (includes both undergraduate/professional and graduate courses). All tenured and tenure-track faculty teach in the graduate program. No graduate assistants, part-time lecturers, or other personnel teach medicinal chemistry graduate credit courses. Three senior graduate teaching assistants (1.5 FTE) teach in a laboratory course for the professional pharmacy program.
Advising/mentoring system for students

All members of the faculty participate in comprehensive oral and dissertation committees, serving as both members and chairs. They also serve on a regular basis on dissertation committees in Chemistry, Pharmaceutical Chemistry, and Molecular Biosciences. Several members also serve on graduate student committees at the KU Medical Center. All members participate in mentoring and advising graduate students. The progress of graduate students is addressed on an ongoing basis by the Director of Graduate Studies, as well as by a bi-annual graduate faculty review of the progress of the first year graduate students. In addition, all faculty advise their respective students. At the undergraduate professional (Pharm.D) level all faculty participate in one or more of these categories: formal student curriculum & career advising, laboratory research mentoring, or informal advising and mentoring of individual students.

Student assessment of quality of teaching

Although we do not have an undergraduate major in medicinal chemistry, our faculty do teach medicinal chemistry courses in the curriculum leading to the Doctor of Pharmacy degree in the School of Pharmacy. The Department has had a consistently strong record of outstanding teaching and the faculty are well-regarded as teachers. Using the question on our teaching survey that asks for a rating from 1.0 (disagree) to 5.0 (agree strongly) “Overall (s)he is an effective teacher”, the average score for the period 2002-2009 at the undergraduate (professional) teaching was 4.15 whereas at the graduate level the ranking was 4.46 for the same question.

Publications and presentations

The performance of the faculty in this area was very strong for 2002-2009 and continues to be so. Although there was faculty growth and turnover in the last three years the productivity continued to be very high in all areas of research. All junior faculty attained promotion to Associate Professor with tenure during the past three years and we have every expectation that they will continue publishing and presenting their findings in the next years. Collectively, the 12 faculty have produced 536 peer-reviewed publications in top-flight journals, and reviewed 1,286 manuscripts as members of 128 editorial boards. They have presented over 500 invited presentations at national and international professional meetings and numerous seminars at academic institutions or pharmaceutical companies.

Grants and contracts

The faculty members of the Department are expected to maintain a vigorous and well-funded research program. All do. The main source of external, federal, funding is the National Institutes of Health (NIH). In 2009, faculty were principal investigators (PIs) on a total of $6,627,043 in direct grant costs (not including overhead or indirect costs). For 2009, this represents an average of $702,000 per FTE (9.44 FTE in 2009). An additional $1,539,223 in direct costs was received on projects with faculty of the Department as Co-investigators on several projects. The State of Kansas budget allocated to the Department in the same year was $1,632,983 which represents 24.6% of our budget. This would be an even lower percentage (16.7%) if we had included the grants with Medicinal Chemistry faculty as Co-investigators and if indirect costs were included into the figures above. For a comparison that demonstrates how much this research productivity has increased from our faculty members, we note that in 1999 the Department’s faculty received a total of $1.35 million in direct costs. The funding obtained during the past 10 years represents an increase of 581% in funding. It should also be noted that the indirect costs generated by our department are more than twice the amount of State funds received. Our Department brings approximately 60% of the total NIH dollars and 98% of the Department of Defense dollars to the School of Pharmacy. Proposals for $18 Million (direct and indirect costs) are currently pending.

Impact of external resources

As noted above, our Department is barely assisted by the State. We probably should refer to our program as being state affiliated since more than 3/4 of our budget comes from external sources obtained
by our faculty. The percentage provided by the State of Kansas is actually even lower (16.7%) when funds received by our faculty as co-investigators on grants in other departments and indirect costs are included. Clearly, the success of our graduate research program is the result of the initiative of our faculty in obtaining external funding. The economic impact of this external funding on the city, the region and the State that this relatively small faculty produces is considerable and should not be overlooked.

