

GRADUATE PROGRAM IN ANATOMY & CELL BIOLOGY

STRATEGIC ASSESSMENT

MISSION: The goal of the Ph.D. Program in Anatomy & Cell Biology at the University of Iowa Carver College of Medicine is to educate individuals dedicated to pursuing careers as scientists and scholars in biomedical sciences—functioning in either an academic environment or a research setting in the biotechnology private sector. To achieve this goal, we have developed an academic environment that fosters creative thinking and excellence in scholarship, research, and teaching. Our program offers students a curriculum with advanced graduate courses focusing on cell biology and molecular medicine, weekly seminars by guest speakers who keep students abreast of the most advanced developments in research, and monthly career development workshops. Students also have an opportunity to learn gross human anatomy and to participate in our departmental mission in gross anatomy teaching. We encourage students to develop a solid foundation in cell biological concepts, synthesize and correlate new ideas and concepts, and develop strategies for rigorously testing novel hypotheses as they relate to the cellular basis of human disease.

ADMISSION PROCESSES AND CRITERIA: Nearly all students enter the Anatomy & Cell Biology Graduate Program via the broader Biosciences Program of the university. Admission to the Biosciences Program is based on several considerations, including undergraduate GPA, GRE scores, TOEFL scores (for foreign applicants), URM status, and letters of recommendation and personal statements of applicants. A representative from the Anatomy & Cell Biology faculty serves as a member of the Biosciences admissions committee to help identify prospective students with appropriate backgrounds for matriculation into the program. The Biosciences program has data on how successful the overall recruitment and admission has been in terms of student quality. The quality of the students that matriculate into the Anatomy & Cell Biology program, as assessed by GRE scores, is comparable to those in other biological/biomedical graduate programs, and has not changed significantly since Biosciences recruiting began in 2001. However, GRE score is only one indicator of a successful student and we have found that the Bioscience Program has overall improved the quality of students who have matriculated into our program. One notable difference in the composition of the program is reflected in the numbers of international students in the program before and after recruitment through Biosciences was implemented. For the period between 1996-2001, fully 45% (10/22) students in the Anatomy & Cell Biology program were international recruits. Following the move to Biosciences recruiting, only 17% (3/18) students were international.

Admission to the Department of Anatomy & Cell Biology—following initial enrollment and participation in the university's Biosciences Program—is based on an evaluation of the applicant's credentials by faculty of the Department of Anatomy & Cell Biology. This includes an appraisal of the student's performance in laboratory rotations, as determined by both oral presentations of research and written evaluations by research advisors.

In considering how effective recruitment under the Biosciences admissions umbrella has been since the department turned to this as a sole mechanism in 2001, several issues should be considered. The first of these is student demand by faculty research mentors. In recent years, recruitment of graduate students from the Biosciences Program has narrowly kept up with demand of research-active faculty mentors in the department. Graduate students recruited from three Interdisciplinary Programs (Molecular & Cellular Biology, Genetics and Neuroscience) and from the MSTP program help to meet demand for graduate research assistants in the department. However, the vitality of the Anatomy & Cell Biology Graduate Program depends on a fairly consistent number of students matriculating into the program from Biosciences each year and this has not happened. Between 2001-2006, fifteen graduate students matriculated into the Anatomy & Cell Biology program from Biosciences, an average of three students per year. However, the influx of new students into the program was inconsistent over this period, with some years having 5-6 students enter the program and other years having 0-1 students. This poses a serious challenge when it comes to developing and offering graduate level courses taught by departmental faculty to meet the specific requirements of our program (see "Program Characteristics"). In addition, since 2006 the department has hired six new faculty members who are establishing active research programs. It is unclear yet whether the increased demand for graduate students will be met by the Biosciences admissions mechanism as it currently operates.

