The following is a response to the request from the Provost’s Task Force on Graduate Education for a current assessment of the Graduate Program in Pharmacy at the University of Iowa. Although this graduate program is administered by the Graduate College as a single graduate program, it operates as four approved subtracks/subprograms: Clinical Pharmaceutical Sciences, Medicinal and Natural Products Chemistry, Pharmaceutical Socioeconomics, and Pharmaceutics. Thus, in addition to the assessment of the overall program in Pharmacy presented below, information is also provided to better place the individual subprograms in the context of graduate study in Pharmacy.

Mission: Excellence in graduate education is fundamental to maintaining and enhancing the position of the University of Iowa College of Pharmacy as one of the premier Colleges of Pharmacy in the nation. The mission of the graduate program in Pharmacy is to serve the state, nation, and world by preparing outstanding pharmaceutical scientists who will be leaders in enhancing human health through innovative research and dissemination of new knowledge in the discovery, development, and evaluation of new drugs and drug delivery systems, in the optimization of safe and effective drug use, and in the provision of pharmaceutical care in a rapidly changing health care environment. The graduate program in Pharmacy interweaves the research, teaching, and outreach missions of the College, and links them with the broader vision of the University of Iowa.

Admission Process and Criteria: The focus of the graduate program in Pharmacy is on the Ph.D. degree, and over 90% of its graduate students enter with this as their degree objective (data for 2004-2008). There is strong student demand for graduate study in Pharmacy, with an average of 184 applications per year (141 Ph.D. and 43 M.S.). For the fall of 2008, there were 159 applications for the Ph.D. program, of which 20 were admitted and 13 enrolled (13% selectivity; 65% yield). For 2004-2008, an average of 26 students was admitted to the Ph.D. program per year with an average of 13 enrolled per year (19% selectivity; 53% yield). Students applying to the program are evaluated by the relevant subprogram faculty on the basis of their entire application materials (i.e., application form, undergraduate and graduate transcripts as appropriate, GRE scores, TOEFL scores if applicable, and letters of recommendation).

We have a clear record of success in enrolling the highest quality students, as measured by multiple criteria. For example, the graduate program in Pharmacy will welcome three new Presidential Scholars who are enrolling in 2009-2010, following the enrollment of two new Presidential Scholars for 2008-2009. For these two years combined, the graduate program in Pharmacy is tied with the program in Mathematics for the highest number (5) of new Presidential Scholars enrolled at the UI. The GRE scores (verbal + quantitative) for incoming students in Pharmacy are 57 points above the UI average and 178 points above the national average for health sciences graduate programs (data for 2004-2007). For 2004-2007, the incoming GPA for all graduate students in Pharmacy (3.46) was comparable to that of the UI Health Sciences (3.47) and all UI programs (3.45) for this time period.

The graduate program in Pharmacy is making progress in increasing underrepresented minority groups among our students who are U.S. citizens or permanent residents, although this remains a challenge. In the Fall of 2008, 7% of our graduate students were underrepresented minority U.S. citizens or permanent residents. The cultural and racial diversity of our program is also greatly enhanced by our international students (50% of graduate enrollment in fall 2008), and this is particularly noteworthy in relation to the UI’s strategic goals relating to increasing internationalization.

Pharmacy has a strong commitment to financial support of its graduate students, and this is accomplished through various mechanisms. Data from the fall semester of 2008 indicate that 62% of our graduate students
received their primary source of support from a graduate research assistantship, and these are usually provided from extramurally funded research grants to the student’s major professor. A total of 22% of graduate students in Pharmacy received their primary support from graduate teaching assistantships, and 16% received their primary support from fellowships during this same time-period. The sources of these fellowships ranged from competitive fellowships on NIH-training grants, to university-wide fellowships (e.g., Presidential Fellows and Graduate Dean’s Fellows), to nationally competitive fellowships, to competitive fellowships from the student’s home country.