If it were not for these external funds, the department could not operate. Only 2.7 of the 6 staff of the department are paid from State funds. The Other Operating Expenses state budget line has been cannibalized repeatedly in past budget rescissions and the permanent shrinkage in budget so that the amount remaining ($48,179 in FY09) pays only the telephone expenses of the department. Everything else is paid from external funds.

Honors and Awards

Many prestigious awards and honors have been bestowed on the faculty since the last academic program review. These include (but are not limited to) one 2007 Rho Chi Excellence in Teaching Award (David) and two 2003, 2005 KU Center for Teaching Excellence Awards (Blagg and Dutta); one is the recipient of the 2009 American Chemical Society David W. Robertson Award in Medicinal Chemistry (Blagg); one received the 2004-2009 Independent Scientist Award from the NIH (Aldrich); one was elected to the 2006 American Chemical Society’s Hall of Fame in the Division of Medicinal Chemistry and a Fellow of the American Association of Pharmaceutical Sciences (Grunewald); one received the 2007 Research Achievement Award of the American Society of Pharmacognosy and was inducted into the Medicinal Chemistry Division of the ACS Hall of Fame and in 2009 to the International Union of Pure and Applied Chemistry (Mitscher). An Associate Professor is the recipient of the 2008 Matt Suffness Young Investigator Award and the 2006 Jack Beal Award of the American Society of Pharmacognosy (Prisinzano). One faculty received the 2009 Kansas Bio BIG Award and the 2008 International Award for Innovation in Higher Education (Aubé); two faculty were invited to join honorary societies (Phi Beta Delta-Aubé and Phi Beta Kappa –Timmermann) and one was elected a Woman of Distinction at KU (Timmermann). The department has five faculty who hold the Higuchi Research Achievement Awards, five are elected Fellows of the American Association for the Advancement of Science-AAAS (Mitscher, Grunewald, Hanzlik, Aubé and Timmermann), two are University Distinguished Professors (Mitscher and Timmermann) and one is a Regents Distinguished Professor (Peterson).

Professional Service

Our faculty have been heavily involved in professional service and have been recognized for their contributions at national and international levels. Over the past three years, two faculty (Aubé and Prisinzano) were nationally elected to serve as Councilors of the Medicinal Chemistry Division of the ACS. Over the past 16 years the Chair of the Division was held by two faculty (Grunewald and Aldrich) and by three alumni of our department. Dr. Aldrich has served as President of the American Peptide Society and Dr. Scott is the Secretary/Treasurer of the Drug Metabolism Division of the American Association of Pharmacology and Experimental Therapeutics. Several faculty have served as elected officers other various organizations (i.e., American Society of Pharmacognosy). Six members of our faculty serve on one or more journal editorial boards as members, Editors or Associate Editors. All faculty of the department do regular manuscript review for more than 20 journals. All senior faculty have served as member or ad hoc reviewers on NIH or other major research granting agencies such as the American Cancer Society or the Army Breast Cancer program. Members of the faculty are active locally in a variety of service organizations, committees and issue-oriented groups. Several faculty of the Department regularly present short courses at a variety of off-campus sites, mostly in the drug industry and continue education for practicing pharmacists in the state of Kansas. Most faculty have served on external review panels for the NIH, NSF and a variety of other public/private national screening panels.

Departmental support for faculty

Allocation of faculty time and talent
The percentage of effort in the three categories (teaching, research and service) will vary depending on the seniority of the faculty member and their other responsibilities. These percentages are set by consultation with the Chair and are reviewed annually. The acceptable ranges are: Teaching, 20% to 60% (average is 40%); Research, 20% to 60% (average is 40%); Service, 10% to 40% (average is 20%). Circumstance may arise in which a faculty member’s efforts may be more productively channeled into one area or another and therefore the overall allocation may vary from the traditional proportion noted here. Such changes in allocated percent effort of an individual faculty member can only be made with the consultation and approval of both the faculty member and the chair. During this evaluation period, all but one taught in the undergraduate professional program and two faculty were not in the normal 0.4 FTE teaching, 0.4 FTE research and 0.2 FTE service due to either an increased administrative responsibility with a center, research career development award or sabbatical leave.

