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INTRODUCTION

The science of immunology grew from attempts by 19th century physicians to explain the commonplace observation that individuals who have recovered from an infectious disease often manifest remarkable resistance to subsequent infectious caused by the same organism.

Vaccination, based on this principle, has proved to be an enormously successful strategy for disease control. Through two centuries of scientific exploration, immunology has grown to encompass studies at the leading edge of molecular and cellular biology and of great relevance to human health.

Immunology research and training at the University of Washington School of Medicine originally was organized within the Department of Microbiology. Increased recognition of the important of immunology as a specialized discipline led the School of Medicine to create a separate Department of Immunology in 1986. Support from the Howard Hughes Medical Institute (HHMI) provided initial funds for laboratory and administrative space, as well as resources for recruiting cutting edge immunologists to complement the researchers already at the University of Washington. Dr. Roger Perlmutter was appointed the first Chair in 1989. When he moved to industry in 1997, Dr. Michael Bevan served as Acting Chair from 1997-1999. In 1999, Dr. Christopher Wilson was appointed as Chair.

Graduate training in immunology at the University of Washington achieved initial recognition in 1985 when a predoctoral training grant from the National Cancer Institute was awarded. With

the establishment of the Department of Immunology in 1989, a rigorous graduate training program leading to the Ph.D. degree was promulgated and approved by the Graduate School in 1991. The first immunology graduate students were admitted under the aegis of the Department of Microbiology in 1990 together with two students who had been admitted to Microbiology in 1989; these individuals formed the first class.

The rationale of the graduate program in immunology is as follows: (1) immunology addresses some of the most intellectually challenging questions in basic biomedical research; (2) these questions are of direct importance to clinical medicine; (3) there is a need for a well-integrated immunology training program that will permit talented graduate students to obtain the formal conceptual vocabulary, and the intellectual and technical skills of contemporary immunology; (4) the next generation of immunologists, like their predecessors, will make fundamental discoveries and will see these translated into advances in medical diagnosis and treatment. Indeed, no other discipline is so ideally positioned to bridge the clinical and basic sciences; (5) the Department of Immunology, University of Washington and its affiliated institutions provide a rich environment in which to recruit and train the next generation of immunologists; (6) Our training program is designed to provide students with the opportunity to pursue an understanding of immune responses in molecular detail. This foundation will serve as a starting point for careers in basic or translational research.

A. Self-Evaluation

1. Strengths

The Department of Immunology is a strongly interactive group and shares the view that the immune system provides an unparalleled platform from which to study processes common to all of mammalian biology, processes unique to host defense, and processes of clear and immediate importance to the understanding and amelioration of human disease. The strength of the program derives from an exceptionally strong faculty, whose research and teaching have allowed the Department to attract strong students, post-doctoral trainees and the funding that allows us collectively to engage in discovery-based training.

a. Faculty

The eleven core (primary and joint) faculty members of the Department of Immunology, along with the 16 adjunct and affiliate faculty (whose primary appointment in another department or in an affiliated institution, respectively) who also participate in the graduate program in immunology, have an outstanding record of research funding and productivity and of successful mentoring.

1) Funding: Current annual extramural direct cost funding for the core faculty of the Department of Immunology is \$8,727, 365 (Appendix C). The bulk of this comes from the NIH, with smaller amounts from private foundations and the HHMI; it should be noted that the figure for HHMI funding does not include the amounts provided to support the salaries of the two HHMI investigators in the Department (Bevan and Rudensky) or to support the personnel in their

laboratories that are employed by the HHMI. Funding of the adjunct and affiliate faculty is also strong (\$12,370,095 current annual direct costs).

2) Research productivity, impact and recognition: Although there is no precise metric by which to judge scholarly productivity, there are a number of features that attest to the quality of faculty research. Research funding, as noted above, is robust. A brief review of faculty biosketches (Appendix Q) indicates that their work (and that of their trainees) is regularly published in the most competitive general biological science and immunology journals. Faculty serve on the editorial boards or as editors for many of these, including *Science*, *Immunity*, the *Journal of Experimental Medicine*, and the *Journal of Immunology*, among others. Multiple members of the faculty are currently or have in the past been recipients of NIH MERIT Awards or prestigious awards for junior faculty, e.g., from the Cancer Research Institute, Burroughs Wellcome, Pew and Searle Scholars Programs. Members of the faculty currently serve on three of the four standing NIH immunology initial review groups, on NIH advisory councils and on review groups for many private foundations that support research in immunology. Members of the faculty are on planning committees and serve as organizers for the American Association of Immunologists, Gordon Conferences, the Midwinter Conference of Immunologists and other programs. Michael Bevan is a member of the Royal Society of London and Leroy Hood of the National Academy of Sciences.

3) Training record: The faculty have an exceptionally strong training record. More than 300 pre- and post-doctoral trainees have completed training in faculty laboratories in the past ten

years, and 30 graduate students and ~85-90 post-doctoral trainees are currently in training in their laboratories. The overwhelming majority of prior trainees are now in full-time academic or industry positions. Dr. Michael Bevan received the Outstanding Mentoring Award from the American Association of Immunologists in 2000.

b. Graduate Training Program

1) Student quality, productivity and completion rate: We attract strong students to our program, and, with rare exception, they have thrived in this environment. Although many inquiries are received from foreign institutions, all but 2 of the 75 students who have entered our program since its inception received their undergraduate training from institutions in North America. The 2 who did not were exceptional Chinese students, and one of these 2 was awarded an HHMI predoctoral fellowship this year. Of the 75 students entering our program since its inception, 33 have received the Ph.D., 9 an M.S., 2 transferred to another graduate program, 1 withdrew, 1 died in an accident and 29 are still in training. Our students have a solid record of publications, and many of these have appeared in high impact journals. More than 90% of our graduates are in post-doctoral positions, medical school, or permanent positions in industry or academia. More detail is provided in sections E and F and Appendices H and M.

