REPORT OF THE REVIEW COMMITTEE FOR THE MOLECULAR AND CELLULAR BIOLOGY (MCB) GRADUATE PROGRAM OF THE UNIVERSITY OF WASHINGTON AND THE FRED HUTCHINSON CANCER RESEARCH CENTER

I. Review Committee

The members of the review committee were Rodger C. Haggitt, M.D., Professor, Department of Pathology, UW (deceased); Martin Kushmerick , M.D., Ph.D., Professor, Departments of Radiology, Bioengineering, and Physiology & Biophysics, UW; David Raulet, Ph.D., Professor, Department of Molecular and Cell Biology, UC-Berkeley; Susan S. Taylor, Ph.D., Professor, Department of Chemistry and Biochemistry, UC-San Diego; and Barbara Trask, Ph.D. (Chair), Professor and Acting Chair, Department of Molecular Biotechnology, UW.

II. Review Process

Prior to the site-visit, Drs. Randy Moon and Jonathan Cooper, Director and Co-Director of the MCB Graduate Program, supplied the Committee with a detailed self-study document describing the major features of the program. The document provided a thorough discussion of the strengths of the program and the challenges for its future, including candid testimonials from chairs and students. In addition, the document presented quantitative data on the quality and size of the applicant pool, the caliber and progress of matriculated students, and the research support of program faculty. In advance of the site visit, Drs. Trask and Haggitt met with Deans Marcia Landolt, John Slattery, Daniel Dorsa, and Gary Christian to discuss the goals of the review and the steps required in preparation for the visit.

The committee's primary charge was to make a recommendation to the Graduate School as to whether or not the MCB program should be elevated from provisional to continuing status. In addition, the committee was asked to assess the overall quality of the program, to highlight the program's successes and strengths, to evaluate the impact of the MCB program on departmental degree programs and the FHCRC, and to make recommendations for improving and/or expanding the program and ways that the university could further aid the program.

The site-visit schedule was developed after consultation among members of the committee, the aforementioned deans, and the MCB program directors. Prior to the visit, the committee invited comments – which proved to be both laudatory and constructively critical -- on the MCB program from students and faculty. The committee also let it be known that any student or faculty members who wished to have a separate meeting with the Committee was welcome to do so. No one made use of this opportunity, although individuals communicated their comments to the committee via email. Students were assured in advance about the confidentiality of the review process.

The formal review of the program took place during a 2-day site visit held May 25 and 26, 2000 (schedule attached). During the site visit, the committee met with the leadership of the main participating units (UW School of Arts & Sciences, UW School of Medicine, and the FHCRC) and approximately 40 program faculty, including the chairs of eight of the thirteen participating UW departments and FHCRC divisions. The

committee met separately with the members of the standing MCB Steering and Recruitment & Advising Committees. The committee also met with ~20 current MCB students, ranging in status from first-year to advanced. At the conclusion of the site visit, the committee held an Executive Session and then summarized its findings to a combined group of the MCB Co-Directors Moon and Cooper, UW Associate Provost Debra Friedman and Deans Landolt, Slattery, Dorsa, and Christian, FHCRC President/Director Lee Hartwell, and Beatrice Greenwald, Assistant to Dean Slattery.

III. MCB Program History and Organization

The MCB program was initiated by the University of Washington in 1987 as a non-degree granting interdisciplinary program. The mission of the MCB program is to "facilitate the development of independent and highly motivated students into creative molecular and cellular biologists". In 1993, the MCB was authorized to award the doctoral degree, and the FHCRC joined the program, contributing both faculty and funding. At this time, the program was granted provisional status, with a review scheduled for the year 2000. The first directors of MCB were David Morris (UW) and Meng-Chao Yao (FHCRC), who currently serve on the steering committee. Randy Moon (UW) and Jonathan Cooper (FHCRC) assumed the roles of Director and Co-Director, respectively, in 1995.