Funding for faculty development

A major cost in faculty development is the faculty startup package. To recruit a faculty member in our field today requires a faculty startup of at least $600,000 and most of our peer institutions offer considerably more than that. KUCR has been very helpful in providing support in the range of $300K to $600K for our most recent hires whereas the KU Cancer Center provided start-up funds of nearly $2.5 Million for the recruitment of our Regents Distinguished Professor. These funds are necessary for laboratory startup and to ensure that a productive research career can begin or continue quickly. Each junior faculty member is assigned a faculty mentor to assist them as they progress, first to a third-year review, and later to a tenure and promotion decision. The two COBRE grants also offer substantial assistance in faculty development for new faculty whose research is in the focus area of the centers. Not only are starter grants made available but also these COBRE grants provide for core service laboratories needed to expand the research opportunities on the Lawrence and Medical Center campuses. Other support for faculty development includes KU resources such as the Center for Teaching Excellence. A major support for research in our equipment-intensive area is the existence of the various service laboratories, most of which are funded through KUCR. In particular, the labs that belong to the Molecular Structure Group are extremely important to our success. The value of equipment holdings in these labs is in excess of several million dollars includes 800 MHz NMR and protein crystallography equipment. Faculty of the Department participate in the activities of the Higuchi Biosciences Center as Directors of individual programs within centers or as individual investigators.

EVALUATION OF THE GRADUATE PROGRAM

The graduate program in Medicinal Chemistry at KU is unique within the state. There is no other Medicinal Chemistry degree program in Kansas. Our curriculum is one of the very few nationally in the discipline with a heavy emphasis on organic and medicinal chemistry. We consider this to be one of our strengths and one of the reasons that our graduates are so highly sought. They not only are competent synthetic chemists, but they also have a significant background in allied fields that the traditional organic chemistry graduate does not have. The Department has a Director of Graduate Studies.

Students in Profile

The graduate program in the Department of Medicinal Chemistry is almost totally oriented toward the doctorate program. A non-thesis M.S. degree is awarded to students after completion of the oral comprehensive examination. Since 2002, 7% of the students who entered the graduate program in the Department take a terminal thesis M.S. degree. Thus, the mission, objectives, and assessment of the M.S. program and the doctorate program are identical.

Our postdocs and visiting scientists work side-by-side with graduate students in the research laboratories and are thus a good source of information and training beyond that provided by the mentor. At any time, the department has 30-40 post-doctoral students who are part of the graduate program and who are supported by faculty’s federal grants. Moreover, the department is also involved in the professional development of undergraduate and graduate research assistants and graduate research
associates. While post-docs and other trainees do not generate credit hour production for the faculty, they do require faculty time for training and they are vital for the success of the Department’s research and graduate education.

Recruitment process

Until the advent of the Internet, graduate student recruiting was done with a very informative brochure to major undergraduate chemistry and biochemistry programs in the Midwest and selected programs nationally. Traditionally, the department primarily targets good four-year colleges and some universities with terminal M.A. programs for student recruitment. Today we rely on the Internet to make the program known to prospective students—but this is not the only way. The medicinal chemistry faculty are very active in attending and presenting papers at American Chemical Society national and regional meetings (Eastern, Central and Pacific) and many other national, international, and regional professional meetings. Prospective students are also recruited in these contexts. The department is also listed in the *American Chemical Society Directory of Graduate Research*. Graduate student applications are reviewed early in the calendar year and the most promising recruits are invited to campus for a visit in March. They interact with each faculty member and with the current graduate students. In the spring of 2005, for example, we invited 13 students for an interview on campus, made 22 total offers of which 12 accepted and became students in the fall. The eight year average (2002-2009) for the GPA and GRE scores for incoming enrolled students in the program continue to be consistent with the figures reported during 2000-2002. The averages for the current review period are 3.51(GPA), 509 (GRE-verbal) and 686 (GRE-quantitative). In the period 2002-2005, the average GRE analytical score was 589; however, since 2005 these scores were reported in percentiles (average 3.96).