2) Funding for Students: The Department of Immunology currently receives support for graduate student training through its training grants from the National Cancer Institute (9 positions), which is in its 17th year of support, and the Cancer Research Institute (6 positions), which is in its second year of support. Three of our graduate students, Caroline Bishop (third

year), Mark Orr (third year) and Yang Yang (first year) are recipients of Howard Hughes Medical Institute Graduate Student Fellowships; several graduates of the program were also supported by HHMI or NSF fellowships. Two students have successfully competed for and are supported by the Molecular and Cellular Biology training grant. Because of the exceptional level of funding for students from these extramural sources, the Department of Immunology has been able to conserve departmental resources, providing funding only for a portion of the first year students (see section F and Appendices O and P).

2. Weaknesses

a. Graduate Students in the Laboratories of Junior Faculty

Of the 21 immunology graduate students in the second year and beyond, only one is currently working in the laboratory of one of our three core faculty assistant professors (Dong) and another from the laboratory of one of our core faculty assistant professors (Bix) is on a leave of absence (Appendix E). It is perhaps not surprising that no students have yet joined the laboratory of our third new assistant professor (Murali-Krishna Kaja), who just joined the department two years ago; and, a student who rotated with him in the winter quarter may elect to join his laboratory this summer. However, we are concerned that only one student is in the laboratory of the other two assistant professors (who joined the department 4 and 3 years ago, respectively), and only one student chose to rotate in their laboratories this year. This is an unusual situation in our experience – junior faculty are more involved in the day-to-day laboratory work, and this, along with their enthusiasm and youth usually draws students to them. The basis for the greater conservatism of students in favoring more established investigators in the last few years is

uncertain. We are trying to gain some understanding of the reasons for this trend and then to address these issues in the context of next year's group of first year students.

b. Diversity

The recruitment of underrepresented minorities remains an ongoing challenge. We have succeeded in recruiting three women and three individuals of Asian ancestry to our core departmental faculty. We have not yet succeeded in recruiting a qualified member of an underrepresented minority to our core faculty. A woman faculty member of African ancestry will join the Department of Medicine with an adjunct appointment in the Department of Immunology later this year.

Under-represented minority applicants are infrequent in all graduate programs. The use of ethnicity as a criterion for admission was eliminated by the state legislature since the time of the last review, potentially further hindering our ability to attract applicants. Nonetheless, we have enjoyed some success, with one American Indian and two Hispanic students among the 75 graduate students entering our program to date coming (see section D and Appendix H).

3. Challenges and Opportunities

a. Recruitment and retention of high quality students

In the first years of this program (1993-1996), applications ranged from 95-120 and the matriculation rate for those offered admission was exceptionally high at ~80% (Appendix H). The numbers of applications declined in 1997, reached a nadir of 61 in 2001, and has risen

thereafter, with 78 applying in 2002-2003. The matriculation rate fell to a low of two in 1996 and 1997, and has risen since then; 9 students of 18 offered admission in 2002 matriculated and with two weeks to go until the deadline of April 15th, four students have already accepted our offer of admission this year (Appendix H). The factors underlying this evolution are likely to be multiple, and include: the departure of Roger Perlmutter as chair in 1997, the development of other free-standing departments/programs in immunology following the success of programs such as ours that began in the late 1980s, and the increasing attractiveness of multidisciplinary programs or programs that provided greater opportunities to explore different disciplines before choosing a specific focus. Thus, while more focused, discipline-based graduate programs appeal to some students who have defined their interests and who value the more close-knit relationships with other students and faculty inherent in such programs, other students may perceive this to limit their opportunities.

b. Interdisciplinary Research and Training

Biological science in the previous century was based largely on a reductionist, small laboratory, single investigator model - this is certainly true for immunology. The fundamental advances obtained from this approach are now being translated into improvements in the understanding and management of human infectious, immunological, allergic and malignant diseases. In parallel with these events, the completion of the human and murine genomes and the genomes of an increasing number of microbial pathogens and commensals has provided a biological blue print from which future advances will be boot-strapped. The completion of the human genome was made possible by enormous technological and computational advances. It is the marriage of

genetics, technology and hypothesis testing biology that will drive discovery in the first part of this century. It is interactions between basic and clinical scientists that will bring discovery to the bedside. Many students understand this implicitly, and challenge the faculty to create training programs that bridge these fields and approaches.

The research programs of many of our faculty already exhibit this type of networking approach. They continue to pursue important questions with specific model systems, but have formed collaborations across disciplinary and institutional borders to bring new approaches to their own research and to see that fundamental findings are applied to problems in humans. Examples include multidisciplinary approaches to study the genetics of infectious and autoimmune diseases and responses to vaccines, and for early diagnosis and treatment of type I diabetes. Such research programs will be attractive to students looking to work at these research interfaces.

A second approach to attract students interested in immunology - but who perceive a need for greater flexibility - is to give them just that. The training program in immunology is joining together with the programs in biochemistry, genome sciences, microbiology and pathology to provide this flexibility. Students interested in these programs will complete a common application form and designate one as their primary area of interest to which they seek admission. Once admitted, students will take their first two rotations in the admitting program, but are free to take a third (or potentially fourth) rotation and to perform their thesis work in laboratories of faculty from any of these five programs.

c. New Faculty and New Space

The Department of Immunology has two state-funded faculty positions to fill. We are actively engaged in a search at the present time. This will allow us to further strengthen our program. We have sufficient space to accommodate two new junior faculty. However, we will be challenged to accommodate their needs and those of existing junior faculty as their research programs mature and laboratories grow. This is a general challenge for the University of Washington School of Medicine. There are two possible solutions. A small amount of additional space will become available in current School of Medicine buildings when the Departments of Genome Sciences and Bioengineering move into new buildings on campus due for completion in 2005-2006. However, there will be considerable competition for this space.

