

Final Report of the Neurobiology and Behavior Ph.D. Review Committee

April 13, 2005

Overview

An interdisciplinary neuroscience and behavior oriented graduate program known as the “Joint Program in Physiology and Psychology” was formed in 1968 and reviewed by the Graduate School in 1992. This program was relatively limited in scope and had only two participating departments – Physiology & Biophysics and Psychology. In 1996, a new, more diverse and broadly encompassing neurosciences graduate program was formed - the “Interdisciplinary Graduate Program in Neurobiology and Behavior” (NEUBEH) with 5 founding departments, including Biology, Biological Structure, Pharmacology, Physiology and Biophysics, and Psychology. While the majority of the NEUBEH Program faculty are drawn from one of the five founding departments, the total Program faculty has expanded to now include a list of more than 100 members, including faculty from additional departments, from a number of different schools and colleges of the University, and with laboratories on the main campus and at Harborview, the Regional Veterans Affairs Medical Center and the Fred Hutchinson Cancer Research Center. The goal of the Program is to train students broadly in the neurosciences as well as more intensively in their specific areas of interest.

The Graduate School review of the NEUBEH Program took place on March 31 and April 1, 2005. The committee included two external reviewers with expertise in the neurosciences - Eve Marder, Professor, Department of Biology, Brandeis University, and David van Essen, Professor and Head, Department of Anatomy and Neurobiology, Washington University in St. Louis. The committee also included three internal reviewers – David R. Morris, Professor, Department of Biochemistry, Stanley Fields, Professor, Department of Genome Sciences, and Christopher B. Wilson, Professor and Chair, Department of Immunology (Committee Chair).

In brief, the Program has a number of strengths, including outstanding students and faculty, and is considered to be one of the top 10 neurosciences programs in the country. Nonetheless, there are some areas to which attention is warranted, to assure that the Program remains among the leading neurosciences programs in the country.

Program Leadership, Structure and Direction

The Neurobiology and Behavior (NEUBEH) Graduate Program was directed by Albert Fuchs and Neal Nathanson from its inception in 1996 through 2002, at which time Tom Reh and Michael Shadlen assumed directorship of the Program. Their research interests and styles complement each other nicely, and they are viewed as an effective leadership team by faculty, staff and students alike. They work well with the administrative staff and are responsive to issues as they arise.

Other aspects of program administration appear to be unduly Balkanized. There are currently five standing committees – steering, program, admissions, student progress and curriculum. This dispersed style of governance may at times impede the ability of the Program to function as a cohesive and consistent unit and to deal effectively with issues in a timely manner. For example, while tracking of student progress is of fundamental importance to the success of the Program, progress does not appear to be monitored in a

consistent manner, even though some steps have been taken recently to address this concern. First year students are assigned a mentor, but the frequency of contact between student and mentor appears to vary widely and no reports to the program leadership are provided from meetings that do occur. The recently formed student progress committee reviews annual progress reports from students in later years of the Program, but how its work is integrated with other aspects of student oversight is unclear.

One approach to achieve greater administrative cohesion would be to consolidate the current program, curriculum, and graduate training committees into a single committee whose charge is oversight of all aspects of the graduate training program. To provide greater consistency, oversight of first year student progress and mentoring should either be the undertaken by the program directors themselves or a single individual who serves as the first year student advisor. Ideally, this should involve meeting with each first year student when they first arrive and then after each rotation. We also recommend that the first rotation should be assigned, as described in greater detail in the Curriculum section of this report.

The two program administrative staff are outstanding, play a fundamental role in program cohesion, and are key sources of support for the students. If other aspects of program administration are streamlined, as recommended above and in other portions of this report, the current staffing members are sufficient for the needs of the Program. Resources need to be identified to assure that pay for the administrative staff is commensurate with their role and importance in the Program.

Students

The quality of students in the Program, particularly those entering in the last few years, is quite high. The Program is clearly competing with other distinguished neuroscience graduate programs for a pool of the best students in the country. On the other hand, the outcomes over the history of the Program have not been universally positive. In the early days of the Program, the number of students withdrawing or leaving with terminal Masters Degrees was distressingly high, time to degree was long and the publication records of the exiting students were inconsistent, with some students receiving the Ph.D. degree in the absence of published papers. The current trajectory is encouraging, but continuing efforts are required as described below.

Student Progress and Mentoring. One senior faculty member described the Program as “Presenting itself as flexible, but in fact not providing enough guidance for the students. They take too long and are not as productive as they might be.” The Committee investigated these issues in some detail.