The most outstanding graduate applicants are identified in time to nominate them for the Madison and Lila Self Graduate Fellowship Program. In the class of 2006 we admitted two Self Fellows. The Department offers GRA stipends and also pays graduate tuition and fees to all enrolled students. The GRA stipends are paid via grants obtained by the faculty. Consequently, it has been easy to compete for highly qualified students. The department employs three GTAs (1.5 FTE) with a School of Pharmacy specified budget line to assist one faculty member with the teaching of the professional pharmacy laboratory course MDCM 602. With the enrollment increase in the School of Pharmacy for Fall 2010, the department will have eight GTAs (4.0 FTE).

We strive to recruit at least one entering graduate student per faculty FTE however in the past two years we were unable to recruit at this level due to the type of grants received and also by phased retirement or faculty no longer accepting graduate students. Our goal is to keep the entering class at 8-12 students. Our major competitors offer full tuition fellowships or have university-wide policies that exempt graduate students from payment of tuition altogether.

The overall departmental applications for masters and doctoral programs have steadily increased since Summer/Fall 2004. Note that we do not admit students to the masters program. During 2002-2009 we received 560 applications of which 135 were admitted in the Ph.D. program. A total of 81 doctoral students enrolled during this period which included 44 domestic Caucasian (18 female, 26 male), 33 international (14 female and 19 male) and 4 other (2 Asian and 2 Hispanic). In terms of Total Student Credit Hours, 2,246 for FY 02-03; 2,535 for FY 06-07, and a record enrollment of 2,624 for FY 07-08 – and this was reflected in the graduate enrollment portion of the overall enrollment. Although applications continued to increase for FY 08-09 and 09-10, the number of acceptance to the program has slightly declined as in other programs in the country. It would be premature to project future enrollment based on a one or two year pattern however, we project the continuation of a graduate program with 35-40 graduate students in the next five years and to grow beyond that proportionate to the resources available to support them (both financial in terms of stipends and space to house them).

The total instructional SCH for tenured/tenure track faculty in medicinal chemistry for 2002-2003 was 1,870; for 2009-2010 it was 2,337 when the faculty for this extended period increased from 10 to 12. Over the next five years, we would project a stable, perhaps slightly higher enrollment for all five years due to new grants and students coming with Fellowships.
Demographics

Over the past several years, the department has admitted students from over 20 states in the U. S. and international students from approximately 10 countries. The Department continues to focus on increasing the diversity of our graduate students: during fall 2007 we had 50 graduate students at different levels which included 22 women, one Hispanic, 2 Asians and 29 international students. During 2008 and 2009, we recruited 13 new, degree-seeking students consisting of three domestic women and five men, four international including one woman and three men and one Hispanic student. Efforts to attract quality minority students have been conducted through direct visits by our faculty to meetings sponsored by minority organizations such as SACNAS, special sessions for minority recruitment at national meetings of the American Chemical Society or contacts with minority oriented colleges.

Program Productivity

Advising/mentoring models

At the graduate level each faculty member mentors their students in the M.S. and Ph.D. programs and also advises those postdoctoral research associates in their research group. The recruitment of graduate students and the monitoring of graduate records and policies within the department are coordinated by the Department’s Director of Graduate Studies. Each faculty member participates in the monthly cumulative exams that are given to graduate students in the Ph.D. program starting in the first semester of their second year. Students must attempt successive examination until they have passed the required number of 24 questions. A minimum of 8 questions must be passed by the end of the second year, and the remainder during the third year. Following this requirement the student takes an oral comprehensive examination and all faculty in the department participate in serving on these committees. The chair of the committee is the student’s advisor. After completion of this exam with a satisfactory or honors pass, the student must then prepare an original research proposal using NIH guidelines. This formal proposal is reviewed by a committee of two faculty members and is discussed at a faculty meeting called for that purpose by all of the members of the faculty who then assign a grade.