The other potential opportunity is at South Lake Union. Under discussion is the vision for this site – who and what should be based there and will this site be used in particular to foster multidisciplinary research programs. For example, a major thrust in infectious diseases and vaccine development and testing is under discussion. This may provide an organizing force to lure certain programs, including a planned program in the genetics of vaccine responses involving some members of our faculty and faculty from other departments. This is also a potential opportunity to foster cross-disciplinary training of graduate students, but will need to assure that students at this site retain the relationships with other students, which are a key part of the graduate training process.

d. Funding

In the current economic situation, it is no surprise that the State of Washington is experiencing substantial budgetary deficits. As a consequence, state funding for the University of Washington was cut by 2% last year and the estimate cut for the upcoming academic year is 2-6%. The major effect of this is a reduction of support for faculty salaries. Faculty salary increases this past year could only be funded by increasing the fraction of their salary paid from their research grants. This is likely also to be the case this year. While this is feasible in the short term, this is a long-term threat to faculty retention and productivity. The reduction in state funding occurs at a time when the HHMI has reduced support for their investigators and the 5-year doubling of the NIH budget has been completed. Although both of the HHMI faculty members in the Department of Immunology recently underwent successful 5-year reviews, their HHMI budgets have been reduced significantly. At the same time, the NIH budget doubling has been completed and may actually fall in the upcoming years, so that competition for funding of research grants by the NIH is also likely to become keener. The HHMI has announced that they will discontinue their graduate fellowship program, removing a source of graduate student funding for which our students have competed quite effectively.

B. Research and Productivity

Faculty research productivity was described in the self-assessment and is not repeated here, rather here are described faculty characteristics and contributions as they relate in particular to the type of teaching environment for graduate students.

1. Breadth, Depth and Interactions

The Department of Immunology currently consists of 11 core faculty members (including 9 with primary and 2 with joint appointments), 8 adjunct faculty members, and 8 affiliate faculty members, who participate in the immunology graduate program. These 27 faculty include 12 professors, 8 associate professors and 7 assistant professors. This provides a good balance of senior and junior faculty for training of our students. In addition to the 9 faculty members whose primary appointments are in the Department of Immunology, the other 18 faculty members have their primary appointments in the Departments of Biological Structure, Medicine, Microbiology, Pediatrics and Radiation Oncology. Affiliate faculty (whose primary association and employment are with institutions other than the University of Washington) have their laboratories at the Benaroya Research Center at Virginia Mason Research Center, the Fred Hutchinson Cancer Research Center, or the Institute for Systems Biology. The Department also has three research assistant professors, who are associated with the laboratories of the core departmental faculty; research faculty in the Department of Immunology do not serve as thesis advisors for graduate students but often participate informally in graduate student training. There also are four affiliate faculty members at more distant institutions, who do not participate in graduate student training.

The department faculty have substantial breadth and depth in various aspects of basic and translational immunology: T cell development and function (Bevan, Bix, Dong, Farr, Fink, Greenberg, Gu, Hood, Nelson, Rudensky, Wilson); B cell biology (Clark, Foote, Lagunoff, Rawlings); normal and abnormal DNA replication, recombination, repair and epigenetic gene regulation (Bix, Concannon, Fink, Gu, Maizels, Wilson); normal and abnormal regulation of cell growth and death (Clark, Dong, Fink, Hockenbery, Wang, Ziegler); signaling in the immune system (Clark, Dong, Lagunoff, Nelson, Rawlings, Scharenberg, Wang, Ziegler); host defense to infection and cancer (Aderem, Bevan, Clark, Foote, Greenberg, Lagunoff, Kaja, Nepom, Wilson); autoimmunity, tolerance, immune recognition and immune evasion (Aderem, Bevan, Concannon, Dong, Elkon, Fink, Gorman, Greenberg, Hood, Lernmark, Nepom, Rudensky, Strong, Wilson). An overarching and common interest is the genetic basis for normal and abnormal immunity. These shared interests are reflected in collaborative interactions that have developed over the years, which are evident from faculty biosketches (Appendix Q) and trainee publications (see below). They are also reflected in joint laboratory meetings (for example, those between Bevan, Bix, Fink, Gorman and Rudensky; Dong, Kaja and Wilson; Aderem and Wilson) and shared interest groups, such as the Seattle Autoimmunity Research Club (Dong, Elkon, Gorman, Lernmark, Nepom, and Rudensky are the core faculty) and B cell signaling group (Clark, Dong, Rawlings and Scharenberg). Thus, productive interactions amongst training faculty are the rule and result in cross-laboratory interactions for our students and post-doctoral trainees.

2. Balancing Research with Teaching and Service

The teaching load in the Department of Immunology is modest. There are two survey courses - a large (~150 students) undergraduate lecture course (IMM 441) in the fall quarter (30 hours over 10 weeks), and a large (~100 student) course for first year medical students in the winter quarter (23 hours over 10 weeks) of each year. At the graduate level, there are two advanced immunology courses that are taught from the literature – Advanced Immunology (IMM 532) is offered each winter quarter (45 hours over 10 weeks), and Host Defense to Cancer and Infection is offered every other spring (20 hours over 10 weeks); the former course has an enrollment of ~25 graduate students and the latter an enrollment of ~15 students. The other classroom-based course – Topics in Immunology (IMM 534) - is offered in the spring quarter of each year and is mandatory for and restricted to first and second year immunology graduate students. In this course, students evaluate and critique one or two recent research publications and use these as a springboard for generating a research proposal with a faculty member acting as advisor; this is a highly successful course that helps to prepare students for the qualifying and general examinations (see section F). One member of the faculty, Nancy Maizels, is jointly appointed in Biochemistry, and organizes and teaches in the survey course in Biochemistry for first year medical students (HuBio514/524); she also organizes a 5-week course during the winter quarter (Genetic Instability and Cancer) as part of the multidisciplinary molecular and cellular biology curriculum, which is a required core curriculum for graduate students in the biomedical sciences. The department also gives 2-4 lectures per year to first year dental students (DENT 550).