The MCB program has grown into the largest doctoral program in the biological sciences on campus, with approximately 103 graduate students (50% at the UW and 50% at the FHCRC) and 180 participating faculty (~140 at the UW and ~40 at the FHCRC). The MCB program involves faculty from thirteen UW departments (Biochemistry, Bioengineering, Biological Structure, Botany, Environmental Health, Genetics, Immunology, Microbiology, Pathobiology, Pathology, Pharmacology, Physiology and Biophysics, and Zoology) and two FHCRC units. The program directors report administratively to the Deans of the Graduate School, School of Medicine, School of Arts and Sciences, and the FHCRC director. A 13-member Steering Committee composed of UW and FHCRC faculty provides programmatic advice to the MCB Directors. An Admissions Committee, consisting of two UW and two FHCRC faculty members, reads and ranks all applications to the program. A Recruitment and Advising Committee, currently chaired by Linda Wordeman, recruits and then advises first-year students and serves as a secondary advisor thereafter. The program is staffed by an Assistant Director (UW) and administrative assistants at both UW and FHCRC.

IV. Findings

Overview: The MCB program has evolved in its short existence into an exceptionally successful graduate-training program. The program responds effectively to the growing national demand from students and employers for multidisciplinary, interdepartmental, and high caliber training in molecular and cell biology. The breadth of the program was repeatedly cited as its most attractive feature. In addition, the program has provided novel opportunities, such as a biotechnology externship and a M.S. in epidemiology, for students wishing to pursue a non-traditional career path outside of academia. These developments reflect a guiding principle of the program's leadership: to tune the program regularly in response to student feedback. The program is now an essential component in

the UW's graduate training portfolio and is the main avenue through which FHCRC faculty can be involved in graduate training. The program is a particularly effective recruiting vehicle, enabling the UW to compete for top students in the nation. The program's leadership, faculty, and students were rated as outstanding by the review committee, as well as by fellow students and faculty. The committee commends the University of Washington for having achieved a good mix of disciplinary training centered in individual departments and broad, interdisciplinary and interdepartmental training, as exemplified by the MCB program.

Leadership: A key to the program's success is its outstanding leadership. Drs. Moon and Cooper were uniformly praised by faculty and students alike, particularly for their responsiveness to suggestions for program improvement. Given the importance of the partnership of the FHCRC and UW to the program – the institutes together provide the breadth and depth of research opportunities that attracts these students – the co-director arrangement functions well to tie the two locations together.

Faculty: The faculty is outstanding, with research programs that are diverse and well supported by research grant funds. Together, the faculty offers a broad spectrum of research opportunities to students. This breadth and diversity of choice is the most attractive feature of the program from the students' perspective. The FHCRC and UW offer different experiences in different cultures to the students. Faculty at both institutions impressed the committee with their real commitment to the program. Both institutions are working hard to serve the students well, and through the efforts of Drs. Moon and Cooper, they function as a strong unit, despite their physical separation.

It was clear that there is very strong cross-departmental support for the MCB program from chairs and faculty, as well as from UW deans and the FHCRC director. This support will become even more critical for the program's success as the demand increases for courses – and the faculty to teach them – that cater to interdisciplinary programs like MCB. Many faculty expressed a willingness to teach more inter-departmental courses, provided that their efforts were compensated by reductions in departmental teaching requirements. All of the departments have warmly welcomed MCB students and integrated them into departmental activities. Thus, the students feel that they have a supportive home in the MCB program, their advisor's department, or both. Given that students and faculty are distributed among thirteen academic units, this distributed support network is important, as it allows the students to identify with a program and a peer group. The students appreciate the breadth of opportunity offered to them and generally feel that the program provides a excellent framework in which they can excel and thrive.