Time to degree

Medicinal Chemistry is an interdisciplinary and research-based degree. It generally takes our students longer to earn the degree than if they took a Ph.D. in organic chemistry, for example. In the period 2002-2009 the average time to degree was 5-6 years but some of our stellar students completed the degree in less than five years. We consider five years to be the optimum time for graduation and in the 2010 curricular review; we streamlined the coursework requirements without sacrificing needed training in order to achieve a more timely graduation. This average to completion time, though, is typical of our peer departments in the U. S.

Degrees awarded

For the period 2002-2009 the size of the medicinal chemistry graduate program (masters and doctoral) has ranged between 31 and 50 students. In this time period our program has graduated 20 Masters and 27 Doctorate degrees.

Student Research productivity

Our graduate and post-doctoral students have been very strong in their record of receiving external and internal fellowships and other awards, in publishing in refereed journals, presenting conference papers, etc.; and the Department’s Ph.D. graduates have been truly impressive in distinguishing themselves in the academic and pharmaceutical professions.

Our graduate students, over the past several years, have been recipients of numerous distinctions including Fulbright Fellowships; Madison and Lila Self Graduate Fellowships; American Colleges of Pharmacy Education Predoctoral Fellowship Awards; Marnie and Bill Argersinger Awards for best doctoral dissertations; Institute for Advancing Medical Innovation Fellowships; American Foundation for Pharmaceutical Education Predoctoral Fellowships and American Chemical Society Pre-doctoral Fellowships of the Medicinal Chemistry and Organic Chemistry Divisions. Many of our graduates have
been accepted for post-doctoral training at prestigious institutions like Scripps Research Institute, Harvard University and Princeton University. Many have distinguished themselves in academic (Washington State University, University of Minnesota) and non-academic sectors (Pfizer, Abbott, Eli Lilly, Amgen, Merck, Sharp and Dohme). The consensus of the KU faculty is that the KU Medicinal Chemistry graduate program is one of its strongest graduate programs.

Students and postdocs published several hundred peer-reviewed articles and abstracts as principal authors or co-authors with their advisors. They have given oral presentations and presented posters at national and international professional meetings.

**Program Quality Outcomes**

**Professional development of students**

Our entire Ph.D. curriculum is geared to helping the student develop professionally. A number of professional development opportunities are available to our students such as organization of the MIKI (Minnesota, Illinois, Kansas & Iowa) Meetings, hosting outside speakers, interacting one-on-one with visiting scholars and lecturers. Students are encouraged to present their research findings at regional and national meetings and every effort is made to assist them in paying for this activity. Our students have the opportunity to conduct research abroad (e.g., Laura Peterson studied at the Institute for Cancer Research in London, Erin Hirt participated as an exchange student at the University of Regensburg) and in academic and federal laboratories in the U.S. (e.g., Boston University, NIH-Bethesda, Abbott Laboratories). Informal weekly “problem sessions” and “journal clubs” exist coordinated by faculty of Medicinal Chemistry and Chemistry with students from both departments. These informal sessions help students gain confidence in presenting their own solutions to problems in a group setting as well as helping them to learn how to apply the classroom material to examples in the literature.

**Satisfaction surveys**

Each year we interview our first year graduate students individually and use these sessions to obtain information from them about their satisfaction with our curriculum while the courses they have taken are still fresh in their mind. Later, we ask students during their thesis defense to make similar comments (usually done informally after the oral exam has been completed satisfactorily so there is no hidden bias in generating a particularly favorable response from the candidate). In addition, we meet informally with alumni of the department at national meetings and solicit similar information about the value of their curriculum to their careers, and the need for changes to better meet the needs of today’s graduates. The overall satisfaction is extremely high. Dan Flynn, President and CEO of Deciphera Pharmaceuticals stated “To this day, I reflect back upon my training at the KU Medicinal Chemistry Department and how crucial it was for preparing me for a career in drug discovery”. Alumni also regularly return to our department to deliver seminars or to just “stop by” and we always ask them what they feel about their training and what suggestions they might have for changes. The unanimous response is that we are doing an excellent job and that they feel proud to be graduates of our department and university. The KU Medicinal Chemistry degree has meaning and value to them. The Chair of the Department has an open door policy and is available to students’ concerns when needed.