The advising and mentoring of first-year students requires strengthening, as outlined elsewhere. Briefly, formal advising during the first year should be routine, consistent and not just in response to a crisis. Evaluations of the rotations of the first-year students should be meaningful and the students should receive copies. Students should be encouraged to form their supervisory committees soon after selecting an advisor. This is particularly critical in an interdepartmental program such as this, where it is quite possible for a student to slip between the cracks.

For students beyond the first year, the Program should achieve consistent, meaningful participation of the supervisory committees. Annual meetings of the

supervisory committees should be diligently and consistently enforced and student progress should be reviewed annually by the reconstituted Program Committee (see above). Annual meetings of the supervisory committees are particularly important for those students who are having problems, be they academic, scientific or personal. The goal should be to put student advising on a proactive footing.

Currently, the responsibility is left to the students for approaching their supervisory committees. Only recently has accountability for setting up the meetings been established. Clear and consistent guidelines for Program standards need to be transmitted to the committees. At present, the standards are decentralized and inconsistent from student to student. The students view the Program as having very little influence on these policies, even though the Program is responsible for administering the degree.

The Program needs to develop a clear and concise statement of what is required for completing a Ph.D. dissertation for distribution to the students, advisors and supervisory committees. There seems to be general agreement among the faculty that two-first author Journal of Neuroscience papers, or the equivalent (the meaning of “equivalent” will vary somewhat according to the sub-field), should generally be expected. However, as for many aspects of student advising in the Program, this has been left largely to ad hoc decisions by advisors and the supervisory committees. This has led to a lack of consistency in quality of the finished product.

Number of Students. Given the number of committed faculty, the size of the applicant pool and the availability of neurobiology students from other programs, it is the opinion of this committee that the Program is about the correct size. There are currently 64 students in the Program and the limit set by the Graduate School is 45. The review committee recommends that this limit be set at 65.

Student cohesion and group identity. Because of the geographic dispersion of the NEUBEH Program, cohesion is difficult and maybe not even necessary for many students. Some participating departments, for example Physiology and Biophysics, Pharmacology and Biochemistry, have well-developed mechanisms for welcoming the NEUBEH students into the department and there are well-developed departmental support resources for these students. In other locations, these resources are not accessible to NEUBEH students, and therefore the Program needs to provide a safety net. An excellent model in this regard is the MSTP, where the students retain strong identification with the Program.

Curriculum

Giving graduate students a broad training in neuroscience is invariably a challenging prospect. Beginning neuroscience Ph.D. students often come from widely disparate backgrounds, ranging from undergraduate degrees in engineering, physics, chemistry, biochemistry, biology, computer science, and psychology. All neuroscience programs face the problem of giving a minimal amount of common knowledge and language to students who start from different places. To be able to read the research literature in neuroscience and to understand research seminars in their field students need to understand the basics of molecular and cell biology, the fundamentals of ion channel

structure and function, the basics of synaptic transmission, neurodevelopment, neuroanatomy, the organization of sensory and motor systems, behavior, cognition, and a general understanding of neurological disorders and mental illness. It is precisely this wide sweep of the field that makes designing an appropriate common curriculum for beginning neuroscience students such a daunting prospect. That said, given the diverse faculty in this program, it is obviously important that students be given some sense of the full range of neuroscience, if they are to be able to understand the range of opportunities available to them, and to understand the purpose and significance of the work of their peers.

At present, all first year students are required to take a three semester course sequence, NEUBEH 501, 502, and 503. The two latter courses, NEUBEH 502 and 503 appear to be reasonably successful, and give students a working understanding of much of systems neuroscience and behavior. However, NEUBEH 501 is clearly not working. All of the students mentioned that NEUBEH 501 is less than optimal, and some of them complained about it bitterly. The faculty is also fully cognizant that it isn't working, but it hasn't been fixed. This is especially problematical because it is the first NEUBEH course that incoming graduate students take, and therefore it sets a less than optimal tone for the Program. The problems identified by the students include 9-10 faculty teaching in the course with no course coordination. Individual faculty members do not know what previous lecturers have covered, and some of the lectures overlap with lectures in Conj 531 and 532 that the students take concurrently. Over and above those problems the syllabus itself is a mixture of topics that belong in a "Cell biology of the neuron", topics that are part of a "Cellular electrophysiology" course, and topics that belong in a "Developmental neurobiology" course. There is nothing intrinsically wrong in bringing these together, but the present situation does not ensure that students are rigorously and adequately exposed to the basics of electrophysiological analyses of neuronal function until they reach Rieke's NEUBEH 532. Actually, both students and faculty said that many of the Ph.D. students felt that they really learned the basics of electrophysiology when they TA'd William Moody's undergraduate course, which is apparently exceptionally successful with this material. Obviously, if the students master the material when teaching it, this also ensures that they have learned what they need to know, but it also means that they have to work even harder in their TA quarter.

