University of Washington School of Medicine
Department of Pathology
Molecular Basis of Disease PhD Program
Doctor of Philosphy

Academic Review Self-Study

Thomas Montine, MD, PhD
Professor & Chair
UW Medicine Pathology

Dan Bowen-Pope, PhD
Professor & Program Director
UW Medicine Pathology

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Section I: Overview of Organization

MISSION & ORGANIZATIONAL STRUCTURE

Overall Mission. The PhD program in the "Molecular Basis of Disease" (MBD) is based in the Department of Pathology but incorporates faculty in other School of Medicine (SOM) departments via adjunct appointments in Pathology. The mission of the MBD program is to train practicing biomedical scientists: individuals who can use the scientific method to ask and answer testable questions about significant biomedical problems. The program emphasizes the research and intellectual skills needed to formulate hypotheses and critically evaluate research data and conclusions. Increasingly, the program emphasizes the translational/clinical context in which basic research ultimately bears fruit for the public. The mission of the program is to meet the needs of three constituencies:

> Needs of students: Graduate students in the MBD program benefit from the opportunity to learn the theory and practice of biomedical research in an environment that spans clinical and basic divisions, that has the funding to fully support the research, and that has a long tradition of training researchers for careers in academia and biotechnology.
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> Needs of faculty: Graduate students provide part of the full diversity (age, race, background, etc.) that most researchers enjoy about working in an academic setting. Most faculty desire the opportunity to participate in the training of the next generation of scientists. The ability to mentor graduate students is usually mentioned as one of aspects of academic research that retains faculty at a university (cf working in "industry").
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> Needs of society: Studying disease at the molecular level, sometimes also referred to as experimental pathology, is the discipline that most explicitly uses modern research techniques to address important problems in human disease. It is desirable that scientists be trained to appreciate and pursue this approach.

Degrees Offered, Enrollment and Graduation Patterns: The MBD program admits students only into a PhD program. A MS degree is offered as an exit option for students who have taken the required courses but who are not able to, or choose not to, satisfy the requirements for the PhD. Enrollment and graduation data are tabulated in Appendix D-1 (Graduates) and D-2 (Current Students).

Shared Governance. The organization of staff is outlined in Appendix A-1 and A-2. Traditionally, the program has been managed by a faculty/staff team. In this system of shared governance, the faculty members (Director and Co-Directors) are primarily responsible for matters requiring scientific or academic judgment and planning. The staff members are primarily responsible for administering the daily operation of the program. The most important staff member is the "Graduate Program Assistant" (GPA), recognized by the Graduate School as the lead administrator. Steve Berard has been GPA since 2009, greatly enhancing the operation of the program.

As discussed below, as we expand our program to encompass faculty in other departments we have augmented faculty management of the MBD program to include more input from participating groups, including faculty from all the "external constituents." Currently, although we are still in the process of fine-tuning this system, faculty members play leadership roles in the following positions (See Appendix A-2):

> **The Graduate Program Assistant** (Steve Berard) and the **Director** (currently Bowen-Pope, soon Crispe) and Co-Directors (Campbell and Mahoney) make day-to-day operating plans and decisions.
>
> The "**MBD Oversight Committee**" is constituted by representatives appointed by the chairs of each participating department and chaired by the representative from Pathology, who serves as program Director. This is the "executive committee" that makes major, usually infrequent, decisions.
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> The "**MBD Steering Committee**" is constituted by the designated representatives from each research interest area (Aging, Cardiovascular, etc.), plus a current graduate student (elected by the students), plus members of the Oversight Committee. This committee deals with recruitment of new students, oversees the creation of new courses, and other matters that benefit from broad input.

BUDGET AND RESOURCES

Unit Budget. Appendix B details our current operating costs and funding sources. Traditionally, the MBD program had served almost exclusively to support graduate students in the labs of faculty with primary appointments in Pathology, and University of Washington (UW) funding for the program has derived almost exclusively from Pathology Department resources plus awards from the Graduate School. Currently, as we expand the program to encompass faculty whose primary appointments are in other departments, we have begun to arrange other sources of funding. The following is a brief summary of the resources that we have arranged (for the class of 2013/14) for our greatest expense: funding students during their first year as they do their required lab rotations:

> 2 slots from Department of Pathology funds. Past years have varied from 1-3 slots, depending on department finances.
>
> 2 slots from the Dean of the SOM. This is new for this year and is a commitment for each year for 2 years to help in our SOM-wide expansion.
>
> ½ slot from the Graduate School. This slot, termed "GSFEI Top Scholar," is awarded every year on a competitive basis. As UW finances suffered several years ago, fewer awards were made and our yield declined from up to 2 slots/year to effectively ½ slot/year during the last few years.
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> Underrepresented Minority (URM) slot. Every year we request Graduate School funding for an eligible URM. We are successful about half the time, and were awarded a slot for

the 2013/14 year. These slots can be used only if enroll an eligible URM. We make every effort to do so.

2 slots from Seattle Children's Research Institute (SCRI). When Seattle Children's Hospital opened its new research institute in South Lake Union, it wanted to fully participate in the UW research community. Via the efforts of Dr. Mark Majesky, our affiliate faculty at SCRI, we have received 2 slots for each of the last 2 years. A renewal has not been finalized for this year, but is expected.

Evaluating Best Use of Current Funding and human Resources. Obtaining and allocating funding is one of the primary responsibilities of the program directors and GPA. Every proposed use of funds is discussed extensively and subject to approval by the budget manager (Erika Hargadine) and Department Administrator (Rachel Cowan).

Fundraising. As noted above, we have recently been successful in adding two new sources of funding: the Dean of the SOM (2 slots/year) and SCRI (2 slots/year). We are also planning to develop and apply for a new NIH-funded training grant in translational research, possibly via modification of the Molecular Medicine training grant (see below). We are also considering methods through which other participating departments could contribute to the operating costs of the program.

