Program Mission: The discipline of Pharmacology interconnects basic scientific research and applied clinical medicine. It entails study of the processes involved in the absorption, distribution, metabolism and elimination from the body of a very wide variety of drugs and environmental toxins, as well as the mechanisms by which these drugs and toxins produce their effects and adverse side effects. As such, it is positioned to improve public health by advancing our understanding of disease mechanisms and developing new drug-based therapies. Since conferring its first advanced degree in 1931, the core mission of the Graduate Program in Pharmacology has been to educate the future leaders of the discipline. It has done so by providing students with rigorous didactic training in the conceptual underpinnings of the discipline, mentoring them in the formulation of novel hypotheses of their own design, and providing them with the opportunity to develop and apply new technical skills in the laboratory in pursuit of the hypothesis. The success of the program is evident in the many graduates who are or have been Deans, Chairpersons or endowed Professors at peer academic institutions, who hold or have held positions of leadership in the pharmaceutical industry, or have had positions of responsibility in government and scientific societies. Not surprisingly, this program has had a federally funded training grant from the National Institutes of Health for over 50 years.

The Department of Pharmacology currently awards two advanced degrees - the Ph.D. and the M.S. The first program goal, completed in the first two years, is to convey pharmacological and other concepts to the students through rigorous coursework. The curriculum is periodically reviewed and revised to ensure its currency and to meet the needs of the students. The second program goal is to train students how to develop, conduct, analyze and interpret laboratory experiments and then communicate their results to others. These basic skills are critical for every student’s future career and developing such skills is a major focus throughout the program. While the Ph.D. program focuses heavily on both of the above goals, the M.S. program focuses primarily on the first with less emphasis on the second.

Admissions Process and Criteria: Over the past 10 years, the Graduate Program in Pharmacology has received an average of ~ 80 applications per year, about 50 for the Ph.D. program and about 30 for the M.S. program. Approximately 30% are from domestic applicants and 70% are from international applicants. In addition, we participate in the Biosciences Program (from which one student matriculates into Pharmacology about every 2 years) as well as the Medical Scientist Training Program (from which we typically enroll one student per year). Applications to the Program are reviewed individually by members of the Department Admissions committee. The main criteria used in the evaluation process are: 1) GRE scores. Applicants are expected to have a combined verbal and quantitative score of 1150 or better (mean over past 10 years is 1250). 2) GPA from prior degrees and course work. Applicants are expected to have a GPA of 3.2 or better (mean over past 10 years is 3.43). 3) previous course work undertaken. Applicants are screened to insure they have the appropriate background coursework to prepare them for our courses. 4) quantity and quality of previous laboratory research experience. While not essential for admission, such experience is quite desirable and increases their chance for success in the program. 5) the personal statement. While there are certain minimum expectations for each of these criteria, deficiencies in one or two may be countered by outstanding credentials in others. Evaluations by each committee member are tallied and the most promising domestic applicants are invited to campus for an interview. Any outstanding international applicants are typically interviewed by phone. The results of faculty interviews (typically 6 to 8) and those by current students are tallied and the most promising candidates are selected for admission.

Over the past 10 years, ~ 50% of those admitted actually enroll in our Ph.D. program (for the M.S. program it’s nearly 100%). The number admitted each year is determined by financial and space considerations (described below) but has averaged about 6 per year over the past 10 years. Considerable effort is made each year to enroll a diverse group of students. To that end, the program is advertised in various ways. Flyers are provided to undergraduate institutions
regionally and nationwide, contact is made directly with students who performed well on the GRE, and the program is promoted on our web site and advertised nationally. Faculty members participate in University summer research programs for underrepresented minority students, visit regional undergraduate institutions (including historically black colleges) and attend national meetings conducted for underrepresented minorities. As a result of these efforts, among the 63 students who enrolled over the past 10 years, 35 were male and 28 were female (a 55 : 45 ratio), 7 of these were underrepresented minorities, 14 were Asian, and 5 were Indian.

Students are guaranteed financial support by the Department for the duration of their studies. The level of support is set by the Biomedical Sciences Research Training Group after annual review of peer institutions, and is the same for all graduate programs in the biomedical sciences throughout the College of Medicine. In their first year, most students are supported by the Department using general education funds “freed” by faculty salary recovery from grants. A few are supported by the Biosciences program or the Graduate College (via SIF funding or Presidential Fellowships). In subsequent years, ~55% are supported by faculty research grants (e.g. NIH). Another 30% are supported by highly competitive pre-doctoral fellowships they have obtained individually from external agencies and organizations. The remaining 15% are supported by equally competitive internal awards (institutional pre-doctoral training grants or Graduate College awards). Our Department does not receive teaching assistantships from the University or the College of Medicine.