Shown in Appendix D is the distribution of formal teaching in these courses for the core faculty members of the department in the past three years. There are two general features that are evident. 1) With two exceptions, no faculty member has more than 15 hours of classroom teaching responsibilities annually. Both Nancy Maizels and Chris Wilson teach more classroom hours, reflecting their commitment to organizing and teaching first year medical students. This group of students for the most part responds best to a less diverse group of instructors and a more cohesive curriculum and teaching style, whereas graduate student teaching is focused on more in-depth and experiment-based teaching from individuals with a particular interest and expertise for that topic. 2) The leadership of the other formal courses is assigned by the department chair, and currently is rotated between the core faculty with each serving in that role for an average three year term. The course organizer assigns lectures to different faculty members based in part on their areas of expertise after discussion with the other course chair and the department chair to assure that allocation of time amongst faculty is equitable. New faculty are not assigned formal teaching responsibilities in the first year of their appointment. New assistant professors are not asked to organize a course before their 4th year, by which time they will have taught both in IMM 441 and in IMM 532/533. The course chairs are asked to provide feedback on the teaching performance of faculty teaching in their course. The quality of teaching is also evaluated formally by the University-based student evaluation system. Both a numeric score and written comments are provided to the faculty member. The department chair receives copies of the numeric scores.

Of course a great deal of teaching occurs in less formal settings. Corporately, these include weekly research-in-progress seminars, monthly journal clubs, and joint lab meetings. Although each of these activities has a course number, we have not listed these because they are shared by all faculty equally. Of central importance to our graduate students is the one-on-one teaching and mentoring by their advisors that takes place through laboratory research projects. The contribution of individual faculty as advisors can be evaluated in part by referring to the Supervisory Committees they have chaired (Appendix E).

3. Recognition of Teaching:

Teaching is rewarded by careful consideration of teaching contributions in annual reviews for merit increases and in relation to promotion. Outstanding teaching evaluations are also commonly recognized by a written comment from the chair to the faculty member. In addition, over the past few years a tradition has arisen in which the organizers of the two large classroom courses (IMM 441 and HuBio 523) recognize each other's contribution with a distinctive bottle of red wine at the end of the quarter.

4. Service:

Faculty also contribute importantly through service on departmental, School of Medicine and University-wide committees. Committee service over the past three years is shown in Appendix F.

5. Development and Mentoring of Junior Faculty:

Because the department is small, the senior faculty members feel that they are collectively responsible for mentoring of junior faculty members of the department. Faculty research progress is ascertained on a regular basis through *ad hoc* discussions and through joint laboratory meetings - Mark Bix's laboratory participates in a weekly meeting with the Bevan, Fink, Goverman and Rudensky laboratories, and the laboratories of Chen Dong and Murali-Krishna Kaja meet every other week with the Wilson laboratory. All of the faculty hear about their research through presentation by students and post-doctoral trainees from their laboratories at research-in-progress seminars. Feedback is given openly in these settings and also in one-on-one discussions when indicated. Senior faculty also review drafts of grant applications and manuscripts.

The Chair meets with junior faculty annually to evaluate progress. The faculty member submits an updated curriculum vitae and a self-evaluation that includes a review of ongoing research projects and progress, funding and pending applications, publications, invited talks, teaching and service over the past year. The chair also has copies of teaching evaluations for review. At the meeting performance, problems and plans for the future are discussed, and the chair provides a verbal evaluation of progress towards meeting criteria for re-appointment or promotion. A written summary of the meeting is provided to the faculty member, to which they may respond if they feel it is indicated (this has not happened to date). The appointment and promotion criteria of the department are shown in Appendix G.

6. *Professional Staff Development:*

Support staff are encouraged to participate in training relevant to their positions through the University of Washington Training and Development Program. The University offers a variety of courses ranging from computer training to career development. In addition, staff can participate in the University of Washington tuition exemption program and take up to 6 credits each quarter. We are able to recognize outstanding achievement by professional staff through salary in-grade increases. In addition, laboratory personnel can be rewarded by attending scientific meetings relevant to the ongoing work in the laboratory.

C. Relationships with Other Units

The field of immunology and the research interests of our faculty range from the exploration of fundamental biological processes and principles, to the application of these findings to better the understanding, diagnosis and management of human diseases. This is reflected in part by cross-appointments of our core faculty in the other departments, which include Biochemistry, Medicine, Microbiology and Pediatrics. Similarly, our adjunct and affiliate faculty have primary appointments in the Departments of Biological Structure, Medicine, Pediatrics, and Radiation Oncology. There are also many informal collaborative and training relationships between our faculty and those from other departments in the Schools of Medicine, Public Health, and Dentistry, and in the Colleges of Arts & Sciences and Engineering. Moreover, the research and training environment of the Department of Immunology and the University of Washington is enriched by neighboring and affiliated institutions, including the Fred Hutchinson Cancer Research Center (FHCRC), the Benaroya Research Institute at Virginia Mason Research Center (BRI), and the Institute for Systems Biology (ISB). The FHCRC is one of the foremost cancer research centers in the nation and consistently ranks in the top few institutions in NIH support for cancer-related research. Together the UW and FHCRC form the Seattle Cancer Care Alliance, forging an extraordinarily strong partnership for basic, translational and clinical research of cancer and cancer-related disorders. The BRI has in the past decade grown to become a robust center for the study of human immunology and genetics, including in particular the study of autoimmune diseases and genetic disorders of DNA repair (e.g., ataxia-telangiectasia and Nijmegen breakage syndrome). The ISB was founded by two members of our faculty (Leroy Hood and Alan Aderem) to facilitate the application of global discovery technologies to the

understanding of complex biological processes and genetic traits. The faculty of the immunology graduate program are derived from these four institutions, which are in close geographic proximity. Each of the other three sites has a critical mass of scientists and facilities conducive to graduate training. Together these institutions, and the greater Seattle academic and biotechnology community, provide an unusually open and collegial environment in which collaborations and open sharing of ideas and reagents take place. Thus, training of students in our program occurs in a rich, open environment, which is intellectually stimulating, scientifically diverse and strongly interactive.