Section II: Teaching and Learning

Student Learning Goals and Outcomes

Student learning goals: The objective of the MBD program is the training of practicing biomedical scientists: individuals who can use the scientific method to ask and answer testable questions about significant biomedical problems. The program emphasizes research skills and the intellectual skills needed to formulate hypotheses and critically evaluate research data and conclusions. To a large extent, this is accomplished by "apprenticeship" in a functioning research lab. Specifically, we consider that graduate students in the MBD program should be:

1) Familiar with the major mechanisms of disease. To facilitate this, we require the courses listed in Appendix E. All except PATH544 are small-group classes.

2) Able to critically evaluate experiments, statements, and publications, and identify their strengths and weaknesses; i.e. be able to function as a member of the scientific intellectual community.

3) Able to frame a significant hypothesis (the "Thesis") and devise an experimental approach to test this hypothesis.

4) Able to use of a range of experimental techniques to test the thesis.

5) Thoroughly familiar with the literature in the area in which the thesis research is being performed and familiar, to some extent, with the broad sweep of current biomedical research and hypothesis.

6) Able to communicate the background, approach and results of the thesis research, both in oral presentations and in publications. During their first quarter in the program, students take a course (PATH 511) in scientific exposition. Following that, students present their research frequently, including about 8 times in a formal lecture hall setting: at the end of each of the 3 required lab rotations and once per year at the semi-annual Graduate Student Retreat (described below). This is in addition to lab-specific presentations (lab meetings, conferences attended, etc.). We expect that students will submit at least one manuscript to a peer-reviewed journal, but do not require that it be accepted for publication.

Evaluation of student learning: The required MBD courses (see below and Appendix E) are graded by the course directors based on an oral or written presentation. Only PATH 544 is graded based on mark-sense assessment of learning.

The most important component of the MBD program is the research that is performed under the direction of the student's thesis advisor and thesis committee, and by far the most important assessment of the student's progress is made by the student's thesis advisor. Advisors and students are requested to complete a once-yearly written assessment of the student's progress (see below), which are have traditionally been reviewed by the Graduate Committee and will now be reviewed by the Steering Committee. A second level of assessment of research prowess is by the student's Thesis Committee. MBD policy is that the Thesis Committee meet with the student once each year. Thesis Committees are composed of at least 3 MBD faculty members plus one faculty member (the GSR: graduate school representative) who is not affiliated with the Pathology Department and who serves to ensure that Graduate School rules and procedures are followed. The GSR is currently chosen by the student/advisor (with approval by the Graduate School) and can have full intellectual input into all meetings and decisions. A third level of assessment is by the other students and faculty in the program, based on the yearly research presentations at the Graduate Student Retreat (formal PowerPoint presentations) or at the annual Department Retreat (poster presentations).

Methods used to assess student satisfaction and improvements made in response. Every year, students (Appendix F-1) and their thesis advisors (Appendix F-2) each fill out a form that records their assessment of progress, and notes any problems that are developing. Student and advisor discuss the forms and sign both. The Graduate Program committee reviews these forms to monitor for problems arising. In practice, the program is small enough that we gain most of our insight into student progress and satisfaction by direct personal contact and by reports from other students and faculty. If a problem seems to be developing, the Director and/or Co-Directors meet with the student (and faculty) to attempt to devise a plan to remedy the problem. On occasion (perhaps 1 student out of 15) a student and/or thesis advisor cannot be reconciled and we have arranged for the student to begin a project in a different lab. In some very rare cases, we assist the thesis advisor and committee in terminating the student from the program.

In addition to the yearly assessments of progress and satisfaction, students that complete the program are asked by the Graduate School to complete an assessment form.

Using findings to make improvements: By far the largest source of dissatisfaction occurs when there is friction between individual students and their thesis advisors. As noted above, we work collegially to arrive at a mutually satisfactory solution. If that is not possible, we facilitate transfer or the student to another lab/advisor.

Recent student feedback has indicated that our students share our desire for augmented clinical contacts. As noted below, achieving this is one of our major goals.

Instructional Effectiveness

***Evaluation of teaching*:** In courses that involve multiple lecturers/participants, as most of our classroom courses do, the course director attends most presentations to monitor quality. When the participant is a junior faculty, the assessment by the course director serves as a documentation of teaching skill that is considered in promotion and retention decisions by the SOM.

To assess instruction/mentoring that occurs during the conduct of research (occupying most of the 5-6 year program) we use the yearly assessment forms submitted by student and thesis advisor (see above) plus collegial knowledge of the research environment and track record of the advisor. As students consider which labs to rotate in, we advise them of any specific issues that have negatively or positively impacted previous students. Most of those issues are dependent on the attributes of both the PI and specific students, and not all lab environments are suitable for all students. We have few enough students that we can maintain close involvement in their choices of lab rotation and final lab.

Training in teaching: The MBD program does not require an undergraduate teaching (TA) experience or emphasize classroom teaching skills. The Department of Pathology does not teach any undergraduate classes. Students wishing to gain formal classroom teaching experience to prepare for academic positions that entail substantial teaching have been able to do this by volunteering to TA for departments that teach undergraduate courses, including Genetics, Biochemistry, Microbiology and Biology. To date, few students in our program have chosen to do this but the opportunity is there. Graduate students do have many opportunities to participate in teaching through community outreach programs such as the Science Education Partnership (SP) Program.

Changes in teaching methods in response to evaluation: As discussed in Future Plans and Unit-Defined Questions, we are considering a global change in the way that we teach our classroom courses: moving toward on-line material to be assimilated before class with class time devoted to group problem-solving rather than lecturing.