Financial aid commitments are made to incoming and continuing graduate students in the form of a 100% stipend with fringe benefits and tuition payment. The Bioscience Program provides support in the first year. Following matriculation into the Anatomy & Cell Biology program, students whose mentor holds a primary

appointment in the department are supported by departmental funds, offered in the form of a one-year fellowship. Support in subsequent years is contingent upon students maintaining good standing in the program, as assessed by academic performance, passing a comprehensive (qualifying) examination, seminars, and evaluation by the research mentor, the thesis committee and the graduate program committee. The source of financial support varies, and includes both externally and internally funded research grants, training grants and pre-doctoral fellowships awarded to students who successfully compete for them (see "Program Outcomes").

Occasionally, students are admitted into the Anatomy & Cell Biology program directly, without going through the Biosciences Program. Since 2000, the program has admitted two international students by this mechanism. Criteria for admission and retention in the program are the same as for other students, but directly admitted students are expected to provide their own financial support. In the two cases cited, the students were fully funded by the Egyptian Government. These directly admitted students are still required to undergo three laboratory research rotations, as is the case with Bioscience Program students.

PROGRAM OUTCOMES: The completion rate of graduate students in Anatomy & Cell Biology was 64% for students who entered the program between 1996-2001. This is comparable with completion rates for graduate students in all biological and biomedical sciences at the University of Iowa, which was 62% overall during the same period. The median time-to-degree in the Anatomy & Cell Biology program was 5.3 years, slightly shorter than the average across related disciplines (5.7 years). Looking forward, for the 15 students who entered the program between 2001-2006, eight students had earned their Ph.D. by June, 2009, with a median time-to-degree of 4.9 years. One student left the program without a degree during this period, and six are still enrolled in the program. These six have all passed their qualifying examinations and are pursuing thesis research. If all of them successfully complete the requirements of the Ph.D. degree, this will result in a completion rate of 93%, a substantial improvement over the period between 1996-2001.

Graduate students in the program have received numerous fellowships, awards and honors in recent years. These include pre-doctoral National Research Service Awards from the NIH, fellowships from the American Heart Association, Cold Spring Harbor and the McCord Foundation for Wound Healing, as well as positions on institutional NIH training grants. Other awards that have been given to our students include the Caroline Tum Suden/Francis A. Hellebrandt Professional Opportunity Award from the Society for Experimental Biology, American Association of Anatomists Award, Merck New Investigator Award, FASEB Summer Conference Trainee Travel Award, and Graduate Student Senate Travel Awards from the University of Iowa. Students in the program have also been recognized for service and teaching efforts with departmental awards, which include the Mary J.C. Hendrix Graduate Leadership Award, the Tung-Yang Wing Award for Superior Achievement in Anatomy Graduate Education and the Award for Superior Achievement in Student Teaching in Anatomy and Cell Biology. Finally, some of the students have received recruitment fellowships from the University of Iowa, including the College of Medicine Dean's Fellowship and the Presidential Graduate Fellowship.

Over the past decade, graduate students in the Anatomy & Cell Biology program have been responsible for approximately 55 primary research papers and review articles, serving as either first or last author. These have been published in many good journals, including *Aging Cell*, *American Journal of Physiology*, *Antioxidants and Redox Signaling*, *Cancer Research*, *Circulation Research*, *Hypertension*, *Journal of Biological Chemistry*, *Journal of Clinical Investigation*, *Journal of Investigative Dermatology*, *Journal of Virology*, *Molecular Biology of the Cell*, *Molecular and Cellular Biology*, *Molecular Therapy* and *Proceedings of the National Academy of Sciences (U.S.A.)*.

We gauge success in training graduate students by the placement of students in post-doctoral research or teaching positions in academia or the private sector. By these standards, we are successful as a graduate program. For doctoral graduates who received their PhDs between 1998-2003, almost all (82%) were initially employed as post-doctoral fellows in academic research labs, which is a higher percentage than that of the average across all biomedical sciences (66%). One student in this group (9%) pursued college teaching, similar to the average across similar disciplines (10%). Of this cohort of students, three (27%) are currently still employed as "post-docs", and five (45%) are employed at colleges or universities in teaching and/or research capacities, with most on the tenure track. This compares favorably with the broader group of graduates from all biomedical sciences programs, of whom 27% are currently employed as tenure track faculty.