The review panel feels strongly that the structure and concept of NEUBEH 501 need to be rethought. There are any number of possible good solutions to NEUBEH 501, but one of the possible good solutions should be found and implemented. Because students are already taking Conj 531 and 532 which have material on ion channels and membrane structure, one possibility would be to turn NEUBEH 501 into a course about cell biology of the neuron and development, and to ask Rieke to take over basic electrophysiology of voltage-gated ion channels and synapses in his course.

The remaining formal course work in the Program seems to be working reasonably successfully, but constant oversight of how these courses are serving the students is important.

Rotation selection. All 1st year students do three rotations. We were surprised to hear that students have been encouraged to arrange their rotations in the summer before arriving on campus. In discussions with the program staff we learned that the staff has

been encouraging students to email faculty to arrange rotations during the summer because NEUBEH students are often competing with students in other programs for access to the most popular laboratories. We find this disturbing, because the most useful information for deciding about where to rotate will come from personal conversations with faculty and students. We feel that students should be encouraged to delay their decisions about each rotation as long as possible, so that they can benefit maximally from what they are learning in their first year.

Our suggestion would be to ask all Pharmacology, Biophysics, and NEUBEH students to submit a list of three-four rotation laboratories for their first rotation. Then a faculty group with members from the three programs could meet and assign rotations, to ensure that all students get one of their top picks, but to avoid students competing with each other at the onset of their graduate career.

Journal Club. All 1st and 2nd year students are required to attend and participate in a biweekly journal club. Speakers in the seminar series are asked to assign a paper to the students on their work, and then the week before the seminar the students are supposed to meet to discuss this paper. This is an excellent idea in principle, and apparently worked in the past. However, students are now meeting without a faculty member, attendance has dropped, and the students find the presentations very uneven and often lacking in rigor.

Our recommendation is that a faculty member with knowledge of the area of the paper meet with the students to provide overall concept guidance and to explain technical issues that may be obscure. This should greatly improve the pedagogical value of the Journal Club, as well as introduce a great many faculty to the 1st year students. Moreover, the faculty member will be able to provide feedback to the presenting student on the presentation itself that should be invaluable.

Practice in Speaking. The Committee was surprised to hear that students are not required to present their work to the entire program after their 1st year rotation talks. The rotation talks do give the 1st year students experience in speaking, but it would be extremely useful if 3rd, 4th, 5th, etc students gave yearly talks on their work to the other graduate students, postdocs, and faculty in the Program. This would add to a) the skill of the students in presenting their work to a relatively broad audience, b) the cohesiveness of the Program, c) introducing 1st year students to many areas of neuroscience, d) help give beginning and intermediate students an idea of what constitutes “a thesis”. We understand that the retreat also potentially provides a venue for students to talk about their work, and depending on what happens with the retreat, this may serve this function adequately.

Retreat. A retreat for the Program has been held during a weekend in the spring on the university campus. The format that had been in place included an invited speaker and student talks. Some students felt that the retreat attracted too limited a faculty attendance, with many of these leaving after the presentation by the invited speaker and prior to the student talks. This year the Program is organizing the retreat as a Northwest neuroscience conference to include other scientists from British Columbia and Oregon.

We feel that a more traditional retreat format, to occur in the early autumn when the new students arrive, would serve NEUBEH well. Such a retreat could be designed around the idea of exposing students to more of the faculty research than they currently receive from the short orientation talks. It could also provide a forum for students to learn more about each other and each other's work, through social time, poster presentations and the like. We appreciate that such a retreat, particularly if it occurs off campus, will require additional funding.

Faculty

Current faculty and faculty participation. Although more than 100 individuals are listed as NEUBEH faculty, a much smaller number are active members of the Program. By one metric – inclusion as training faculty on the neurobiology training grant based on mentorship history and active research funding - 50 faculty actively participate. But based on various queries we posed during our visit, we estimate that ~20-40 faculty constitute the core of active faculty, as evidenced by participation in programmatic activities (seminars, retreats, student recruitment, admissions & supervisory committees) and in terms of having rotation students and/or thesis students. The overall quality of the faculty, especially of the core faculty, is excellent, in terms of research productivity and national prominence.