A formal affiliation between the University of Washington and the FHCRC was finalized several years ago. This affiliation was used as a blue print to develop a formal affiliation between the Department of Immunology and the Benaroya Research Institute, which was approved in 2001. Through this affiliation, immunologists at the Benaroya Research Institute, after review and approval by the voting faculty of the department, are proposed to the Dean of the School of Medicine for appointments as affiliate faculty. Core faculty of the Department of Immunology participate in the evaluation, selection and recruitment of prospective immunologists to the BRI, to assure that they have qualities that would make them appropriate for affiliate appointments in the Department of Immunology. Once appointed, they participate actively in all aspects of the Department of Immunology, including the training of graduate students and formal and informal teaching activities. The BRI contributes to the cost of the graduate program in proportion to the fraction of students that train in their laboratories. We are actively pursuing the establishment of a similar affiliation between the ISB and the Department of Immunology. The goal of these

affiliations is to enhance the diversity of laboratories available to our students, while maintaining cohesion among students and faculty. This is assured in several ways. For their first rotation, all students are placed in a laboratory based at the University of Washington. They are then free to rotate in laboratories at other sites and may choose to pursue their thesis work at one of the other sites. Students at other sites come to the University weekly at minimum to attend departmental seminars and/or journal clubs.

The greater Seattle immunology community also includes scientists working at leading biotechnology companies, including CellTech/Chirosciences, Corixa, Dendreon, Amgen, ICOS, Zymogenetics, and others, who are engaged in immunology research and drug development. Careers in biotechnology are appealing to many of our students and the proximity of these companies is an attractive option for individuals seeking to remain in the Seattle area following the completion of graduate school or post-doctoral training. The strategies we have used to enable them to learn more about careers in industry are described in section E below.

D. Diversity

1. Recruitment of Graduate Students from Underrepresented Racial/Ethnic Groups

The recruitment of underrepresented minorities is an important priority for our training program. As is well known, minority applicants are infrequent, and attempts must be made to both recruit applicants from a very limited pool, and to encourage the pursuit of scientific careers by a larger percentage of college-bound minority youth. We have adopted a proactive strategy to identify and recruit minority applicants. Through these efforts, we successfully recruited Kevin Otipoby, a graduate of Washington University and a member of the Comanche Tribe, to our 1994 entering class, Robert Alaniz, a Hispanic graduate of Texas A & M University to our 1995 class, and Alena Gallegos, a Hispanic graduate of the University of New Mexico entered our 2000 class (Appendix H). These are excellent results given the small size of our entering classes. Our plan has the following components:

(a) Representation at National Meetings of Minority Students. Robert Alaniz has helped us to take a pro-active role in recruitment of minority students by attending as our representative the Society for Advancement of Chicanos and Native Americans in Science in 1999. This is a national meeting (see www.SACNAS.org), which is held each year and attracts a substantial numbers of potential students. He has maintained contact with the organization as a way to encourage further recruitment. We intend to send a student representative to this meeting at least every other year.

(b) The University of Washington STAR (Stipends for Training Aspiring Researchers)/

BRIDGES (Biomedical Research Identification of Graduate Education Successful Student Support Services) programs (<https://depts.washington.edu/bridges4/>). The STAR and BRIDGES programs at the University of Washington bring to the UW campus each summer a group of approximately 30 minority students from across the country. These students work in faculty laboratories, selected based on mutual interest. A stipend and transportation costs are provided. Faculty laboratories are chosen based on their commitment to this effort and history of successful mentoring. There has been ongoing participation by our faculty. Drs. Concannon and Wilson have hosted STARS students in their laboratories during the summer. This program builds on an existing foundation of efforts by faculty, many of whom have or have had minority students working in their laboratories on research projects and as laboratory assistants.

(c) Graduate School Recruitment Visits: Each year the Graduate School sends representatives to visit and meet with prospective students at a number of schools which traditionally have disproportionately provided undergraduate education to minority students. During the previous year these included Alcorn State, Jackson State, Tougaloo College, New Mexico State, University of New Mexico, Atlanta University, and Florida A&M. The Graduate School is also represented at the national and certain regional Minority Research Symposium.

(d) The National and Western Name Exchanges. These programs were established over ten years ago to facilitate access of individuals from underrepresented minorities to graduate programs nationally or in the western region of the United States, respectively. Students can contact the graduate school at any of the participating institutions, and receive a form that allows

them to indicate institutions and programs from which they would like to receive more information. The coordinating center (at the University of Washington) then forwards the information to the relevant institutions and through them to the appropriate graduate programs. These programs then send to the students information and applications.

(e) Personal Contact Through Immunology 441. Every effort is made to use this large undergraduate course as a recruitment vehicle. In particular, personal relationships that develop between faculty members and students can provide a basis for consideration of a research career.

2. Recruitment and retention of faculty from underrepresented groups

Of the eleven core faculty members in the Department of Immunology, three are women (one professor and two associate professors) and three are of Asian origin (one of whom was born in the United States). Of the three research faculty members of the Department of Immunology, one is a woman. A woman faculty member of African ancestry will join the Department of Medicine with an adjunct appointment in the Department of Immunology later this year. Teaching and committee service by these faculty members is similar to the department as a whole.

E. Degree Program

1. Objectives and Criteria for Success

Our training program is rigorous and provides graduate students with the opportunity to pursue an understanding of immune responses in molecular detail in an environment in which the relevance to human health and disease is emphasized. Through this, students acquire the intellectual and technical skills needed to define and address important research questions, and to effectively convey what they have learned to others in writing or through oral presentations. Our goal is to prepare students for future careers in academic, biotechnology and pharmaceutical research careers, and for teaching at the undergraduate and graduate level. This curriculum also provides a foundation for those individuals who ultimately elect an alternative career, such as publishing or patent law. The typical course of instruction is shown in outline form in Appendix I, and a detailed description of the Department of Immunology Graduate Program Requirements is shown in Appendix J.