In 2009, graduate students had the opportunity to participate in a survey for satisfaction in different areas. The 25 students who participated in this anonymous survey provided quite satisfactory responses giving the “overall program quality” and “quality of graduate teaching by faculty” the ratings of close to “very good”.

**Placement, employer assessments**

Medicinal chemistry, unlike other disciplines, orients itself to preparing students for a specific occupation or profession. Most of our M.S. and Ph.D. graduates have a choice of several good job offers and all are placed (either upon graduation or following their 1-2 year postdoctoral appointment at another university). Post-doctoral students are also sought by academia or major pharmaceutical and biotechnology companies after completing their training in our department. Many of our graduates are prominent in our discipline both nationally and internationally. With the expansion in number of
pharmacy schools and the aging of the pharmacy faculty nationwide the demand for jobs in academia is wide open for our graduates if they wish to follow this path.

Student awards

The quality of our graduate students is measured by a number of factors. High on this list is the ability of our students to compete and win numerous national fellowships and scholarships such as the highly competitive American Chemical Society (ACS) Organic Chemistry Division as well as Medicinal Chemistry Division Predoctoral Fellowships; American Cancer Society; Army Breast Cancer Fellowships; Research Fellowships from the American Heart Association, and from the American Foundation for Pharmaceutical Education (AFPE) as well as Fulbright Fellowship. Other recognition was the receipt by five students of the Irsay-Dahle Award (the highest award the Department can give to recognize an outstanding graduate student). Several of our graduates were recipients of the Marnie and Bill Argersinger Award given to the outstanding dissertation at KU commencement exercises and graduate student hooing.

Overall Quality

External indicators of quality

National rankings do not exist for medicinal chemistry programs in the U.S. In our field the KU graduate program in medicinal chemistry is generally regarded as being among the top five such programs in the U.S. Our major peer institutions include the University of Wisconsin, the University of California at San Francisco, the University of Minnesota, the University of Michigan and Purdue University. The KU School of Pharmacy ranks among the top in the number of NIH grant dollars received by Schools of Pharmacy in the U.S. In 2009, our School has moved up to No. 2 nationally (and No. 3 when that ranking is made on dollars per FTE faculty). Our department is a major contributor to this success by bringing nearly 60% of the total NIH dollars to the School of Pharmacy.

All of the present faculty have the terminal (Ph.D.) degree. Collectively, the twelve tenured faculty have produced 536 refereed professional journal articles or chapters in books, 154 editorial and memberships on editorial boards, 1286 journal reviews. They have presented 526 invited presentations at professional meetings, as well as 631 abstracts presented, received numerous awards and fellowships from national professional organizations, three teaching awards, two University Distinguished Professors and one Regents Distinguished Professorships, and presented many named lecturer.

During their academic career, the medicinal chemistry faculty have held numerous offices in professional associations as well as many appointments to federal proposal review panels and most have been called upon to render professional judgments concerning tenure/promotion decisions at KU and other universities. Every member of the faculty has served as a referee for a number of professional journals and senior faculty have served on important KU committees such as the Provost and Chancellor Selection committees.

Reflecting on our mission statement

*KU has a program in medicinal chemistry because..... of the uniqueness, success and professionalism of its faculty members who contribute not only to the education of future pharmacists, academicians and researchers but also who are dedicated to the discovery, synthesis and development of new drugs from natural and synthetic sources for the betterment of human health in Kansas, the U.S. and the world.*

Overall assessment

Given the significant contribution of our department to the School of Pharmacy ranking among the top 2 nationwide; the quality and productivity of the faculty; the student assessment of the quality of instruction; the cost-effectiveness of the program; the description and evaluation strengths and uniqueness of the faculty and the medicinal chemistry graduate program and the demand for our graduates, this program deserves an “exceptional” rating in terms of performing significantly above the level one would expect to encounter at a state’s flagship research and teaching university with an educational mission like
that of the University of Kansas and the School of Pharmacy.