The NEUBEH faculty we interviewed were predominantly from this core group and were in general very enthusiastic about the Program and committed to its success. For faculty outside of this core group, our impression is that relatively few participate substantially in any of the NEUBEH program activities. A specific example is that willingness to contribute to student recruitment efforts is evidently less than universal, though estimates of the scope of the problem varied. It is virtually inevitable that the degree of faculty participation in a large interdisciplinary program will span a large range, as is the case here. However, the sense of our committee is that the NEUBEH Program should focus on increasing the fraction of the faculty that are active even if this occurs at the expense of trimming the total number of those listed. One general strategy for doing so would be to articulate and broadcast the requirements and expectations involved in being a NEUBEH program member and to enforce these guidelines routinely. It is our understanding that steps in this direction have already been taken. We encourage further such efforts.

A related issue concerns the degree to which faculty participation is constrained by explicit or implicit pressures from department chairs, as distinct from the fact that faculty members are generally very busy and make personal priorities on their time allocations. We received a wide range of opinions on this issue. In general, it seems clear that faculty in most departments are encouraged (or at least not discouraged) to participate in NEUBEH activities, including teaching. In some departments, the issue appears to be more complex, especially in relation to handling of teaching responsibilities. It is our committee's sense that the NEUBEH Program stands to benefit all of the participating departments and that the faculty participation in this program should be encouraged as much as is practicable.

Relationship to other programs

The NEUBEH Program is intertwined with a number of other graduate programs. We heard estimates that NEUBEH students account for approximately one-half of the neuroscience-oriented graduate students at the University of Washington, with the other half coming from other graduate programs, most prominently Biology, Pharmacology, Physiology and Biophysics, and Psychology. While some felt that the overall caliber of the graduate students in the NEUBEH Program was on average slightly stronger than in these other programs, others did not. Given the inherently competitive/cooperative nature of these programs, the relationships among them seem to be collegial and healthy. It also reflects a healthy tradition of mutual respect that is highly appropriate but of course not guaranteed. Continued attention to these relationships and to relationships with other departments and programs, will be important for the future health of the NEUBEH Program.

The university has established a strong and vibrant undergraduate program in neurosciences. It is worth considering whether a joint curriculum committee looking at all of the neuroscience courses offered to the undergraduates and graduate students could identify places in which faculty teaching “savings” could be made. In other words, can more courses be used to meet the needs of both the first year graduate students and talented seniors, so that faculty can be used more effectively? Of course, one doesn’t want to risk breaking anything that is working, but it may be worth taking a serious look at the total neuroscience teaching enterprise.

Long-term development of the field

Neuroscience is still in an explosive growth stage of its development. The last few years have seen enormous new interest in translational work as numerous genes relevant to all sorts of neurological disorders and mental illnesses are being identified and studied. This is an era when very complex cognitive disorders may reveal themselves to be associated with fundamental cellular mechanisms, and as such this is an area of tremendous potential interest, both in the field and to students. The University of Washington has enormous potential strengths in many emerging aspects in this field, but it does not seem to be effectively poised to capitalize on the conjoint strengths of its basic science and clinical programs, and we feel that this is an opportunity that should not be lost.

The Program Directors correctly note that despite its incredible strengths in many areas of neuroscience, the University of Washington is relatively weak in cognitive neuroscience. This again is an opportunity to bring strengths in Psychology closer to those in the Medical School, as cognitive neuroscientists are often found both in Psychology Departments and in Medical Schools.

The neuroscience community at the University of Washington cannot directly hire new faculty, and thus influence the direction of the NEUBEH Program. In this way, the Program Directors are “hostage” to the programmatic needs of the individual departments. If the University wishes the Program to be one of the best in the country, then some coordinated consideration of the strengths of different subareas of neuroscience needs to be done, and some mechanism implemented to ensure that relevant program faculty are consulted as departmental hires are made.

Examples of the potential for further productive collaboration between different departments and programs at the University of Washington include: Cognitive Neuroscience- Psychology; Neuroethology, Behavioral Genetics – Biology; Computational Neuroscience- Physics, Computer Science, Biomedical Engineering, Applied Math. These are all areas in which new hires would have “double valence” and add both to the strength of a department and to neuroscience.

Resources

The Program sorely needs to have a stable budget commensurate with its needs. In the absence of this funding, it will be difficult to maintain the excellence of the Program and to continue to attract students of the current quality. The budget from the Graduate School appears not to have increased since the establishment of the NEUBEH Program, and in fact has been subject to State cuts as well as continuing increases in stipend levels. Thus, this budget now funds ~8 first year students. Additional funding in the form of 4 TA lines will be provided with the recently agreed upon increase in the commitment of NEUBEH graduate students to teaching in the undergraduate neurosciences program. Some additional funds come into the Program by the co-sponsoring of seminars by participating departments, but this funding is variable and provided on an ad hoc basis.