2. Standards for Success

Students are admitted to the graduate student program with the goal of pursuing the Ph.D. degree. A terminal master's degree is granted to students in good standing who successfully pass their qualifying examination and who choose not to complete, or are unable to satisfactorily complete, their thesis. Alternatively, a master's degree may be granted to students who successfully complete their coursework but who are unable to pass the qualifying examination; these students must prepare a written master's thesis based on the research work completed to that time. We judge success by the fraction of students receiving the Ph.D. degree, the time to

completion of the degree and the placement of students in appropriate positions at the time of graduation. Our goal is to have more than 75% of entering students receive the Ph.D, to have the average time to receipt of this degree be 5-5.5 years, and to have more than 80% pursue post-doctoral training after graduation, with the remainder entering another career that utilizes the skills they acquired in graduate school. Each student must publish at least one high-quality research paper. We seek to have a high degree of overall satisfaction of our Ph.D. graduates, as indicated in the graduate school survey.

We have achieved considerable success in meeting these goals. For the 40 individuals in the entering classes for the period 1989 through 1996, one individual is deceased and one individual transferred to the Molecular and Cellular Biology Program. The balance of the 38 students completed the program; 81.6% received doctoral degrees and 18.4% Master's degrees. The average time to completion of the degree is just over 5.5 years, which is our goal (Appendix L). More than 85% of students in the past three years have pursued post-doctoral training in good laboratories on completing the program (Appendix M). The publication record of our students is solid.

Student Publication Record, 1991+

Year	Number of Publications
1991	0
1992	0
1993	4
1994	5
1995	9
1996	11
1997	14
1998	16
1999	15
2000	14
2001	10
2002	8

Student satisfaction has been high for nearly all aspects of the program, with the least satisfaction related to preparation for teaching. This is a common concern of students in research-based graduate programs. We have responded by increased supervision and interactions of the course organizer(s) in IMM441 with the second year students acting as teaching assistants. In addition, we are attempting to place greater emphasis on student journal club presentations, in which students are coached by a faculty mentor other than their thesis advisor in how to provide an appropriate background review of the literature, critique an article(s) and outline future directions. Students also have the option of volunteering for additional teaching assistant experience, but most favor focusing their time on their research.

For some students, the receipt of a master's degree and the redirection of their careers in another direction may be the most appropriate long-term outcome and in their best interest. This is often the case for those students who elect to leave having successfully completed all their

requirements. In these cases, we feel that a measure of success has been achieved. However, approximately half of those who have left with a terminal master's degree have left because they were not successful in meeting the requirements of the program. For these students, a major goal is to assist them in identifying other career options that are more appropriate for their skills and career commitment. Not surprisingly, satisfaction of students receiving the M.S. is less than for students receiving the Ph.D.

3. Student Mentoring and Career Guidance

The graduate program coordinator, Peggy McCune, works with students throughout their career to assist them with the logistics of the department, graduate school and University. The faculty member servicing as first and second year graduate student advisor mentors first year graduate students – assigning the initial rotation, meeting with them at least quarterly, advising them on subsequent rotations, discussing difficulties that may arise and reporting on their progress at the first faculty meeting of each quarter. This provides a forum at which student progress and laboratory choices of the first year students are discussed; at the end of the first year the choice of thesis advisor reviewed and approved. After they choose a laboratory at the end of the first year the primary mentoring role is assumed by the thesis advisor. However, the graduate student advisor meets with second year graduate students at least twice during the second year to assure a smooth transition and to provide additional guidance leading up to the Qualifying Examination; the extension of the mentoring role of the graduate student advisor into the second year was initiated in response to a recommendation at the time of our last review in 1996. Once the qualifying examination is completed, the third year student forms a Supervisory Committee,

which assumes the mentoring role for the rest of their time in the program. As students near the time to completion of their thesis, the thesis advisor, Supervisory Committee members and other departmental faculty function as advisors and sounding boards about the next phase of their careers. This commonly consists of discussions regarding post-doctoral choices and the like, preparation of letters of recommendation and acting as broker to assist them in finding an appropriate position.

The majority of students who have graduated with the Ph.D. have gone on to careers in academic medicine, biotechnology or pharmaceutical research programs. The academic track is familiar to students. To enhance our students awareness of opportunities in industry, we have for seven years held an annual Department of Immunology Immunex/Amgen joint research symposium. This consists of 6 platform presentations in the morning (3 from the faculty of each institution) and two poster sessions in the afternoon. This is open to faculty, students and post-doctoral trainees and is enormously popular. This year, 161 have already enrolled for the symposium on April 23.

The interdepartmental program “What Can You Do With a Ph.D. in Biological Sciences” is a monthly seminar series to educate graduate students and postdoctoral fellows about a variety of other career options. This series provides graduate students exposure to scientists working in careers outside of academic medicine. Some of the past offerings have been “Science Education Careers”, “Careers in the Computer Industry”, “How to Get an Academic Position”, Careers in Clinical Research and Regulatory Affairs”, and “Careers in Science Policy”. This program is

organized by the graduate students in biomedical science with support from participating departments, including ours.

The Department of Immunology Website, <http://depts.washington.edu/immunweb>, provides students and postdoctoral fellows with links to resources for career development, training and funding opportunities. The Department maintains a database of all students who have completed the program. We follow-up with the graduate students or their mentors to track their careers.

F. Graduate Students

1. Recruitment

A major source of outstanding students is word-of-mouth referral by faculty of talented undergraduates and research technicians from scientists at other institutions. The departmental web site and Peterson's guides are also a source of important information about our program. Once applications are received, the departmental admissions committee reviews them and those judged to be qualified in principle are invited to visit the campus at departmental expense. We typically invite ~25 students to one of two interview sessions held in February. These visits begin with a Thursday evening poster session held in the department. This is attended by one or more members from nearly all departmental laboratories, and refreshments are served to facilitate a casual, interactive atmosphere. After this, a group of current students takes the prospective students to dinner. This is followed by interviews and facility tours on Friday, and an informal dinner at the home of one of the faculty. This is attended by the prospective students, a representative group of current students, and faculty. We typically make offers to one-half to two-thirds of those interviewed, and make great efforts to "sell" the selected students on the program at the Friday dinner.