Teaching and Mentoring Outside the Classroom

Faculty involvement in teaching outside the classroom: The vast majority of faculty teaching time is spent outside the classroom. During the first year, students perform research projects (1 quarter each) in 3 different labs. At the end of each quarter, students are required to present their projects (background, hypothesis, results, conclusions) in a 10 minute PowerPoint presentation followed by a question period. These rotations provide an experience of 3 different research environments and a beginning appreciation of practical hypothesis testing. Occasionally, students do a 4th rotation before deciding on a thesis advisor/lab. After choosing a thesis advisor, that faculty member becomes the student's thesis advisor and his or her lab the student's "home lab." Further research training in a functioning research lab is analogous to an apprenticeship. This makes the home lab environment extremely important. The thesis advisor, as chief of the home lab, becomes the most important and most visible example of the practice of academic science, but everyone in the home lab becomes a potential role model, instructor, and mentor. Almost all MBD research laboratories include more postdoctoral fellows than graduate students, so the graduate students have an excellent opportunity to observe and learn from scientists at the next levels of professional development.

Recruiting and Mentoring Underrepresented Minorities (URM): For its size, the MBD program has an exceptionally active and successful outreach program. Our URM students work closely with program directors and with Steve Berard to recruit new URMs, a major program goal, and this helps establish a high level of camaraderie and satisfaction with the program. 2012 marked the second year in a row that at least two representatives of our graduate program attended the annual SACNAS Conference, and the first year that program representatives, including trainees, attended the ABRCMS Conference. We are methodically creating a future pipeline and networking opportunities for URM candidates.

Under the new leadership and direction of our chair, Tom Montine, our outreach efforts are no longer limited to public information materials and participation at local recruitment events. We are now active participants in a variety of national recruitment conferences (ABRCMS, SACNAS). We took a leadership role in the organization of the 2012 SACNAS Conference in Seattle that was hosted by UW and the Fred Hutchinson Cancer Research Center (FHCRC) from October 11-14, 2012. Dr. Bill Mahoney and GPA Steve Berard served on the UW SACNAS Local Organizing Committee, with Steve also acting as Co-Chair of the UW SACNAS Field Trip Committee that hosted 300 conference attendees on campus for a series of customized program/lab tours. The department has also provided funding support for current graduate students to join Dr. Mahoney and Mr. Berard at the conferences. The interpersonal contact with prospective candidates and our faculty mentors, program manager, and trainees at the conferences has been instrumental to the success of our outreach efforts. Additionally, in recognition of our outreach efforts, Steve Berard serves on the Institute for Systems Biology Diversity Board and has participated in several University of Washington Graduate School diversity focus groups.

The success of our recent URM outreach efforts can be immediately measured by current trends in our URM applicant pool. 2012 marked the second year in a row in which over 25% of the applicants invited to interview were URMs. And for second year in a row we extended offers to

multiple URM candidates and worked to secure Graduate Opportunities and Minority Achievement Program (GO-MAP) Presidential Scholar Award funding to enhance our offers.

Current URM graduate students in the MBD program:

Chris Brewer (Hispanic)
Marvin Lai (Hispanic)
Mitchel Lee (Native American)
Americo Lopez-Yglesias (Hispanic)

Ensuring steady academic progress: As noted above, most of the instruction and mentoring in our program occurs outside the classroom. After the first year, our graduate students spend most of their time in their thesis advisors' labs, learning through direct (one-on-one or small group) interaction with the thesis advisor and other lab members, how to design, perform and interpret the experiments that test their thesis hypothesis. Labs also participate in larger "interest groups" (e.g. cardiovascular, aging, etc.) that provide larger, but still focused, venues for collaborations, organized discussions, seminars etc.

Teaching, monitoring, and mentoring continues at the MBD program level:

> Twice per year (end of winter and end of summer quarters) all MBD graduate students are required to attend the Graduate Student Retreat. At the winter retreat, the more junior students present their research. At the summer retreat, the more senior students present. These retreats are organized like conferences, with presentations and catered lunch. Students are required to submit abstracts beforehand. These are printed for the audience along with an evaluation matrix deigned to allow helpful comments and to choose the best presentation (which is given an award). In order to familiarize students with formal communication (e.g., at a national/international conference), we hold the retreats in a formal lecture hall (podium, microphone, etc.), and students are chosen to chair the two sessions into which each program is divided.
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> Once per year the Department of Pathology has a 2-day retreat to which faculty, graduate students and postdocs are invited. The goal of the department retreat is to promote interaction between all ranks/members of the department. Graduate students are encouraged to bring posters of their research projects and to be available to discuss the work during the poster-viewing/social sessions. To encourage participation, a cash prize is offered for the best graduate student poster.

Preparing students for the next phase of their professional lives: The MBD program trains students to be successful at the next professional level (postdoctoral fellow or researcher in biotechnology), but it does not provide assistance, at the program level, for making that transition. That responsibility falls to the students' thesis advisors, committees, and to the students themselves.

Section III: Scholarly Impact

Broad Impact of Faculty Research and Scholarship. Scholarly publications by MBD faculty are listed in their CVs and Biosketches (Appendix C). Appendix C is available via Catalyst Dropbox:https://catalyst.uw.edu/collectit/dropbox/summary/sberard/26203

All MBD faculty have actively-funded research programs. No faculty member is allowed to mentor a graduate student without the current (and anticipated long-term) resources to maintain an active lab and provide tuition and stipend for the student. Since research funding, most of it from the NIH, is a recognition of research progress and promise, all of our active faculty have this form of outside certification. The Department of Pathology alone brought in over $24 million in NIH funding in FY 2011.

Many MBD faculty have clinical responsibilities in addition to research programs. As discussed in Part B, we believe that this adds depth to our program and we propose using this opportunity to augment student exposure to the practice of medicine.

Participation of Postdoctoral Fellows. Most MBD labs have more postdocs than graduate students. The Department of Pathology as a whole has 48 postdocs (31 US citizens, 17 non-US citizens). Postdocs play a critical role in educating graduate students. They often provide the hands-on technical instruction necessary to perform experiments, they help establish the intellectual breadth for productive discussions in lab meetings, and they serve as visible examples of the next stage in a scientist's professional development.