Students: The faculty was uniformly laudatory about the students that are attracted and retained in the program. The caliber of the students is very high. The average entering student has GPA of 3.7, and GRE scores of 647V,742Q, and 731A. The program currently admits 15-25 students per year from a very large pool of outstanding applicants (244 in 2000, with an average GPA of 3.45 and GREs averaging at the 76th percentile). The program selects for students that are independent, motivated, and self-starting. Of the

current students, 82% have been awarded individual training fellowships or slots on training grants. Given the high faculty-to-student ratio in the program, the students are a desirable commodity, resulting in considerable competition among the faculty to attract the students into their laboratories. The faculty's primary complaint was that there weren't enough students to go around (see below).

Innovation: The program is a proven test-bed for innovation. For example, the program has pioneered on-line applications, leading the UW into the internet age. The program is now "paperless" with all information made available via the web. Other novel developments include the Weintraub Memorial Symposium, which was initiated by the FHCRC to profile graduate-student research. In addition, students can opt to participate in the Science Education Partnership program at the FHCRC for one quarter instead of a regular TA-ship. The students especially value this opportunity to work with science teachers and to help educate members of the lay public about science. Finally, the needs of MCB students have been the main driving force behind the development of the Conjoint courses, a series of 5-week modules offered at the UW and the FHCRC. Students in departmental programs have also benefited from these offerings. Although many suggestions were offered for the improvement of the Conjoint series (see below), the Conjoint series' success has catalyzed the development of new interdisciplinary courses.

Importantly, the MCB program has responded to the national need to help train doctoral students for non-academic as well as academic careers. It has initiated a novel Biotechnology Externship Program at local biotech companies for its students. Students view this development as very desirable given the likelihood that many of them will choose careers in biotechnology industry after graduation. The committee encourages the program to solicit more industrial partners in the program, as it was disappointed to hear that some students and companies could not be matched due to administrative constraints. The program also has established a joint degree program in business management and offers concurrent degrees (M.S. degree in epidemiology and M.D./Ph.D.). It has established informal ties with the Program in Entrpreneurship and Innovation.

Recruitment: Perhaps the strongest aspect of the program is its effectiveness as a recruiting tool. The MCB program competes successfully for top students in the nation. The consensus of opinion was that the program attracts a class of students that would not be attracted directly to other UW programs, such that it complements, rather than competes with, other UW departments. Students that decline offers are typically lost to MCB-like umbrella programs at other top schools. In fact, the program has had a positive impact on departmental graduate programs, by channeling the applications of outstanding students who are rejected by the MCB program to the admissions committees of other UW departments. Thus, the program has enhanced the quality of the applicant pools for departmental programs. It is expected that the recruitment statistics will further improve as the student population matures, publishes its work, and moves on, and the program builds its reputation for training students for successful careers.

Student mentoring: The program has a good mechanism, mediated by the Recruitment & Advising Committee and the Program Directors, for mentoring students in their first year. Various ideas were proffered to help guide first-year students through the somewhat overwhelming choices of research opportunities, such as clustering projects thematically on the website and posters, and using a matrix format to present the research interests of faculty.

The faculty is well attuned to students who might be falling through the cracks, which is important with students widely distributed across campus. Despite the breadth of program, most students feel they have a "home" department. The majority of the students identify most closely with the home department of their advisor; a few identify more closely with the MCB umbrella. These latter students are the least integrated, but they seemed independent and content.

Faculty involvement: From the students' perspective, the faculty is accessible, yet few had availed themselves of program faculty other than their advisor for advice. At the same time, the students expressed a yearning for a more cohesive program and more interactions with faculty. Although there appears to be good faculty involvement in recruitment, teaching, and first-year advising, many students expressed disappointment at the level of faculty involvement in program-wide activities, such as the recruitment fair and rotation talks. This sentiment was seconded by the program director, Dr. Moon, who referred to the process of getting faculty to come to rotation talks as "herding cats". Some faculty viewed their involvement as excessively altruistic, given the low probably of attracting a student to their labs. This situation is unfortunate, since it is the breadth of faculty expertise and experience that the students wish to tap into.

