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Report of the Review Committee for the Interdisciplinary Ph.D. Program in Molecular and Cellular Biology (MCB) at the University of Washington

Review Committee and Site Visit

The members of the review committee were William M. Sugden, Professor, Department of Oncology, University of Wisconsin-Madison, Daniel S. Kessler, Associate Professor, Department of Cell and Developmental Biology, University of Pennsylvania, Helen Sherk, Professor, Department of Biological Structure, UW, and Yongmin Kim (chair), Professor, Department of Bioengineering and Department of Electrical Engineering, UW.

The formal review of the program took place on December 6th and 7th, 2010 (the site visit schedule is attached). The committee met with the program Co-Directors, faculty, students and staff. In addition, the committee met with the MCB Steering Committee.

Overall Evaluation

The MCB program is an exceptionally strong and successful interdisciplinary graduate training program. It is an excellent role model for interdisciplinary training and collaboration in the University of Washington and elsewhere. The MCB faculty is outstanding in both their research activities and involvement in the MCB program. The Co-Directors of MCB are fully engaged and committed to the success of the students, and have performed exceptionally well in leading this large and diverse program. The applicant pool for MCB is outstanding, and the matriculating students perform exceptionally well in all aspects of academic and research activities. About 90% of matriculating students complete the Ph.D., most do so on time and with multiple peer-reviewed publications, and most go on to use their Ph.D. professionally. The administrative staff is excellent and plays a key role in the program's and students' success. This exceptionally successful program should continue in its current form. Towards the end of our report, we make some suggestions to further increase the excellence of the MCB program.

Quality of Program

A key strength of the program is the high quality of the students. The applicant pool is large, averaging about 340 per year over the last 5 years, with many applicants from premier universities. Attracting talented applicants is only half the battle; the other half is recruiting them into the program, and the MCB program has done well here, with a recruitment rate of 35%. The qualifications of the successful applicants are outstanding: average GPA of entering students during the past 5 years has risen to 3.72, and almost all have had substantive research experience. Many faculty commented on the increase in the caliber of incoming students compared to the late 90s and early 2000s, a remarkable achievement considering the high quality of students during that earlier time period. Equally important, the selected students are resourceful, self-reliant, and strongly motivated. These qualities are important for successfully completing this relatively unstructured interdisciplinary program, just as they will be for success in scientific careers beyond graduation. The high quality of MCB students is widely appreciated among the faculty. Even those faculty members with access to students enrolled in

departmental graduate programs are keen to bring MCB students into their labs because of their reputation for excellence.

The MCB faculty is a major strength, covering a broad swath of biology and offering the students an abundance of well-funded laboratories in which to do their thesis research. Many are leaders in their fields; they include members of the National Academy of Sciences, and a recent Nobel laureate. The recruitment of new faculty to the program appears thoughtful and successful. The care of coupling new clinical faculty with experienced faculty is particularly impressive.

The Co-Directors, Dr. David Raible at the UW and Dr. Michael Emerman at the Fred Hutchinson Cancer Research Center (the Hutch), are universally described by students and faculty as outstanding. They are exceptionally successful in leading this large and diverse program. The effort that they put into this program is immense. They handle not only administrative oversight, but contribute extensively to teaching, meeting weekly with the first-year students, and serve as advisors to first-year students. They also are the chief resource for both students and faculty when problems arise. In addition, they play an important role in student recruitment. Finally, they are responsible for shaping the future direction of the program.

The MCB program is challenging in that it places an unusually large amount of responsibility on each student for determining his/her own path to a Ph.D. Because there is no common curriculum, students choose all of their courses, and also their TA requirements or alternative service experience. Students also decide whether to expand their education by enrolling in any of several concurrent programs; these include the MBA program offered at the UW Bothell campus, an MS in Epidemiology, and summer externships at local biotechnology companies. During their first year, students choose their thesis advisor. Students seek guidance from the Co-Directors and, they report, from more senior students. The proposed “Areas of Interest” committee, discussed below, would be another resource for students, particularly when they are choosing courses and laboratory rotations. Despite this rather daunting array of choices, the great majority of students seem to thrive in the program. The average time to graduation, 5.7 years, compares favorably with similar graduate science programs. The graduation rate is excellent, with on average 88% of entering students receiving Ph.D. degrees, based on data through 2004 (some students from more recent classes are still enrolled), and 7% receiving MS degrees. The drop-out rate is miniscule, about 5% for those same years. All of the students we interviewed expressed a high level of satisfaction with the program. Notably, many students said that they joined the MCB program because, when they visited, the students already in the program were happy with it.