Impact of Program Graduates on the Field. The great majority of MBD graduates have continued to participate in biomedical research as postdoctoral fellows and then faculty or researchers in biotechnology (Appendix D-1).

Advances in the Field that Have Changed the Program. Apart from the general advance of the technologies employed, the most significant change has been the increasing emphasis by funding agencies (NIH) on translational goals. This is one of our motivations for increasing student exposure to that aspect of their research.

Collaborative and Interdisciplinary Efforts. The Department of Pathology, as well as the UW in general, is (from all reports) an unusually collaborative environment, both across and within departments and research areas. Part B describes our plans for establishing/solidifying the MBD program as a broad-based graduate program for translationally-oriented biomedical research encompassing faculty whose primary appointments are in many departments and divisions in the SOM.

Almost all labs in the MBD program participate in higher-order "interest groups", usually with support from training grants. The Department of Pathology alone is home to four T32 training grants:

> Genetic Approaches to Aging Research (Director, Peter Rabinovitch, Pathology; 8 predoc posititions; 8 postdoc positions)

Experimental Pathology of Cardiovascular Disease (Director S. Schwartz, Pathology;7 predoc positions; 8 postdoc positions)

Environmental Pathology and Toxicology (Director: Tom Montine; 8 predoc posititions; 3 postdoc positions)

Neurobehavior, Neuroendocrinology, and Genetics of Alzheimer's Disease (Director: Tom Montine) 7 postdoc positions

The Medical Scientist Training Program (Director: Horowitz), available to MD/PhD students, is also directed by a Pathology faculty member.

Program Support for Junior Faculty. The MBD program does not itself support junior faculty, and faculty need to have achieved significant research funding before they can become members of the MBD faculty able to mentor a graduate student. This policy is intended to stabilize student funding and to protect junior faculty from over-commitment of time to graduate student teaching/mentoring. Junior faculty who do achieve funding success are extremely attractive to our graduate students.

Recruiting and Retaining URM Faculty. The MBD program does not play a direct role in faculty recruiting, but our demonstrated commitment to recruiting/training URM graduate students should be appealing to potential URM faculty recruits.

Section IV: Future Directions

Where is the unit headed? Since our program is in the process of rapid evolution, in this document we will use the following terms to orient reviewers to the time periods referred to: "traditionally" refers to the period up till 2011, when Dr. Tom Montine became Interim Chair of Pathology, and "currently" refers to the last 1-2 years under Dr. Montine, who became Chair in June 2012, and to the immediate future. Traditionally, the Pathology MBD program has been small: sized to serve a single department. Currently, we are in the process of becoming an SOM-wide program emphasizing basic biomedical research in the context of the practice of medicine.

What opportunities does the unit wish to pursue and what goals does it wish to reach? We will increase faculty number and breadth and clinical expertise by adding faculty from clinical departments that do not have their own graduate programs. Increasing the number of available labs in which students can perform their thesis research will allow us to increase entering class size from ~3 to between 7 and 10 and will provide real opportunities (as well as requirements) for clinical exposure.

This expansion in size and scope was initiated by Dr. Montine in 2011, in consultation with clinical department chairs. The goal is to establish a structure that gives participating departments and divisions a role in the MBD program, along with an incentive to approve faculty participation. The Dean of the SOM has demonstrated support for this program by awarding two

first-year tuition/stipend slots for each of the next two years. After this trial period, we hope that an additional slot will be awarded.

How does the unit intend to seize these opportunities and reach these goals? Traditionally, the program included, in addition to Pathology faculty, a high quality, but small, group of investigators whose primary appointments were in SOM departments and divisions that did not have PhD programs. Currently, the MBD program has begun to actively recruit prominent faculty and grant them affiliate appointments in Pathology, with subsequent granting of MBD faculty status, so that they can participate fully in graduate student training and serve as thesis advisors (See Appendix G for list of current and pending MBD faculty organized by area of research interest). The MBD PhD program is still administratively based in the Department of Pathology, but we have established a management system (see above) that incorporates input from a representative of each of the research focus areas (via the MBD Steering Committee) and a representative from the other departments/divisions involved (via the MBD Oversight Committee). We now refer to the PhD program as "MBD" rather than "Pathology".

An individual faculty member is recruited to participate (teach, mentor, etc.) in the MBD program based on the following criteria:

a. Interest in a research area which is symbiotic with our existing MBD program, but may be in an area where we could use more participating faculty members.
b. Interest in training graduate students (i.e., agree to host at least one graduate student over a 10-year period and serve on more than 2 graduate student committees over a 10-year period).
c. Availability of funding to support graduate students (i.e., R01 funding, access to training grant(s), etc.).
d. Interest in teaching graduate students (i.e., Proseminar, a relevant MBD course, and/or developing a new course).
e. Prior to each recruitment cycle, describing ongoing projects in his or her labs which would be available to rotation students.
f. Ongoing support of department activities during recruitment events (i.e., participate in interviews, attending social events, etc.).

After a faculty member conveys interest in joining the MBD program to our Department Chair and the Director of the Graduate Program, his or her candidacy is discussed by the MBD Oversight Committee. If research area and history of mentoring students warrants participation in the MBD program, the faculty member is invited to introduce their research to the department through one of our departmental seminars. The application for adjunct appointment will then be reviewed and voted upon by Pathology Appointments, and Promotion (A&P) committee, the entire Pathology faculty, and members of the MBD faculty.

As we expand our program to include faculty in clinical departments or divisions, we are attempting to do this by encompassing strong groups, rather than scattered individuals. Each group will teach a course in their area and will provide the critical mass for inter-lab interactions in the area. This system also provides a means for adjusting student recruitment and home labs,

since each focus area will have a representative on the Steering Committee that makes student admission decisions.