Fortunately, MCB students are a motivated cohort, and they have initiated several student-only forums, such as biweekly research seminars presented by graduate students for graduate students and an annual student retreat. These forums satisfy their need for interaction and support. However, it is the Committee's view that these forums cannot replace regular opportunities to speak to audiences that include faculty so that the students can receive much-needed critique from experienced individuals. On this note, several students mentioned that they regularly receive feedback on the scientific content of their talks, but they rarely receive constructive criticism on the style and organization of their presentations, and they are ravenous for this feedback. Another suggestion to improve the cohesiveness of the program was to profile the students and their work on the website. Such as step would facilitate tracking the students by all faculty, yet it does not replace face-to-face interactions.

Curriculum:

Conjoint series: Conjoint series is an interdisciplinary palette of 5-week course modules that is a cornerstone of the MCB program's curriculum. The success of the MCB program is intimately tied to the effectiveness and quality of this series. Students and faculty alike were delighted by the recent shift to 5-week modules, which allows the series to be more flexible and responsive to scientific progress. Another positive development is the increased involvement of FHCRC faculty in the conjoint series, with roughly half of the courses now being taught by FHCRC faculty. Hutch faculty also

coordinate literature review sessions that parallel the courses. New courses in computational biology and biostatistics and the recent decision by the Genetics department to offer Genetics courses as Conjoint modules were also seen as very beneficial to the MCB program.

The consensus opinion of faculty and students is that the Conjoint series is not receiving the level of attention given to first-year recruiting and advising. In the opinion of many, the Conjoint series is a disjointed set of courses, a consequence of serving many masters. The modules are heterogeneous in quality, format, and workload. Students clearly favored small, literature-based courses over the large, lecture-style classes.

The review committee recommends that the MCB faculty take a hard, collective look at the Conjoint portfolio to ensure that their students are offered a coherent curriculum to complement their research experiences. Many faculty expressed the view that the series has not been formulated with a comprehensive vision of what constitutes core knowledge in molecular and cellular biology. It is also important that the curriculum address the need for quantitative expertise (statistics, computer science, physics) in order to train the leaders of the future. The curriculum should also be revamped to include training in effective public speaking and technical writing, a deficiency noted by students and faculty.

The Steering Committee would appear to be the logical group to define and oversee the academic program. Its current role was unclear to the Committee; it appears to be taking a passive role in the program. However, this committee is in powerful position to shape the curriculum and effect constructive change in the conjoint series. The committee recommends that the steering committee be reconstituted (as necessary) and charged with defining the MCB curriculum and overseeing the course offerings. The committee should include both FHCRC and UW faculty and at least one student representative. Although the committee heard voices for populating the committee with department chairs, the general consensus was that it would be better to ask faculty who are deeply involved in MCB to serve on the committee and to work closely with their respective departments to effect change.

The conjoint series is an essential facet of interdisciplinary training at the UW and deserves considerable thought and attention. The committee therefore recommends that a review of the Conjoint offerings be undertaken by a high level committee that spans the Schools of Medicine and Arts & Sciences and the FHCRC. Given high-level attention and resources, the series could evolve into a model for inter-departmental education and keep the UW at the front edge of a national trend in interdisciplinary training. Departmental cooperation is needed to adjust departmental teaching obligations for faculty who contribute to the Conjoint series. Many faculty felt that they could not take on conjoint courses, unless their departmental teaching requirements were proportionately decreased. A committee with broad representation is also required to address issues of overlap among Conjoint offerings and departmental courses. Eliminating overlap would somewhat lessen the teaching burden on faculty.

Other: The program effectively addresses the diverse professional aspirations of its trainees, who may choose careers in academia, health-care, industry, and/or management. As mentioned above, it offers biotech externships, teaching-assistantships, entrepreneurship workshops, and joint degree programs in business management and

medicine. Students expressed the desire for career-development workshops, and several faculty recommended that the TA options be reviewed to ensure that they are equally rigorous and adequate training for an academic career.