2. Graduation statistics

Below is a table which presents data for all graduate students entering the program, graduation statistics and statistics for individuals leaving the program prior to getting their Ph.D.

Academic Year	Entering Program	Graduating with Ph.D. (To date)	Leaving Program Prior to Completion of Ph.D.
1989-1990	2	2	
1990-1991	5	4	1 (MS)
1991-1992	5	4	1 (MS)
1992-1993	5	3	2 (MS)
1993-1994	8	7	1 (MS)
1994-1995	6	4	2 (MS)
1995-1996	7	6	1 (Transfer to MCB)
1996-1997	2	1	1 (Deceased)
1997-1998*	2	1	
1998-1999*	6	1	1 (MS); 1 (Left Program)
1999-2000*	5		1 (MS)
2000-2001*	6		1 (Transfer to MCB)
2001-2002*	7		
2002-2003*	9		

*Note: Graduate students from the entering class of 1997-present are still completing their studies; therefore the numbers from 1997+ are not complete.

Since the inception of our graduate program, 75 individuals have entered (data for 1997 to the present is not complete as students are still working towards their degrees). Of these students:

33 received the doctoral degree

9 received a master's degree

2 transferred to the Molecular and Cellular Biology Program

1 left the program

1 is deceased

29 are still in training

3. Inclusion of students in governance and decisions

At the annual departmental retreat, which is held in September at the time new first year students

join the program, the entire graduate student body meets to elect members to represent them at departmental activities and on committees. These include:

- 1) Monthly faculty meetings: The graduate students each year elect 2 individuals to share in representing the graduate students at the monthly department faculty meetings. The graduate students are active members of the meeting, providing information regarding graduate student concerns, providing feedback to faculty regarding programs, faculty recruitment and the graduate student application process.
- 2) Graduate and Professional Student Senate is attended by one of two representatives.
- 3) Seminars: The graduate students annually chose the Sandra Clark Lecturer. They invite the seminar speaker to the University, meet intensively with this individual and at the end of the visit host a dinner for the speaker.
- 4) Sandra Clark Poster Award Jury: A joint graduate student (3)/faculty(2) committee judges student posters presented at the annual Department of Immunology Retreat and presents a \$1,000 award to the best poster.
- 5) Annual Student Recruiting: Fourth year graduate students organize and lead graduate student participation in the student recruiting process each year. They are responsible for transporting the applicants, providing tours to our affiliated sites (Benaroya Research Institute, Fred Hutchinson Cancer Research Center and Institute for Systems Biology) and entertaining the applicants. The graduate students provide important information about our program to applicants and their

opinions about prospective students are considered in the faculty decision process regarding student selection.

4. Appointments and Funding

All Department of Immunology graduate students receive a graduate student appointment throughout the duration of their graduate studies. As noted above, the average time to graduation is ~5.5 years, and students must complete their studies and defend their thesis within seven years. The seven year policy was instituted several years back and has resulted in a lowering of our mean time to graduation by focusing both students and advisors on the goal of timely completion. The faculty reserve the ability to waive this limit if special circumstances indicate that an extension is warranted.

Student stipends are paid throughout the period of graduate study at the Basic Science Department Predoctoral Research Associate 2 Level. To remain competitive on the national level, the Basic Science Heads of the School of Medicine annually evaluate graduate student stipends, comparing them to like programs within the United States and, in particular, at our competitor programs in California. For academic year 2003-2004, a 2.5% increase effective July 1, 2003 has been approved by the Graduate School and will be implemented by the Department of Immunology.

A first year graduate student rotates in a different laboratory for the first three quarters of their appointment and the Department guarantees their support. Each year we have successfully

submitted a request to the Graduate School Fund for Excellence and Innovation for nine month's of stipend and tuition support for a first year graduate student. We have just successfully applied and have funding for this position through 2005. Some of our incoming graduate students have received Howard Hughes Medical Institute Fellowships, which provide a stipend of \$21,000, tuition and fees, and an allowance for research expenses. Entering graduate students not covered by the Graduate School or Individual Fellowships are supported by the Department of Immunology recapture funds. Occasionally, first year students are supported from one of our training grants. First year Medical Scientist Training Program students are supported by the M.S.T.P. federal training grant which is administered by the Department of Pathology.

The Department has a recently renewed (Appendix O) National Institutes of Health NCI training grant in its 17th year with nine predoctoral training slots, a newly funded Cancer Research Institute Predoctoral Emphasis Pathway in Tumor Immunology Training Grant with 6 predoctoral training slots, and a floor position on the Molecular and Cellular Biology predoctoral training grant. In addition graduate students can compete for competitive positions on the Molecular and Cellular Biology Predoctoral Training Grant. Each summer, the Training Grant Committee reviews applications and proposals from graduate students and awards the open positions. Typically a student with a successful application is awarded funding for a period of up to three years. Students not supported by one of the mechanisms above are supported by their advisors' research grants. The source of support for students from 1999 to the present is shown in Appendix P.

5. Supervision of the Educational Process

During the first three quarters of a graduate students appointment they attend required and elective courses and doing three laboratory rotations (see Appendices I and J). At the end of each quarter (with the exception of summer rotations), each student presents a short departmental talk, summarizing the experimental problem addressed, the techniques used to approach it, and any preliminary data acquired by the student during the rotation. MSTP students have finished rotations when they join the Department, and are only required to present a 'rotation' talk at the end of Autumn Quarter during their first year, giving the Department an opportunity to view them on a plane with the other new graduate students. The rotation advisor completes a written evaluation of the student's performance during the rotation and the rotation talk, and discuss this evaluation with the student. MSTP students' advisors submit an evaluation only for Autumn Quarter when the student gives the rotation talk. The evaluations are part of the student's academic record. The quality of first year student rotation performances, presentations and grades in coursework are reviewed during the first faculty meeting following the end of each quarter, in a faculty only executive session.