Currently, we cover the following research focus areas (The primary department/divisions involved are in parentheses):

- Aging (Path)
- Neurodegenerative disease (Path)
- Cardiovascular disease (Path and Medicine/Cardiology)
- Cancer and genetics (Path)
- Inflammation, injury and repair (Path)
- Mitochondria and metabolism (Anesthesiology and Pain Med)
- Comparative medicine/animal modeling (Comp Med)
- Lung biology (Med/Pulmonary)
- Diseases of the eye (Ophthalmology)
- Developmental biology and stem cells (Path, Pediatrics and Children's Research Institute)
- Physiology (Physiology and Biophysics). Note: this is a basic science department that has chosen to join MBD and stop recruiting into its own department program)

The unit's current benefit and impact regionally, statewide, nationally, and internationally. The Department of Pathology is among the most highly funded research organizations in the country ($24million for FY 2011) and is a leader in biomedical research.

PART B: UNIT-DEFINED QUESTIONS

OVERVIEW: As explained above, the MBD PhD program, directed by the Department of Pathology, is in a period of transition from a small, department-centered program to a much broader program that emphasizes translation-oriented research and that incorporates the strongest faculty from clinical departments. We have used the opportunity of this program review to explicitly consider our current situation, review our progress, and formulate future plans. To make the review most useful for the program, we have proposed four questions that address the core issues that we face, and about which we want guidance from the reviewers. In the sections below, we present each question, the background for that question, and our current response(s). We anticipate that the reviewers will bring their expertise to bear and help us refine and improve our plans to address these questions and reach our goals.

QUESTIONS:

1) How would an expanded MBD program relate to other interdepartmental PhD programs at UW?

Background: Our expanded program is similar to two existing programs: "Molecular and Cellular Biology" and "Molecular Medicine."

Molecular and Cellular Biology (MCB): This is a broad interdepartmental, PhD program that is operated jointly by the UW and the FHCRC. MCB is the largest graduate program at the UW SOM, accepting 19 students for 2012/13. Faculty from the FHCRC, or from any participating UW department (including Pathology), can apply to become faculty mentors in the program, based on strong research and training credentials. Thus a student in the MCB program who works in a Pathology faculty member's lab will earn a PhD in MCB, not MBD. The focus of the MCB program is on basic research, and MCB faculty must have department affiliations in a basic science department (this includes Pathology, because it is considered both a basic science and a clinical department). <u>The expanded MBD program will differ from MCB by encompassing faculty in clinical departments and by emphasizing translational research</u>.

Molecular Medicine (MM): Molecular Medicine began as a Howard Hughes-funded program to facilitate the exposure of graduate students in basic research departments to clinical medicine. It created several courses, established a requirement that each student have a "clinical mentor,", and students who satisfy MM program requirements earn a Certificate in addition to their PhD in whatever program they are in. It does not replace or conflict with department programs. Several MBD students are in the MM program. HHMI funding for Molecular Medicine is now ending. The organizers have been granted a small NIH training grant (3 students, through 2016) to support training in translational research.

The director of MM, Dr. Nancy Maizels (Immunology), has proposed seeking UW approval to convert MM into a PhD-granting interdepartmental graduate program, like MCB, but retaining MM's focus on clinical/translational research. This is very similar to what the Pathology-centered MBD program has become (is becoming). On 11/28/2012, representatives from the MM and MBD programs met to consider how the two groups could synergize or even merge, rather than competing with each other. MBD proposed that MM should work to expand its existing small training grant into a larger grant suitable to provide significant support to translational research training (but not attempt to set up the infrastructure to become degree-granting), and that MBD should continue to expand its existing translationally-oriented PhD training program (with tuition/stipend support from the MM training grant). The meeting ended without agreement as to any coordination of effort.

<u>Response:</u> <u>The Pathology-centered MBD approach to expanding translational research training works well within the rules of the UW Graduate School and the SOM, while the approach used by MCB, and proposed by MM, would not</u>: The MCB program is an interdepartmental PhD-granting program that might seem to be a model for a possible MM program with a translational focus. However, MCB encompasses mostly faculty in departments that already have PhD programs, as well as some with affiliate appointments in such departments. Graduate faculty appoints at the UW/SOM are <u>department-based</u>. A faculty member without such an affiliation (e.g. a faculty member in a clinical department) can only mentor an MCB student if another

MCB faculty member with an appropriate graduate program appointment) serves as co-mentor. This is awkward and, in practice, few MCB students work in such labs. This set-up would be a particular problem for a non-departmental MM PhD program that plans to encompass researchers in clinical departments. By contrast, the MBD model is more straightforward: We identify and contact faculty in clinical departments with strong research programs, solid funding, and documented mentoring skills, whose research focus fits within our areas of focus. If they are enthusiastic, and if the MBD and Pathology A&P committees consider them good candidates, they are granted affiliate faculty status in Pathology and put up for a vote by existing MBD faculty to be granted MBD faculty status. At this point, they can function as full members of the MBD PhD program. As mentioned above, we began this process in earnest when Dr. Montine began as interim chair in 2011 and when Bill Mahoney and Jean Campbell joined Dan Bowen-Pope as co-directors of MBD. Since we feel that we have the infrastructure already established to continue as a PhD-granting program focusing on the molecular basis of disease, with translational goals, we will continue our plans to become as broadly-based as possible through encompassing strong faculty in non-PhD departments.

2. How can we increase student exposure to translational research and clinical practice?

Background: The MBD program has always emphasized the medical/pathological context in which basic biomedical research occurs. We now want to establish concrete pathways through which students can more fully appreciate and understand that context. Our goals here are to:

1) Distinguish our program from more basic research programs. This would be an advantage in recruiting students.
2) Add interest and value to basic research by showing the contexts in which it has been moved into the clinic.
3) Enhance understanding of the types of human health problems that need to be addressed and the real-life contexts in which that would need to occur.