**Program Outcomes:** The 5-year percentage completion rate for the graduate program in Pharmacy is 64%. This rate of completion is equal to the average of all biomedical and health sciences and well above the UI average of 55%. The percentage of students who entered graduate study in Pharmacy and left without any degree was 13%, slightly better than the average of 15% for all biomedical and health sciences. The median time-to-degree for Ph.D. students in Pharmacy is 5.9 years (Graduate College data on 46 Ph.D. graduates from 2003-2008). While this is comparable to the 5.7 year median for the biological/health sciences, we plan to continue our ongoing efforts to reduce the time-to-degree for Ph.D. students in Pharmacy.

As noted above, the graduate program in Pharmacy competes extremely well at the university level for Presidential and Graduate Dean’s fellowships (e.g., 3 new Presidential Fellows and 1 new Graduate Dean’s Fellow enrolled for 2009-10). Moreover, our students show outstanding success in competition for national and international fellowships. A complete listing of awards and honors to our graduate students in Pharmacy is located at [http://www.pharmacy.uiowa.edu/grad/awards.htm](http://www.pharmacy.uiowa.edu/grad/awards.htm). Graduate students in Pharmacy are very active in presenting their research at scientific meetings and in publishing the results of their research. For 2002-2007, the total number of peer-reviewed research publications with Pharmacy graduate student co-authors averaged 56.3/year.

The graduate program in Pharmacy has an excellent record of placement of its Ph.D. graduates. As a recent example, our 22 Ph.D. graduates from May, 2007 through May, 2009 have all accepted initial positions directly related to their graduate education. These graduates began positions as research scientists within pharmaceutical and biotechnology industries (10) and a research institute (1), as postdoctoral research fellows (6), and as college/university faculty (5). Data on initial placement of the 48 Ph.D. graduates in Pharmacy from August of 1998 through May of 2003 indicate that all were employed in positions related to their field of study. Of these Ph.D. graduates from 1998-2003, 54% went to research positions in pharmaceutical, biotechnology, or related industries, 28% went to postdoctoral research positions in academia or industry, 13% went to college/university teaching positions, 2% to academic research positions, and 2% to government positions. As there is a national trend in graduate education to enable students to consider a diversity of career options for Ph.D.’s in the sciences that is broader than traditional academic positions, it is important to note our longstanding success in this area.

**Program Characteristics:** Our evaluation of the characteristics of the program in relation to future challenges and opportunities begins with an assessment of the appropriate size of the program. We are currently very close to a limit for the size of the graduate program in Pharmacy due to the current size of the graduate faculty in Pharmacy as well as limits on the laboratory facilities of an aging Pharmacy building. Current budgetary constraints in these two critical areas overshadow the opportunities that are present due to the fact that our faculty continue to increase their productivity in extramural grants and contracts that supply funding for research assistantships, and our graduate students are increasingly competitive for university, national, and international fellowships. While these positives will continue to contribute to improvement of our graduate program at its current size, the constraints imposed by our current facilities and our inability to significantly increase the number of graduate faculty due to the current economic environment of the university and state dictate limits on our growth. Indeed, the number of tenured and tenure-track faculty in Pharmacy has
decreased by 8.8% during the past 5 years, and this inherently sets limits on the growth of the graduate program.

The taxonomy used by the National Academy of Sciences (NAS) has unfortunately prevented participation of the graduate program in Pharmacy in their national ranking survey. This is, however, true of many of the graduate programs in Pharmacy across the nation. The breadth of our program, covering aspects of Pharmacy that interconnect with disciplines from economics and social sciences to the biological, chemical, and physical sciences, make it difficult to place our program, and many other programs in Pharmacy as well, into the categories currently defined by the NAS. Moreover, even among programs in colleges of pharmacy some include Pharmacology (ours does not), and some (like ours) include pharmaceutical socioeconomics (others do not). Nonetheless, it is clear that the UI graduate program in Pharmacy is highly regarded both nationally and internationally, and that our students compete successfully with other students in related fields both at university and national levels. As one example, the American Foundation for Pharmaceutical Education (AFPE) awarded a total of 43 Pre-doctoral Fellowships in the Pharmaceutical Sciences for 2009-2010 in a competition open to all colleges of Pharmacy in the U.S. Our students won 6 of these prestigious fellowships, and this was tied with the University of Michigan as the most awarded to Ph.D. students from any one school. One of these AFPE awards was declined by the student due to simultaneous award of a larger competitive fellowship from the American Chemical Society.