Time to degree: Although the MCB Program Directors voiced concern about the length of time the average MCB student takes to graduate in the self-study document, the Committee did not see a serious problem. The time-to-degree (currently a median of 5.75 years) was viewed as comparable to other good places. The Committee did not regard the application of pressure based on a rigid time schedule as warranted or particularly helpful. Rather, the rate of progress should be monitored on a case-by-case basis.

Size: From the perspective of most UW and FHCRC faculty, a modest increase in the number of students would be readily absorbed by the large number of laboratories that have space, resources, and projects for graduate students. The faculty was adamant that this increase be accomplished without lowering standards for entry or the curriculum. From the students' perspective, increases in the program size should not come at the cost of diminished personal attention and should go hand-in-hand with an increase in the number of conjoint modules and/or literature review offerings. Because of the success of the MCB program, the committee concurs with both faculty and students, and recommends a modest increase in the number of students providing: a) that the admissions committee not lower the bar for entry; b) the faculty introduces new modules to complement the existing repertoire; c) the program consider organizing itself into thematic clusters to provide additional programmatic cohesion and identity for the students; and d) funding of student stipends/tuition is increased to accommodate the added students (see below).

Financial support: The MCB Program has been supported by the Graduate School, the School of Medicine, the College of Arts and Sciences, and the FHCRC, with funds for the ~ 18 first-year student slots contributed jointly by the Graduate School and FHCRC. Given the overwhelming success of the program and its importance to both the UW and the FHCRC, this support should both continue and expand.

The committee recommends increasing the cap on the number of MCB students to 120, providing that the quality of the entering students and the level of faculty-student interaction are not compromised (see above). This 20% increase would be beneficial to the program and the institutions, given the large number of laboratories with space and funded projects to accommodate these students and provide for their interdisciplinary training

The committee urges the leadership of the Provost's Office, the Graduate School, the School of Medicine, the College of Arts and Sciences, and the FHCRC to join forces to contribute funds to support the stipends and tuition of these added students. In addition, the UW administration should work towards establishing state-line funded FTEs that are dedicated to teaching conjoint courses in support of UW's state-of-the-art interdisciplinary programs.

Although the committee was not charged with reviewing the relationship between the MCB program and the NIH-funded MCB training grant, it became apparent during

the review that students are very concerned about the stiff competition for available fellowships. UW and FHCRC funds support the students in their first year, and the students feel immense pressure when they are set adrift in their second year. If students are accepted into the program, they should be confident of continued support for the duration of their studies. The current mechanism of requiring faculty to confirm their ability to support a graduate student before accepting them as rotation students is only a partial solution; additional training-grant-, UW-, and FHCRC-funded slots are clearly needed to allow the students to choose their faculty mentors freely.

Other: The committee urges department chairs and deans to coordinate their actions that impact the MCB program (e.g., coordinating the timing of stipend increases) by communicating regularly with MCB program directors and/or members of the Steering Committee.

The deans of the School of Medicine and Graduate School should review the current administrative oversight structure, streamlining it as necessary.

In addition, the structure for sharing costs between the UW and the FHCRC should be revisited and clarified as soon as possible.

The committee was confronted with some unusual arrangements that concern students and could negatively impact the program. The students and faculty complained that MCB students choosing a Genetics lab for his/her thesis work have had to leave the MCB program and join the Genetics program in order to be funded off the genetics training grant. The committee was happy to hear from Breck Byers, Genetics Chair, that this situation has been amended recently.

Coordination with the MSTP program is also warranted: The size of the entering MSTP class has apparently increased over the years, without a concomitant increase in funds to support the students who choose the MCB program for their graduate training. Coordination is needed to ensure that the expansion of the MD/PhD program is accompanied by funds to support the students during their early years of training in MCB.

V. Summary of Major Recommendations

The MCB program is a highly effective training program in interdisciplinary molecular and cellular biology. The program responds to a growing national demand for individuals with interdisciplinary training. The program fosters productive interactions between FHCRC and UW faculty and students. The program is a test-bed for innovation, having shown responsiveness to change and a strong effort to train students for careers in and out of academia. The MCB program has attracted outstanding students and faculty to the UW and the FHCRC, complementing and benefiting departmental graduate programs.