Response: We have begun to expand our MBD faculty base to include faculty in clinical departments and divisions. These new faculty will greatly augment our ability to provide clinical exposure to our students. We are still pondering how to make use of that expertise in practice. We are considering one or all of the following:

1) Mandate that each course in the MBD series include a substantial component that exposes students exposed to the relevant clinical application. For example, in PATH 512, "Intro to Pathology Methods," half of the sessions consist of practicing pathologists showing (via digitized slides or videoscope) specimens that illustrate how they use histologic information to make diagnoses. Students attend an autopsy during or after, the class. How can clinical exposure be extended to include specialties with patient contact, without interfering with patient care or confidentially and without overburdening the clinicians?

2) Develop a new course that explicitly lays out the principles/practice of translational research.

3) Require that each student have a "Clinical Mentor" in addition to a Thesis Advisor. The Clinical Mentor would be responsible for introducing the student to the practice of medicine/pathology that most closely matches the area in which the student is doing bench work. In most cases, we expect that the Clinical Mentor would be a member of our MBD program. How much clinical exposure will we expect and how will we monitor it?

3. What courses should we offer and require?

Background: We created the Molecular Basis of Disease course series (see Appendix E) at the time of our previous review in 2002. Each of these half-quarter courses covers one area of research focus. Currently they are all required. As noted above, more will be established as new faculty join the program. In addition to those focused courses, we believe that we should create a new course in general pathology designed specifically for PhD students interested in the clinical issues that their research could impact. As noted in Appendix E (Required Courses) we have traditionally exposed our graduate students to the broad sweep of general pathology by requiring that they take courses designed for students in MD or DDS programs. This was efficient with respect to faculty effort, but the courses had other primary constituencies and were never optimized for the needs of future scientists. Curriculum changes in other programs are eliminating those courses after this year, so we cannot continue to use them even if desired.

Response: Overall, as we expand our program and add research focus areas with their accompanying MBD series courses, it will be important to avoid becoming diffuse while trying to be broad. We may need to make some of those courses into electives to avoid infringing on research time. We clearly need to create a new General Pathology course, optimized for the needs of future scientists. The expansion of the MDB program (more students and more faculty) makes creating a new general course a more effective use of faculty time, and we expect that many students in other PhD programs would also take the course.

In going forward with a new General Pathology course, we need to consider how the content of this course should differ from the combined content of the half-quarter courses in our "Molecular Basis of Disease" series. We propose that the General Pathology course cover general principles and clinical presentations, and that the MBD course series focus more on research topics in specific areas (though all with as much clinical context as possible). We also need to decide how the course should be taught. It seems desirable for it to be taught by the smallest possible number of faculty (ideal = 1) so that this course can present a coherent sense of general pathology The MBD series courses take the opposite approach, with many experts each discussing sub-topics within each subject area.

4. How can we move away from lecture-style classes to problem-solving teaching?

Background: As outlined in the Vision Statement for the Medical School Curriculum (July 2012), the SOM recognizes and emphasizes the primacy of critical thinking and active learning.

The Vision Statement for Medical School Curriculum can viewed at the following website:

http://tinyurl.com/bd45zhn

Most of the time that our students spend in the MBD program is not in traditional "classes" of any sort. Students spend most of their time in the hands-on problem solving required to perform their PhD thesis research. This effort involves working with other lab members and their thesis advisors, i.e. it is already the sort of interactive learning environment imagined by the SOM Vision Committee. It is just the more traditional courses, during the first year, that need to be re-thought.

Response: We are considering several options for meeting this challenge in our classroom courses:

1) The equivalent of the current lecture material could be available online. Students would be required to assimilate this before faculty-student contact time. Faculty-student contact time, which was previously devoted largely to lectures, would then be mostly or entirely replaced by discussion or problem-solving, based on the online content. It appears to be acceptable (to the Chair and Dean), in principle, that the content be generated from current faculty lectures or be purchased from an institution or company that has already created it. It appears to be desirable that the content be modular so that it can be combined/recombined for different purposes. It may not be acceptable to record an existing lecture.

2) We are considering two approaches to promoting problem-solving during faculty-student contact time:

    a) Require students to analyze published articles in the area covered by the online "lecture" material. This is the format that we already use in PATH 501 Proseminar classes. We require that students take three of these classes. Students are assigned to present and critique publications in the topic area of the course, which varies each quarter as our faculty take turns as course director. This is excellent training, but, in general, students tend to spend the vast majority of their time thinking about the paper that they are responsible for and not reading/thinking about the papers assigned to other students. Nevertheless, they benefit from hearing what other students (aided by faculty input) point out for praise or criticism.

    b) Challenge students to answer questions (in class) based on assigned material. This is what many of us already do to keep students engaged. We could do much more of it.