Each graduate student is required to take the Qualifying Examination during July immediately following his or her second year of classes. MSTP students take their Qualifying Exams following their first year of graduate classes. The qualifying examination is first and foremost an important educational exercise. It is meant to help the student acquire the ability to review the literature critically and to formulate skills necessary to develop research proposals, which provide an important foundation for a career in immunological investigation. It also helps the

faculty to identify areas in which additional attention or effort is needed. Students may receive advice on the choice of topics and the development of the outline for their proposal from their advisor or other faculty members. The topic for the Qualifying Exam must be cleared with the Qualifying Examination Committee by submission of an official request to the Chair of the Committee by May 15. This request should consist of a short statement of the dissertation proposal and a brief outline of the Qualifying Exam proposal, totaling less than one typewritten page. The development of the proposal thereafter, including the articulation of the hypotheses and experimental approaches, is to be done by the student without input from the advisor. Examples of previous immunology Qualifying Exams are available in the Immunology Conference Room library. The examination consists of 6-page written research proposal and an oral defense of the proposal before a qualifying examination committee, consisting of 4-5 faculty members. Faculty serve on a rotating basis on this committee; the student's thesis advisor does not participate. The oral examination takes approximately 1-1/2 hours. Students are notified about the outcome of the examination within 48 hours and specific comments are provided to them within one week. Students may either pass, be asked to prepare a written revision in order to pass or be asked to re-take the examination. Each student is permitted to retake the examination once, at a date to be scheduled by the student and the Committee, but usually not more than 2 months after the first attempt. This is a rigorous examination and has been a source of concern for many of our students. Over the seven years since our last review, at which time concerns about inadequate preparation of students for this examination were raised, we have redesigned the Topics in Immunology course (IMM 534) to facilitate students gaining the skills

needed to successfully complete the qualifying examination. This course has been very successful and has now been emulated by other graduate programs, e.g., pathobiology.

Students who have passed the Qualifying Exam then form a Supervisory Committee in accordance with graduate school guidelines. This committee will serve as the General Examination committee. The General Examination is taken near the end of the third year of graduate study; MSTP students take the General Examination at the end of their second year or beginning of their third year in the Department. The focus of the General Examination, as for the Qualifying Examination, is in defining a scientific problem and describing the means to approach it. But the General Examination is based on the research proposal developed with the thesis advisor and undertaken by the student in the laboratory. The emphasis is NOT on data at this stage, but on strategy. The written section of the examination consists of a description of the background information, specific aims, methodology, preliminary results, and the significance to the field of immunology. The student presents, discusses and defends this proposal in the oral part of the examination, which takes approximately 2 hours; after a brief discussion, the Committee will notify the student of its decision. The chair of the Examination Committee (chosen from the members and excluding the Thesis Advisor) writes a summary of the student's performance, including any formal recommendations (such as coursework) made to remedy any weakness in background knowledge. After passing the Exam, the student has officially qualified for the Ph.D. program in the Department of Immunology. Failure of the General Exam may occur if the examining Committee believes that the student has not identified a satisfactory research problem and an experimental approach that can be expected to illuminate aspects of this

problem, or has failed in assimilating sufficient background to place the problem in an appropriate scientific context. A student may retake the General Examination once.

Once the general examination is completed, the student pursues the research project under the direction of the thesis advisor with annual review by the Supervisory Committee. When the committee feels that the student is ready, the candidate is instructed to prepare and present a dissertation demonstrating original and independent investigation and achievement. The dissertation should reflect not only mastery of research techniques but also the ability to select an important problem for investigation and to deal with it competently. When the Supervisory Committee agrees that a doctoral Candidate is prepared to take the Final Examination, the Dean of the Graduate School is informed, and a Reading Committee is selected from among the members of the Supervisory Committee. The defense consists of a public seminar, immediately after which the Supervisory Committee meets to sign the Warrant for Final Examination for the Doctoral Degree. MSTP students must defend their dissertation before returning to the clinical part of the program.

Recognizing the value of learning to write scientific prose in a clear and concise fashion, it is required that students will have published or accepted for publication one or more first-author peer-reviewed manuscript describing original research prior to graduation from the doctoral program.

6. Grievance Procedure

We seek to informally resolve grievances by being accessible to student concerns through multiple avenues. These include the graduate program coordinator, who is warm and receptive to hearing about student concerns and who brings them to the attention of the first and second year graduate student advisor and/or the Chair, if appropriate. Students also may raise concerns directly with their thesis advisor or thesis committee members, the graduate student advisor or the Chair. When this is not sufficient, graduate appointees who believe they have been subjected to unfair treatment in the administration of academic policies may seek formal resolution of their complaints. The Department of Immunology follows the Academic Grievance Procedure outlined in Graduate School Memorandum No. 33. Students seeking resolution of their complaints must initiate either an informal conciliation or file a formal complaint within 3 months of the complained of incident. The student is encouraged, but not required, to first attempt to resolve a grievance with the faculty or staff member(s) most directly concerned. If the student attempts informal conciliation, the student must initiate this process within 3 months of the complained of incident by requesting one of the following persons to conciliate the grievance: Chair of the Department of Immunology or the Dean of the School of Medicine. If the discussion with the faculty or staff member(s) concerned, facilitated by the Chair or Dean, does not resolve the grievance, the student may request the Graduate School to assist in an informal resolution. In such a case, the Dean of the Graduate School may request the Graduate School to assist in an informed decision. If the student is dissatisfied with the informal conciliation, he or she may file a formal complaint with the Dean of the Graduate School within

10 days of the conclusion of the attempted informal process. Graduate School Memorandum No.

33 outlines the formal complaint process.