Key recommendations (additional recommendations are found in the body of the review):

1. The MCB program should be granted permanent, continuing status.
2. The MCB program should be expanded by up to 20%, providing that the quality of the entering students and the level of faculty-student interaction are not compromised
3. The steering committee should be reconstituted as necessary and charged with overseeing the course offerings in order to ensure that MCB students are offered a coherent core curriculum to complement their research experiences. The curriculum should address the need to train the leaders of the future in quantitative disciplines and effective communication.
4. The MCB program, having achieved excellence in recruiting and advising its first-year students, should now turn its attention to more advanced students. Efforts should be made to increase faculty involvement in MCB student activities, such as at student seminars and retreats, so that the students can benefit from the input of greater number of MCB's outstanding, interdisciplinary faculty.
5. The Provost's Office, Graduate School, School of Medicine, FHCRC, and College of Arts & Sciences should join forces to expand the financial support of this stellar program.
6. A review of the Conjoint offerings should be undertaken by a high level committee that spans the Schools of Medicine and Arts & Sciences and the FHCRC. Given high-level attention and resources, the series could evolve into a model for inter-departmental education.
7. The UW administration should work towards increasing the number of state-line funded FTEs that are dedicated to teaching conjoint courses in support of UW's state-of-the-art interdisciplinary programs. Furthermore, Chairs of participating Departments should jointly develop a coordinated approach to balance the staffing of Conjoint courses and Departmental courses so as to minimize overlap and ensure the participation of talented teachers in both programs.

UNIVERSITY OF WASHINGTON
The Graduate School

Interdisciplinary Molecular and Cellular Biology Program Review
May 24, 25 and 26, 2000

Wednesday, May 24

6:30 PM	Review Committee Executive Session

Thursday, May 25

8:00 – 9:00 AM	Co-Directors Randall Moon and Jonathan Cooper
9:00 – 9:45	Professors John Clark, Ed Giniger, David Kimelman, Zhengui Xia, Robin Wright, Jim Champoux, Barbara Wakimoto
9:45 – 10:30	Professors Trisha Davis, Tom Reh, Ken Stuart, Henk Roelink
10:30 – 10:45	**Break**
10:45 – 11:30	Professors Edith Wang, Adam Geballe, Stan Fields, Bill Carter, Bill Zagotta, Tim Rose, Pat Stayton
11:30 – 1:00 PM	**Review Committee Working Lunch**
1:00 – 1:45	MCB Steering Committee: Mark Bothwell, Dan Storm, Gerald Schubiger, Meng-Chao Yao (First Hutch director of MCB)
1:45 – 2:30	Recruitment and Advising Committee: Michael Emerman, Toshio Tsukiyama, Dina Mondoli, Linda Wordeman
2:30 – 3:15	Meeting with First Year Graduate Students
3:15 – 3:30	**Break**
3:30 – 5:00	Meeting with post-first year Graduate Students
6:30	Review Committee Executive Session

Friday, May 26
Conference Room 348/350, South Campus Center

8:00 – 9:00 AM	Dean Daniel Dorsa and FHCRC President Leland Hartwell
9:00 – 10:30	Department Chairs: Anita Hendrickson, Richard Palmiter, Joe Ammirati, Chris Wilson, Bill Catterall, Nelson Fausto, Breck Byers
10:30 – 10:45	**Break**
10:45 – 11:30	Professors Beth Traxler, Mary Lidstrom, Stan McKinght, Julie Overbaugh
11:30 – 1:00 PM	**Working Lunch and Executive Session**
1:00 – 1:20	Professor Wayne E. Crill
1:20 – 3:00	Executive Session
3:00 –	**Exit Interview** Randall Moon, Jonathan Cooper, Judy Gray Deans Landolt, Slattery, Dorsa; President Leland Hartwell; Associated Provost Debra Friedman; Beatrice Greenwald, Assistant to Dean Slattery