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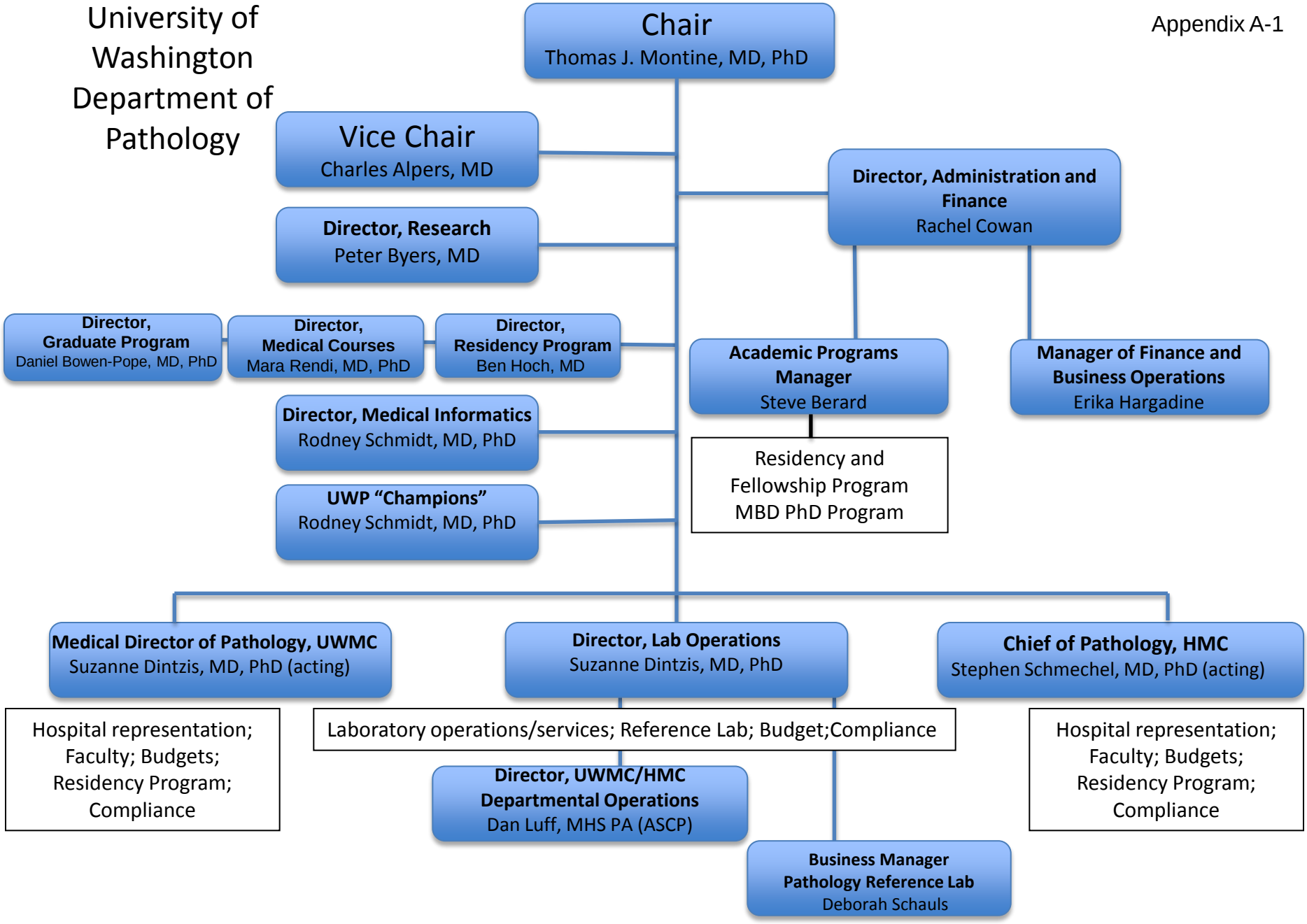
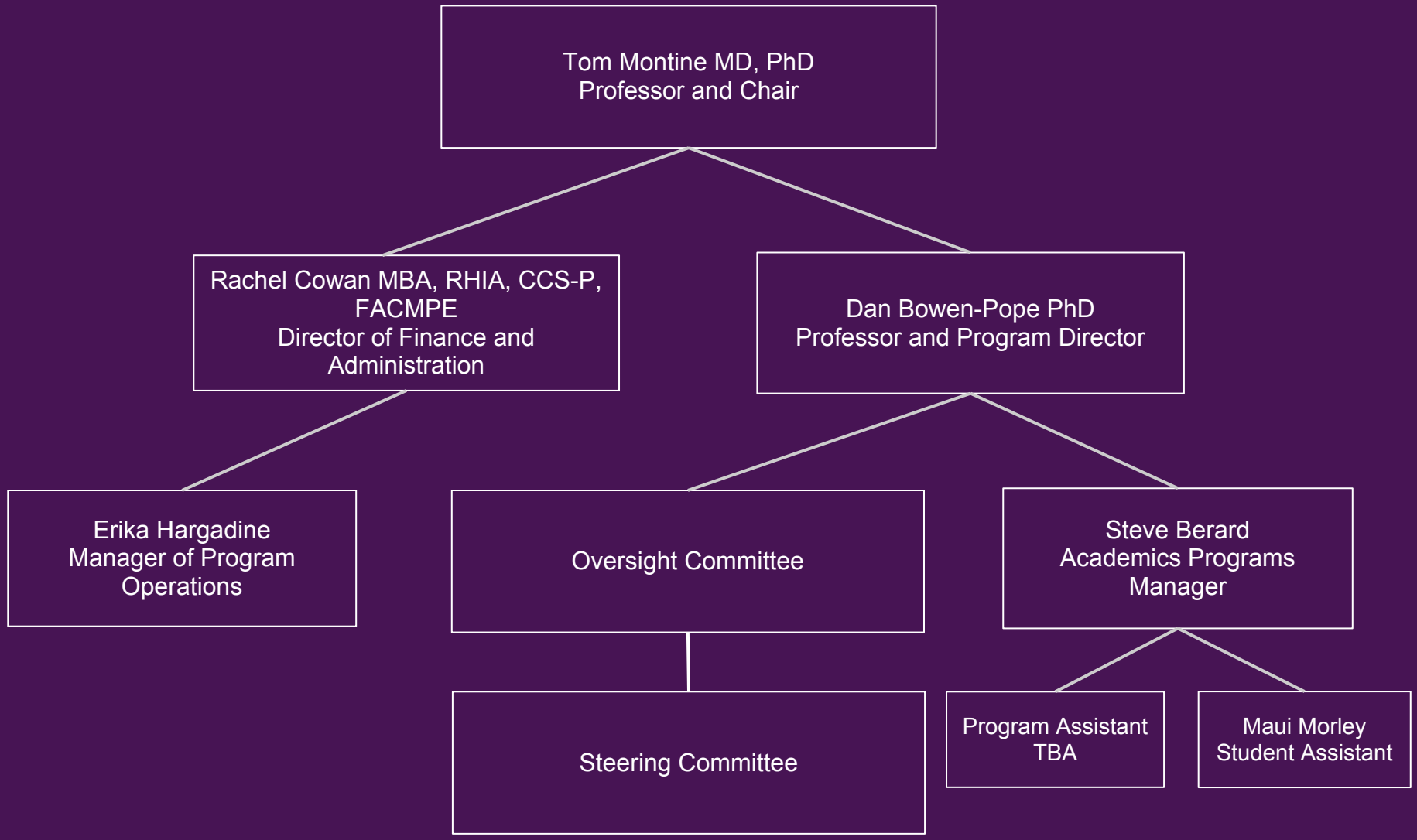
Appendix A-1