Major strengths of the graduate program in Pharmacy include our very successful recruitment of highly talented students on both national and international levels, success in our students obtaining highly competitive fellowships at the university and national levels, our rate of completion for Ph.D. students, and successful placement of our students in a variety of research-related careers. We also enjoy a strong base of alumni of the graduate program in Pharmacy who are able to assist us both in recruitment of students and in providing career information to our current students. While these are clear strengths, we do have some challenges for the future. One of these areas is in recruitment of underrepresented minority students who are U.S. citizens or permanent residents. While we have made progress in this area, we are still working for further improvement.

As noted above, opportunities for growth of the program are closely tied to future success in obtaining new research facilities for Pharmacy and increases in numbers of graduate faculty. Although a new building is a long-term prospect, capital planning at the university level is now incorporating the need for a new Pharmacy building. While this is a very positive sign for future growth and development, ongoing needs for renovation of research facilities in the current building will also need to be addressed in the short term in order to accommodate growth in research programs of both new and current graduate faculty. In addition to potential opportunities for growth of the graduate program, the College of Pharmacy is currently in the process of transition from a divisional to a departmental administrative structure. This will provide the opportunity for exploring potential alteration of the current single program of approximately 80-90 students into programs/subprograms that would better align with departments, as is most commonly seen across the UI. Another opportunity for the future of the graduate program is to enhance further development of the current educational connections with UI Pharmaceuticals, a service division of the College of Pharmacy that is the largest and most experienced university-affiliated Food and Drug Administration-registered pharmaceutical manufacturing facility in the U.S.

Conclusions: The comparative data provided by the Graduate College support the conclusion that the Graduate Program in Pharmacy is one of the very strong and highly successful graduate programs on campus. Admission to the program is in high demand and is highly competitive, and our students compete extremely well with their peers on a national level. Graduates of the program pursue a variety of rewarding career paths in both research and teaching. Our challenges for future growth in the Ph.D. program are principally in the areas of physical facilities for graduate study, as well as the need to increase our number of graduate faculty.
Appendix: Subprograms within the Graduate Program in Pharmacy

The graduate program in Pharmacy comprises four subtracks/subprograms approved by the Graduate College, and these are representative of the current depth and breadth of scientific inquiry and graduate education in Pharmacy. Some of the individual characteristics of each of these areas of graduate study in Pharmacy are presented below.

Pharmaceutics: The Pharmaceutics subprogram’s mission fulfills the Pharmacy graduate program’s mission of the preparation of outstanding pharmaceutical scientists to be leaders in the discovery, development and evaluation of drug delivery systems and the optimization of safe and effective drug use. Pharmaceutics is a multidisciplinary science that examines the development, production and characterization of dosage forms, as well as the disposition and action of drugs in the body. This subprogram has historically educated scientists for employment by the pharmaceutical industry, and more recently biopharmaceutical industry, and has a rich history of successful graduates achieving senior leadership positions (e.g. Director, Vice President, Chief Scientific Officer) in major pharmaceutical companies and emerging biotechnology and technology-based firms. Faculty members and students in the Pharmaceutics sub-program have the unique opportunity to interact directly with The University of Iowa Pharmaceuticals and participate in the development of drug products intended for early-stage testing in humans. The recently-established University of Iowa Pharmaceuticals Development Consortium is the operational home of these joint endeavors. Several of the Pharmaceutics subprogram faculty members hold joint appointments in the College of Engineering, a recognition of the common interests and complementary expertise of these programs, and several of these faculty members also hold key leadership positions in the National Institute for Pharmaceutical Technology and Education (NIPTE) initiative, a national consortium of 11 pharmaceutics and engineering programs focused on improving human health by improving the quality and lowering the cost of pharmaceutical products. The Pharmaceutics subprogram has a long tradition of educating both domestic and international students, and currently the program enrolls students from over 9 different countries. Students have been very successful in obtaining highly-competitive fellowships, including those sponsored by The University of Iowa Graduate College, The Fulbright Foundation, The American Foundation for Pharmaceutical Education, and the United States Pharmacopeia. Prior to and upon graduation, students are actively recruited by the pharmaceutical industry, and over 90% of Ph.D. students are placed in their first permanent position immediately following graduation.