**What are your plans to advance the program?**

**Targets for change**

The graduate program is intrinsically and intimately connected to research. Faculty-lead research programs comprise experimental and theoretical endeavors that rely on the efforts of the graduate students for their successful implementation. A long-standing, overriding target of the department that will benefit both research and teaching mission and activities for all faculty, students and research personnel is to coalesce into one physical location near the new School of Pharmacy building on west campus. The faculty is currently spread between Malott Hall on Main campus and the Multidisciplinary Research Building and the Delbert Shankel Structural Biology Center on West Campus.

**Plans to enhance quality and competitiveness**

Periodically review and assess the curriculum
Retain the department’s traditional focus on organic chemistry, and in particular, chemical synthesis
Strengthen the department’s fledgling but complementary emphasis biochemistry in both the research program and the graduate program
Expand upon the new course in Industrial Medicinal Chemistry
Explore the establishment of a program of industrial internships
Continue to encourage research collaborations with other departments and elsewhere as appropriate
Continue to provide teaching opportunities for graduate students and postdoctoral researchers interested in pursuing an academic career
Strengthen our "outreach" to industry for seminar speakers, research collaborations/contracts, and industrial externships for students, new coursework/industrial lecturers emphasizing new technology, and job placements for graduate students and postdocs

**Plans for innovation and new initiatives**

A. Appointment of some senior, well-regarded faculty—preferably via distinguished professorships—the key to a nationally recognized program and the resulting benefits with respect to junior faculty recruitment, good graduate students, and job placements for our Ph.D.s.
B. Increase visibility and national recognition via topflight appointments and successful graduate students. More junior faculty are needed soon to precede upcoming retirements and provide continuity without a significant loss of expertise. As our younger faculty increase the size of their research groups in the years ahead, the student population should increase.
C. Host special seminars and meetings as part of the various NIH Centers and provide opportunities for job placement for our graduates
D. Continuation and extension of the Smisson, Mertes and Abbott Lecture Series which have been integral to our course offerings, faculty development, and the national visibility of our department
E. Continuing commitment to recruiting high-quality women and minority graduate students and faculty, with a view to increasing diversity
F. Continue applying for graduate student training grant support
G. Continue efforts for support for graduate student tuition scholarships

**How will you evaluate future progress and success?**

We plan to evaluate future progress and success of our students by continuous assessment of the general quality of the students attracted to the medicinal chemistry program in terms of prior training in organic chemistry, GPA and GRE performance, the success of our students as recipients of national fellowships and awards, peer-reviewed publications, invitations to national professional conferences, the degree to which medicinal chemistry graduates are accepted by prestigious universities or pharmaceutical/biotechnology companies, and the record of academic and non-academic employment or professional status of our alumni.
The only Department of Medicinal Chemistry in the only School of Pharmacy in the State of Kansas is at the University of Kansas. The mission of the Department is to serve several client groups, most importantly undergraduate pharmacy students, graduate and postdoctoral students, the scientific community, industry and the federal government, international programs, and the University and the State of Kansas. The Department serves the undergraduate student by providing excellent up to date teaching of basic science courses in the pharmacy curriculum and providing laboratory research opportunities to pharmacy students. The faculty members are available to participate in continuing education programs for pharmacy practitioners. The Department maintains a vigorous and internationally recognized program of research and considers its primary mission to be the education of highly qualified students in medicinal chemistry with emphasis in the areas of design, synthesis, isolation, chemical and biological characterization and analysis of lead substances and their rational elaboration into novel candidate drugs. The education of these M.S., doctoral and postdoctoral students is done by outstanding faculty who are national and international leaders in research, teaching and service in the discipline of medicinal chemistry. All graduate students in the program receive broad-based didactic training in the basic chemical sciences and in the areas of Medicinal Chemistry emphasized in the Department. The areas chosen by the graduate students or postdoctoral students for research topics will receive special emphasis during their training and students are expected to demonstrate proficiency, knowledge, originality, and research capabilities in their chosen area of specialization. Faculty members of the Department are active in national and international societies and government agencies and also provide consulting to private industry.