University of Washington Department of Pathology



Appendix A-2: MBD Organization



Appendix B: Unit Budget

Major costs associated with the grad program:

1. Staffing
2. Recruitment
3. Yearly program events
4. Stipends and tuition for the first year/3 quarters: covered by the program
5. Stipends and tuition for subsequent years: covered by the students' advisors/PIs
6. Stipends and tuition for quarters when the PI does not have the resources: usually covered by the program.

1. Staffing

Professional staff:

Grad program assistant: 75% FTE; Steve Berard

Fiscal manager: Erika Hargadine with no specific allocation currently identified.

Faculty:

Program Director: 25% FTE Dan Bowen-Pope (current) followed by Nick Crispe beginning Spring of 2013.

Co-Directors: No specific allocation. Bill Mahoney and Jean Campbell.

2. Recruitment

Advertising/promoting the program:

$2100 online advertising via GradSchools.com, the leading online graduate school directory. Our partnership has dramatically increased in traffic to our program website with nearly 50K page views and 250 direct inquires about our graduate program since we started listing program information on the site in 2011.

$2-5K to attend various local and national recruitment conferences, including ABRCMS and SACNAS meetings. Total funding support determined by location of conference and number program representatives attending.

Interviewing/recruiting:

$15,835 Airfare, lodging, poster session/lunch, reception, social event, public information materials, etc

3. Yearly Program Events

$1500 Catering for Winter and Summer grad program retreats

$1K Annually for Summer retreat social event/team building with grad faculty and students (Last year: rock wall climbing)

4. Funding First Year Stipends and Tuition

For 2012/13, the costs per student for a full year are:

Stipend	$27,384
Fringe benefits (14.2%)	$3,883
Tuition (operating fee only)	$14,782
Total:	$46,049/year

During the first 3 quarters in the program, the students rotate in possible home labs and are paid from sources that the program identifies. 10 years ago, these were largely from training grants and the Grad School. Currently, training grants do not cover first year students and Grad School resources are greatly diminished.

The 7 ½ first-year funding slots that we have identified for students entering next year (Autumn 2013) are:

2 slots from Pathology Department funds. This is an average commitment. Past years have varied from 1-4 slots, depending on department finances

2 slots from the Dean of the SOM. This is new for this year and is a commitment for each of 2 years.

½ slot from the UW Graduate School. This slot is not certain since these slots, termed "GSFEI Top Scholar" positions, are awarded every year on a competitive basis. As UW finances suffered several years ago, fewer awards were made and our yield declined from up to 2 slots/year, to effectively a half slot/year.

URM slot. Every year we request funding for an eligible URM. We are successful about half the time, and were awarded a slot for the 2013/14 year. These slots can be used only if enroll an eligible URM. We make every effort to do so.

2 slots from Seattle Children's Research Institute (SCRI). When Seattle Children's Hospital opened its new research institute in the South Lake Union area, it wanted to fully participate in the UW research community. Via the efforts of Dr. Mark Majesky, our affiliate faculty at CRI, we have received 2 slots for each of the last 2 years. A renewal has not been finalized for this year, but is expected.

Example: Funding last year's entering class (2012/13)

For 2012/13 we were granted and used a URM slot and did not need to use our full allotment of department slots. Actual funding sources used:

Anthony Castanza: SCRI slot

Ana Dinca: SCRI slot

Bonnie Hastings: Top Scholar slot (the Grad School slot) since best GRE and grades. Second half year from department funds

Mitchell Lee: Native American: Bank of America / GOMAP for first and last years

Chun-Chi (James) Lu: Self pay (grant from Government of Taiwan).

Natalie Miller: Natalie entered our program from the MSTP program (MD/PhD) and did not use a first-year slot. During her first 2 years in MSTP, taking classes toward the MD, she did research rotations paid for by the MSTP program. When she committed to a Pathology lab (Paul Nghiem) for her PhD research, she was paid by the Nghiem lab.

Ellen Quarles: The department of Physiology and Biophysics had decided to stop recruiting into their own PhD program and begin participating in MBD. As a form of admission fee, they contributed one slot, which we used for Ellen.

5. Stipends and Tuition for Subsequent Years

After the 3 rotations during the first year, the student joins a home lab and PI of that lab assumes responsibility for funding them, usually from a combination of research grants and training grants. We send the designated mentor a letter laying our responsibilities and costs.

6. Stipends and Tuition for Quarters When the PI Does Not Have Sufficient Resources

Although the program does not formally guarantee funding for the entire time to degree, the Pathology Department has always provided funding sufficient to cover emergencies. When the PI cannot arrange funding. for some defined period (traditionally, up to 2 quarters, usually the final 1-2 quarters), the program director discusses funding with the PI and the department fiscal manager so as to provide emergency funding that is adequate but defined in scope and time.

Appendix C

Faculty CVs and Biosketches available via Catalyst Dropbox:
https://catalyst.uw.edu/collectit/dropbox/summary/sberard/26203