Both faculty and students commented that the Administrative Staff of the MCB program is excellent. All pointed to their pivotal role in tracking students, tracking funding, coordinating the program between the University of Washington and the Hutch, and serving as essential support for the MCB students in need. Many expressed the fear that if this exceptional group were to be undercut by reduced funding, the MCB program would suffer dramatically. It is clear that the Administrative Staff for the MCB program is essential to its success and should be maintained.

Probably the best testament to the strength of the MCB program is the success of the students after graduation. Of students who received degrees through 2004, and thus have mostly moved beyond their training years, more than 60% are scientists at academic or research institutions, or in industry; many in this group have faculty positions. Most of the other 40% are still in training, either as post-doctoral fellows or as medical residents. Many of the remaining

graduates are making use of their scientific training, for example as administrators in academic or research institutions, as patent lawyers, or as science writers.

Role in the Community

The MCB program is more strongly connected with the community than a typical academic unit. More than half of the students are doing their thesis research in laboratories that are located outside of the University of Washington, in one of the non-UW research institutes that are members of the MCB program (these include the Hutch, the Institute for Systems Biology, Seattle Biomed, and the Benaroya Research Institute). Furthermore, the program has ongoing relationships with local biotech companies to provide students with the opportunity to do a Biotechnology summer externship. Finally, many students choose to participate in programs aimed at improving science teaching and understanding in the community. These include programs directed toward high school science teachers (the Science Education Partnership), toward high school students (the BioQuest program), and toward the public at large (Portal-to-the-Public at the Pacific Science Center). As a consequence, there is unusually broad community awareness of, and appreciation for, the MCB program.

Role in University and Academic Discipline

Because of its size and the quality of its students, the MCB program is the major contributor to graduate education in the broad area of molecular and cellular science. Any interdisciplinary graduate program faces the question of redundancy with the graduate programs of individual departments. In practice, the MCB program offers an educational experience different from that of any departmental program because of its flexibility and wide range of options. Although some entering students are highly focused on a particular research area, many of the most talented ones are not, and are drawn to in the MCB program specifically because of its diverse array of possibilities. Excellent applicants frequently choose to apply to the MCB program in preference to any of the departmental programs, which has contributed to both the shrinkage of some departmental programs, and the suspension of at least one. Administratively, a large umbrella program like MCB would be more efficient than a number of small ones. From the students' point of view, being part of a larger entering class than they would find in most individual departmental programs is helpful, providing a support cohort that is particularly important in their first few years.

The research of MCB students is important to the laboratories in which they reside. This point is underscored by the strong interest that MCB faculty show in recruiting students into their labs. MCB students contribute to undergraduate teaching at the UW as teaching assistants without any TA remuneration. The program considers teaching experience to be an important part of students' training, and considerable effort is made to provide information about the different teaching opportunities that are available, and to optimize the match between these opportunities and student interests.

The MCB program should be commended for their initiative and effort on the recruitment and retention of students from diverse backgrounds. Their leadership resulted in ~10 other UW biomedical departments working together to present information on UW graduate education at three or more national conferences each year that many underrepresented minority students attend, which has increased the visibility of UW biomedical graduate programs. On top of this, the program has attained ~90% Ph.D. completion rate, which is impressive.

Resource Requirements

The level of funding provided to the MCB program by the institutions has been adequate. Two main uses of the funding for the MCB program are financial support to students (who do not bring their own external fellowship) during their first year and support for 4.5 FTE support staff positions. After their first year, students are supported from non-MCB sources, including research grants, training grants, and fellowships. The support staff, who are housed both at the UW and at the Hutch, work seamlessly together and are crucial to the smooth functioning of the program. Costs are shared by the University of Washington (mainly the Graduate School) and the Hutch. Recently, new member institutes to the MCB program started to make financial contributions. The School of Medicine has provided the office space for MCB in the Health Sciences Building. However, we were surprised to learn about the lack of financial support from the School of Medicine since SOM is a major beneficiary of the MCB program.

Comments & Suggestions for Increasing the Excellence of the MCB Program

Students: The students enjoy the sense of community the MCB program affords them during their first two years and would like to maintain that at some level in their ensuing years. They suggested that all would benefit from an annual seminar series in which MCB students would introduce their own research and detail its progress to the remaining students. It is not clear to what extent this kind of seminar would overlap with existing seminars. It is evident that the community of MCB students is an important asset to the program and fostering it during the last three years of graduate education would be desirable for some/many of the students.