Program Outcomes: Over the past 10 years, the Ph.D. completion rate for our program is about 55% (this can be attributed nearly entirely to one entering class). Of the remaining 45%, 32% complete the M.S. degree then leave the program while only 13% leave the program without a degree. During this same period, the time to degree for the Ph.D. has been about 5.1 years and that for the M.S. has been about 3.1 years.

The ability of 45% of our graduate students to successfully compete nationally and locally for individual fellowships is a testament to their high quality, the commitment of our faculty to their career development, and the quality of the training environment. Our students are also frequently recognized for their research via travel awards from National Societies (and from the Graduate College) to present their work at national meetings, as well as via awards from various research symposia, both local and national. In addition, student research is recognized through publication of their work in peer reviewed journals; each student publishes an average of 2 research papers during their graduate career.

Graduates of our Program have a wide variety of career opportunities including positions in academia, teaching, research institutes, pharmaceutical companies, biotechnology companies, and government agencies (FDA, CDC, etc) and they have pursued all of these options. Approximately 33% have gone on to careers in academia, about 33% to careers in industry, about 25% to careers in various medical fields, and about 5% to careers in government. As noted at the outset, many have risen to high levels in their chosen careers.

Program Characteristics: The appropriate size for the Graduate Program is determined by the size of the faculty and the grant support they are able to obtain. Grant support relates to two components described above: ability of faculty to pay student stipends and ability of faculty to provide space / experimental supplies for students. Over the past 30 years, the size of the program has been about 1.5 Ph.D. and 0.5 M.S. students per faculty member. Because the faculty size has declined over the past few years (currently only 11.3 FTE), so has the size of the graduate program. Care has been taken to ensure that the number of students does not exceed the capacity of laboratories with active research programs, and to this end the number of students has been reduced in the past four years from a program high of 32 to 21 by limiting admissions and facilitating graduation of current students.

Published rankings for this program are more than a decade old, but at that time placed this program 11th among pharmacology programs in the nation. We await the most recent ranking,
but anticipate that we may not be quite as strong due to the retirement or departure of some very active senior faculty during the past 10 years and their replacement by more junior faculty who are still on an upward trajectory. A review of the top ten pharmacology programs in the nation determined by NIH funding indicates that their research foci (typically neurosciences, cell signaling and cancer cell biology) are identical to those of our faculty. This suggests that we have elected the proper balance, but may lack a sufficient number of faculty with nationally recognized research programs to return to the top ranks.

Current strengths of our graduate programs are that: 1) it has remained strong, vibrant and nationally recognized for more than 50 years. Most notable is recognition by NIH through funding of a T32 training grant for nearly all of those 50 years. 2) beyond didactic course work, our students receive extensive training to enhance their written and oral communication skills. Extensive exercises in proposal writing have translated into strong success in their competition for extramural funding as noted above. 3) uniquely, our graduate students have organized, coordinated and delivered an undergraduate Pharmacology course since the late 1970’s. 4) many of our graduates go on to highly successful careers as noted above. 5) our research laboratories are quite interactive, not only attracting students from various interdisciplinary programs but also providing students in our program the opportunity to gain some of their training in laboratories outside of our department.

Current weaknesses of our graduate programs are that: 1) because of its relatively small size, fluctuations in student population can affect delivery of graduate education. In years when lack of funding limits recruitment numbers, it negatively impacts not only the competitiveness of our program to attract the best quality applicants, but also the delivery of certain core courses (because an insufficient number of students enroll) and overall program morale. 2) diminishing faculty size currently limits the number of students we can recruit, as discussed above. 3) as the College moves toward an integrated admissions process, the ability of our (and other) graduate programs to effectively recruit adequate numbers of students that will matriculate into each program may be compromised.

Opportunities for growth will occur upon recruitment of a permanent Department Head, which is anticipated by July 2010. His or her first priority will be recruitment of new faculty with active research programs and a coordinate increase in the number of graduate students that can be recruited. We have recently completed a review and reorganization of our curriculum, following the lead of Biosciences Program to reorganize courses into 5 week modules. This change will provide more focused, shorter courses giving our students more opportunities for targeted coursework and customization of their curriculum. This change may also address the limitations on core course delivery mentioned above by increasing enrollment in some of our core courses by students in intersecting disciplines (e.g. biochemistry). Finally, we always try to remain aware of career and employment opportunities for our graduates as well as industry needs and adapt our program to meet those needs.

Conclusions: While every graduate program can claim that it is unique, the discipline of Pharmacology is by nature broad-based, multidisciplinary and integrative. Methodologies are developed and used as needed to answer the question at hand, whether they are molecular, biochemical, systems level, physiological or cellular by design. Our program provides its trainees with the conceptual strengths and diverse technical skills required to become leaders in their chosen field. We have a history of self-study and of making adaptive changes to meet the needs of our students and the discipline, while maintaining fiscal responsibility. We have a history of excellence in training leaders in the discipline, which has been recognized through one of the longest-running federally supported training programs in the nation, and will continue to do so under the leadership of a new Head this coming year.