A similar trend applies to the cohort of students who graduated between 2003-2008. Most of these individuals (87%) initially pursued academic post-doc or research positions, and 13% were initially employed in tenure-track

college teaching positions. Of this group, half are still engaged as academic post-docs, and the other half are employed in academic teaching or research positions around the country.

PROGRAM CHARACTERISTICS: 17 faculty members currently hold primary appointments in the Anatomy & Cell Biology department, and their expertise ranges from basic cell and molecular biology to developmental and stem cell biology, cancer biology, neurobiology and vascular biology. Currently, 10 graduate students in our program are pursuing a PhD objective under the mentorship of faculty members with primary appointments in the department. The Anatomy & Cell Biology program is the smallest program in the Biological/Biomedical Sciences group, and that is both a strength and a weakness of our program. On the one hand, students benefit from greater accessibility to faculty and departmental research facilities (e.g. confocal microscopes, ultracentrifuges, etc.). On the other hand, the small number of students and the variance in matriculating students from year to year pose serious challenges to our program with respect to curriculum development, our student seminar series, and our professional development workshop. We have capitalized on several opportunities to expand our program to meet this challenge. First, we have recruited students into our program whose faculty mentors hold primary appointments in clinical departments that do not have a graduate program. This has both added to our student population (four current students), and has contributed to the diversity of mentor expertise, especially in areas related to molecular medicine. Second, the department has added several new faculty members in recent years and they are proactive in recruiting new students into the program. Third, the Anatomy & Cell Biology program has joined forces with the Molecular & Cellular Biology program to offer a shared career development workshop series to students of both programs. However, even with these efforts it is not a given that our program, which relies almost entirely on recruiting from a fairly small pool of Biosciences students, will achieve or maintain a size that would best serve the needs of our students. Ideally, our program would grow by addition of 5-6 students a year until a steady state population of 25-30 students was maintained. One possibility would be to combine our program with other graduate programs. Although it is desirable to maintain control over the structure and management of our program within the Anatomy & Cell Biology department, the Task Force might consider the possibility of merging some of the smaller biomedical sciences graduate programs into larger units with shared missions in graduate education. One other basic science department (Physiology and Biophysics) also only recruits students directly from the Bioscience program and this department has a similar mix of researchers as Anatomy & Cell Biology. It would be useful to know if they are also encountering similar challenges. An alternative solution to grow the Anatomy & Cell Biology graduate program would be to reinstitute direct recruitment like other graduate programs by establishing a recruitment committee. Now that the department has grown substantially its junior faculty ranks, this strategy would likely have good participation in recruitment efforts needed to be successful in such an endeavor.

CONCLUSIONS: The graduate program in Anatomy & Cell Biology strives to provide the best environment for our students to develop the skills needed to be competitive in today's research and teaching environment. As we face challenges in funding graduate education, maintaining a critical mass of students and enhancing the diversity of our student body, we are fortunate to have a growing nucleus of faculty members with new ideas about how to best address these issues.

This narrative has consciously avoided discussing the issue of training graduate students for teaching careers in Anatomical Education. Given the fiscal realities that are inherent in supporting graduate students from NIH research grants, the stated career objectives of recent graduate students recruited to our program and the changing composition of the faculty, there has by necessity been a transition in the Mission of the PhD program towards a more research-focused goal. This creates a challenge in that future anatomy teachers are not being trained in our graduate program. At the same time, we have an opportunity to change the mechanism by which graduate students with an interest in teaching gross anatomy are prepared for this career objective. One possibility would be to develop a new "Teaching Track" in our graduate program, possibility with a terminal Master's degree objective. Because "how to pay for it" is the eternal question in graduate education, the solution to this problem might be to charge students tuition and fees to become trained anatomy instructors. The department currently has a "Teaching Certificate" in place for the graduate program, but this has been underutilized because the type of students entering through the Bioscience Program are most often not interested in learning gross anatomy.