Curriculum: Much of the desirability of the MCB program for the students who chose to join the program is its flexibility. It is clear that the current curriculum reflects that flexibility. The MCB program has no set curriculum that is required of all students. Instead, students choose a minimum of 6 short courses (5 weeks each) from a palette of 24 “core” courses. Both MCB faculty and students noted the low quality of certain course offerings, a lack of course offerings in specific research areas, and a lack of sufficient course numbers in the spring quarter. For example, 8 out of 24 courses relate to genetics (one of the program’s “Interest Areas”), while only 1 course relates to neuroscience (another “Interest Area”). In some of 5-week time slots, there are 6 different core courses available, while in another time slot there is only one course. To address these issues and to provide a mechanism for the review, development and planning of the curriculum, MCB should consider establishing a Curriculum Committee composed of faculty with a history of active participation in the teaching of MCB courses. This committee should undertake a comprehensive review of the current course offerings, collect course materials and evaluations, and survey both MCB students and faculty regarding the strengths and weaknesses of the courses offered. The goals of this curricular review would be: 1) to determine whether additional new courses should be offered in essential research areas not covered by current courses; 2) to determine if existing courses fail to meet student needs either in topic or quality, and recommend whether such courses should be eliminated or put under the direction of new faculty; and 3) to determine whether the course schedule should be revised to ensure a balance of course offering in all quarters.

The establishment of a standing Curriculum Committee, working together with the MCB Co-Directors and the chairs of the “Areas of Interest” (who can serve as Curriculum Committee members), will allow a regular review of the curriculum. This committee should report to the MCB leadership annually with recommendations designed to improve the quality and breadth of courses offered by the MCB program.

It is also evident that as research interests evolve the offered courses may become outdated, and those available during any quarter may not satisfy students' perceived needs or interests. One possible solution to this problem (which exists in all research universities today) would be to modify the requirements for the MCB program so that some of its required credits in course work be allocated to tutorial courses that could be organized by one or more faculty and interested students to address an emerging topic of interest to all participants. It would also be desirable to extend credit to courses that mentor students in public speaking and formal writing. While flexibility in the MCB curriculum is one of its perceived strengths, it is also clear that it lacks some necessary didactic courses. In particular, all surveyed indicated they need a course in statistics tailored to students of biomedical research. It appears that this need is being stymied by the Department of Biostatistics which, if correct, should not be countenanced. If the Department of Biostatistics is not willing to offer a service course needed by other departments and programs, then they should not object to MCB and/or other faculty developing and offering such a course.

We recognize that there are impediments to this course of action. The chief obstacle concerns the creation and implementation of new courses. Many faculty expressed an interest in teaching in MCB courses, but have reservations because for the majority of faculty, any time spent contributing to these courses is not recognized and counted as part of their teaching load by their home departments. The MCB program would be strengthened if departmental chairs recognized teaching effort in the MCB program and counted it as part of their faculties' net teaching load.

Committee Structure: For such a large graduate program, the MCB program has a minimal committee structure. The Steering Committee provides input from the member departments and institutes, its members being either proxies for departmental chairs or the chairs themselves. This large committee meets only twice a year, and much of its time is devoted to considering new appointments to the MCB faculty. There is also a small Admissions Committee, and a Recruitment Committee, dealing respectively with selection of the applicants to be interviewed, and the recruitment of those offered admission.

The MCB program could benefit from several changes at an administrative level. One would be for the Steering Committee to be changed into an abbreviated Oversight Committee consisting of the two Co-Directors and representatives of the Deans of the Graduate School and the School of Medicine, the corresponding representative from the Hutch and a few others (e.g., dean's representative from the College of Arts and Sciences or local biotech executive). This Oversight Committee would provide advice and help the Co-Directors have access to those responsible for this interdisciplinary program and avoid the potential conflicts of interest of chairs who sit on the present Steering Committee. The second change would be to constitute a committee termed, perhaps, the Executive Committee. The committee would meet more frequently, e.g., monthly, to discuss in depth more program-related topics, and decide issues important to MCB faculty and students. This committee is similar to what the Co-Directors have proposed as an "Areas of Interest" committee. Its members ideally would include student representatives and faculty engaged in the MCB program who willingly spend the time necessary to benefit it. They could represent each of the proposed 8 "Areas of Interest". This committee has the potential to take on additional functions and relieve some of the load from the Co-Directors. For example, they could provide students with more information and guidance about courses, lab rotations and research relating to each of these areas. Also, they would serve as a group experienced in the intricacies of the MCB program and be candidates for becoming Co-Directors in the future.

Co-Director Succession, Leadership and Areas of Interest: Much of the success of the MCB program can be attributed to the Co-Directors' daily involvement, particularly with the first-year students. Their personal engagement with individual students is a major strength of the program. One requirement for the continued success of the MCB program is to identify the next generation of Co-Directors who will be as successful as are the present pair. This succession should be a high priority of those outside of the program who are responsible for its success (the Graduate School and/or the Oversight Committee). Candidates for Co-Director might be found among members of the proposed Executive Committee or "Areas of Interest" committee, since these individuals are strongly invested in the program, and are likely to have a more detailed understanding of it than the faculty at large.