Strengths, Productivity and Qualifications of the Faculty

The faculty of the Department average 15.8 years of research and teaching experience. All members of the faculty have a Ph.D. degree. Of the 12 tenured members, two are University Distinguished Professors and one is a Regents Distinguished Professor. Five faculty are elected Fellows of the American Association for the Advancement of Science (AAAS), one has been inducted to the American Chemical Society (ACS) Hall of Fame, one received the Research Achievement Award of the American Society of Pharmacognosy, one is the recipient of the prestigious ACS David W. Robertson Award in Medicinal Chemistry and two have received KU Center for Teaching Excellence Awards. Over the last seven years, the faculty members have authored over 536 peer-reviewed papers in top-flight journals and have made over 500 invited research presentations. The amount of external funds received (direct costs only) has increased more than 500% in the past 10 years and in 2009 was over $6.6 Million (average of $702,000 per faculty). An additional $1.5 Million in grant funds on projects of which the faculty were co-investigators was received in 2009. In the same year the state appropriation for the Department was $1.6 Million.

Curriculum and its Impact on Students

Graduate students receive broad-based didactic training in medicinal chemistry. The graduate students have a choice of one of two major sub-disciplines for their research training. These students are expected to demonstrate proficiency, knowledge and research capabilities in their chosen area of specialization. Upon completion of this program a majority of the graduates accept postdoctoral appointments for one to two years and then most accept positions in the pharmaceutical or biotechnology industry. In the past five years only two of our Ph.D. graduates have accepted academic positions.
Student Need for the Program and Employer Demand

Graduates of our program (Ph.D. and M.S.) have a 100% job placement record. Most have a choice of several excellent positions to choose from, and a significant number of our graduates hold positions of leadership and administrative responsibility in many of the major pharmaceutical companies in the world. The quality of our students is high (e.g., 22% of our graduate students held competitive fellowships from external sources in 2009; two doctorates in the past five years have received the Marnie and Bill Argersinger Award for Outstanding KU dissertations). There is a high demand for our graduates. We plan to increase the enrollment in our program. To do that will require the availability of increased research grant funding (to support GRAs and postdocs). This seems assured by the dramatic increase in external support over the past five years and the expanded laboratory space on West Campus (MRB and SBC).

Service Provided by the Program

Members of the faculty participate in the usual departmental, school and university committee work. In addition, some members of the faculty hold positions of responsibility and leadership beyond the usual. Two professors head two NIH Centers of Biomedical Research Excellence (COBRE), one professor is the director of two major NIH Centers of Excellence. Two faculty members served on the selection committees for hiring the new KU Chancellor and Provost and others serve on various committees at KU. At the national and international level, members of the faculty serve in high leadership positions in the most prominent professional societies and organizations of our field.

Cost-effectiveness

Less than 17% of the Department’s budget comes from the State of Kansas if we take into consideration grants received by the faculty as PIs or co-PIs. Our cost per credit hour at the undergraduate and graduate levels is well within the norms for other KU departments of similar mission. The proposed increase in graduate enrollment will result in a lowered cost for SCH for doctoral education.

Overall Program Quality

William Greenlee, Vice President at Merck/Schering-Plough and Co., Inc. had this to say about our program: “The Department of Medicinal Chemistry at the University of Kansas is one of the premier medicinal chemistry programs in the United States. It has broad capabilities in biomedical research and a world-class faculty with extensive experience in synthetic methods and design of drug molecules. The Department is well-known for producing some of the most talented medicinal chemistry leaders in industry, and for the contributions of its faculty to several drugs on the market”. James Monn, Senior Research Fellow at Eli Lilly and Company, wrote “The KU Department of Medicinal Chemistry is widely recognized for the quality of its faculty, its diverse yet highly relevant research pursuits, and its compelling track record of training young scientists for careers in biomedical research”.

Program Changes

Major program changes are not planned but the Department remains posed to seek new opportunities when they arise.