Medicinal and Natural Products Chemistry: The subprogram in Medicinal and Natural Products Chemistry (MNPC) provides graduate courses and research in basic chemical and biological sciences related to drug discovery and drug design. Graduate study in MNPC is at the forefront of current research on the development of new synthetic methodologies to construct medicinal agents, the design and synthesis of novel anti-infective and anti-cancer agents, and on drug-related research efforts in enzymology, biocatalysis, carcinogenesis, chemical toxicology, signal transduction, and neurochemistry. Research efforts in MNPC also include the discovery and development of novel drug targets and the development of innovative gene delivery systems. Graduate students in MNPC have demonstrated outstanding success in winning highly competitive national fellowships. Indeed, for 2009-2010 there were 5 nationally competitive American Foundation for Pharmaceutical Education (AFPE) Pre-doctoral Fellowships awarded to MNPC graduate students, with one winner declining that award to accept an American Chemical Society Division of Medicinal Chemistry pre-doctoral fellowship. MNPC is an active participant in two NIH Pre-doctoral Training Grants on campus (Biotechnology and Pharmacological Sciences), with multiple students successfully competing with other biological/health sciences students on campus for these positions. Also relevant to assessing comparative excellence on campus, this subprogram is welcoming one new UI Presidential Scholar and one new Graduate Dean’s Fellow for 2009-2010.
**Pharmaceutical Socioeconomics:** Graduate study in Pharmaceutical Socioeconomics (PSE) employs an interdisciplinary approach in studying behavior and choice in health care with an economics and social-psychological theoretical basis. Areas of study include comparative effectiveness of treatments, influences on and effects of pharmacy services and drug insurance, as well as factors affecting medication use by patients. A major strength of the graduate coursework and research in PSE is the application of principles of the social sciences, economics, epidemiology and statistical methods in new and innovative ways to create new knowledge critical to the practice of pharmacy and the safe and effective use of medications. One measure of the quality of the students in this subprogram is in their successful competition for both university and national fellowships and other awards. In the fall of 2009, there are two UI Presidential Scholars continuing their graduate study in PSE with a third beginning graduate study in this semester. An additional student in PSE is a current recipient of a highly competitive national AFPE Pre-doctoral Fellowship. The graduate subprogram in PSE received additional university-wide recognition in 2008, with Professor Farris being selected as the UI Outstanding Graduate Mentor of the year for the biological/life sciences.

**Clinical Pharmaceutical Sciences:** The Ph.D. in Clinical Pharmaceutical Sciences (CPS) is the newest doctoral subprogram in Pharmacy, with its first admission of Ph.D. students in 2005. Graduate study in CPS, however, has a much longer history, since the current Ph.D. program developed from a longstanding successful M.S. program in this area. The focus of doctoral study in CPS is on clinical research in pharmacy. The goal of the program is to advance the science of human pharmacology and therapeutics and to improve the safe, effective and economical use of medications by patients. The program emphasizes the integration of clinical and basic research. It involves advanced studies of clinical pharmacology, pharmacokinetics, pharmacodynamics, pharmacogenetics and the requirements for regulatory approval of new drugs. The Ph.D. in Clinical Pharmaceutical Sciences has made a very strong beginning, with one graduate (Spring 2009), 11 current students (Fall 2009), and its first UI Presidential Scholar beginning the program this Fall.