The Co-Directors have proposed several Areas of Interest as a way of defining the research focus of the large and diverse faculty membership of MCB. We strongly support this approach, which will not only facilitate the student search for rotation and thesis labs, but also define subsets of faculty working in specific areas, and thus promote interaction and collaboration. Also, this expansion of the leadership structure will reduce the significant burden of responsibility current carried by the two Co-Directors and will strengthen the overall leadership of MCB, ensuring continued excellence of the MCB program.

Program Cohesion and Faculty Review: The Co-Directors identified program cohesion as an area where they would like to see improvement. The faculty is very large (250 members) and their expertise spans a great diversity of areas, so the common threads holding the program together are not easy to identify. The "Areas of Interest" approach seems like a good mechanism to help promote areas of cohesion within the broader program.

Given the large size of the MCB program, it is important that the faculty membership be limited to faculty showing an active involvement and commitment to MCB activities. To accomplish this goal, a set of MCB activities should be defined to specify the many different ways that MCB faculty may contribute to the overall goals of the programs. These program activities would include course lectures, course direction, committee service, student advising, attendance at program retreats and poster sessions, participation in recruitment activities, etc. Defining a list of MCB activities will not only allow the evaluation of the contributions of the current faculty, but also will suggest to newly joined faculty the many ways they may contribute to MCB. A minimum activity requirement should be established, perhaps in hours of service per year, for continued membership in MCB. A record should be kept of the contributions made by each individual faculty member in the defined areas, and an annual summary should be provided to each faculty member to confirm or correct the record. Faculty should be reviewed on a regular schedule (i.e., 33% of member faculty per year) to evaluate their contribution to and participation in MCB activities. Those with insufficient contribution can be removed from membership in MCB, or alternatively, could be placed on a 1-year probation during which they may increase their contribution to an acceptable level. Establishing such a system of faculty review will insure that MCB faculty are actively engaged in the training, teaching and advising missions of MCB.

Program Size: It appears highly desirable to increase enrollment in this program at least modestly (20%) over the next few years. Many of the faculty interviewed favored such an increase. In addition, the success of the program and excellence of the pool of applicants makes it likely that an increase in the enrollment would maintain the excellence of those admitted. Judging by the success that graduates have had in establishing science-based careers, there is a strong demand for this program's graduates. Note that only during their first year are students supported by the MCB program, so that an increase in funding by the

University would only be required during the first year of an expanded entering class. After that, the program would be, as it is now, self-sustaining. A larger increase in class size is more problematic because it might place an excessive burden on the Co-Directors and on the staff, all of whom appear to working at close to capacity effort.

Can this modest increase include an increase in students from abroad? Faculty trainers born abroad have volunteered to interview candidates in their home countries. Such interviews could guarantee excellence in applicants and provide a broader mix of outstanding students to the program. Although it is for the program to decide, we feel that there is some room for the MCB program to increase the number of truly outstanding students from abroad.

Future Funding: The MCB program is an exemplary interdisciplinary graduate program of the highest quality. The University of Washington should be proud of creating and nurturing this exceptionally successful program in such a short time and should promote, protect and reward this kind of excellence. The current funding for the MCB program appears adequate for its current class size and operation. This current level of funding is essential to maintain its exceptional quality in graduate training and its leadership role in interdisciplinary training and collaboration. It would be wise for the University of Washington and the Hutch to increase its funding for the MCB program to allow the enrollment to grow modestly. We believe that the overall return on investment in the MCB program would be one of the best we have seen at UW and other research-intensive institutions.

Due to the importance of the MCB program to the School of Medicine, SOM should restore the financial support that it used to provide (e.g., research assistantships and course support fee). The Graduate School, School of Medicine and the Hutch could work together to identify additional sources of revenue for the program, e.g., fundraising for MCB fellowships from individual donors, foundations and biotech industry.

One potential source for small amounts of discretionary funds would be for the Co-Directors to approach the biotech companies in the Puget Sound area to participate in an annual meeting in which the students present their research. Those biotech companies that support externships may be particularly predisposed to contribute to the program. Another source of funding will be, and now may be, from those early MCB graduates who work in biotech companies or pharmaceutical companies.

The MCB program is outstanding and extremely successful. The committee found no major areas of weakness or concern. We identified some areas where the program and/or the University of Washington (and the Hutch) can work on to further enhance the quality of the MCB program and its training. With the highest level of enthusiasm, the committee recommend for program continuation.