The directors identify 5 key areas where new funding would have a major impact: seminar series; annual retreat; retention of staff; student travel to meetings and courses; and flexibility to allow the additional student to be accepted in any given year. We agree that these are critical needs, and that no acceptable system is now in place to meet them. We note several potential sources of additional funding:

1. The University should reevaluate its level of funding in light of the success of this program nationally. The Graduate School, working with the deans' offices of the relevant units, the department heads, and the undergraduate program, should develop a new budget that can sustain the quality of this program, especially for first year student support. The budget level needs to be reevaluated over time as stipends will continue to rise.
2. The Neurobiology Training Grant is largely used to fund NEUBEH students, with 11 of the 12 trainee slots filled this year from the Program. The training grant has a \$2200 allocation per trainee per year. If the students are provided \$1000 each of this amount for travel, an additional \$1200 x 12, or \$14,400, could be made available to the Program for trainee-related activities (such as the retreat or seminars). The training grant director appears receptive to allowing this allocation. There may be other funds available from the other training grants available to NEUBEH faculty.
3. The participating departments, especially those with the bulk of the NEUBEH students in their laboratories, could each commit to a fixed amount of support per year. This could be in lieu of their present ad hoc funding of seminars, which comes with limited certainty, some strings and the frequent necessity for multiple emails and phone calls from Program staff before it is received. Departments could agree to some amount that represents the average cost of travel,

- accommodation, food and honorarium for a seminar speaker, and then each department could commit to funding one or more speakers. These funds would give the NEUBEH Program the flexibility to bring in speakers as they see most appropriate without the need for constant negotiation.
4. The Program should look at the possibility of new training grant or foundation support. For example, the NIH has a broad-based neuroscience training grant for first and second year students, which is funded by several of the institutes. HHMI has recently established a new training program that may be relevant to NEUBEH. While such requests obviously may not be successful, the Program has sufficient faculty that the effort to take on these applications should be available.
 5. The Program should work with the participating departments, especially the core ones, at outside fundraising. Given the market for psychotropic drugs, the prevalence of psychiatric disorders, and population demographics, support for training in neurosciences both from pharmaceutical and biotechnology companies and from the general public should have a natural appeal. A graduate program working on its own to raise funds may be in a difficult position, but in combination with the departments should be able to make a strong case.

Summary:

1. The NEUBEH Program has a strong reputation nationally, reflecting the strength of the faculty and the quality of the students it attracts.
2. The Program co-directors are effective and have the respect and support of the faculty and students. However, the administrative structures of the program, particularly as relates to the mentoring and monitoring of student progress, does not appear to be optimal.
3. While efforts to assure timely progress towards the Ph.D. appear to be having a favorable effect, there is still a lack of clarity regarding what is required for completion of the Ph.D. in NEUBEH.
4. Most NEUBEH courses are focused and effective. However, the goals of the NEUBEH 501 course are not clear and it does not appear to be an effective part of the current curriculum. Some of the informal aspects of the curriculum, including the journal club and retreat, do not appear to as effective in facilitating Program cohesion and student training as they could be.
5. The active core faculty are dedicated, enthusiastic and highly regarded. While the other faculty, by increasing the diversity of apparent opportunities, may be a positive factor in student recruitment, program cohesion might be enhanced by setting and enforcing minimal standards for faculty participation.

6. The interdisciplinary nature of the NEUBEH Program is a strength, but lack of 'ownership' of the Program by any one department, school or college or by the Graduate School may impede its ability to respond to changes in this rapidly evolving field and is a threat to its future vitality.

Recommendations

1. The number of students approved for the NEUBEH Program should be increased to 65.
2. The NEUBEH Program needs to have a stable budget commensurate with its needs. Identification of resources for improved funding should be a joint responsibility of the Program, the University, and the participating departments.
3. Advising and mentoring of first-year students and timely formation and regular meetings of supervisory committees in the later years need to be improved and consistently applied. Expectations of the Program for completion of the Ph.D. need to be clearly and concisely articulated and distributed to the students, advisors and supervisory committees.
4. Fall quarter rotations for first year students should be assigned based on a list of possible rotation laboratories submitted by students in the summer before they matriculate; ideally, assignments should be made in concert with fall quarter rotation assignments in other graduate programs with large numbers of neuroscience-oriented students.
5. The journal club and retreat should be reworked and strengthened, and research in progress presentations to the Program by students from the 3rd year onward should be implemented.
6. The structure and concept of NEUBEH 501 needs to be rethought and a modified course implemented.
7. Consideration of the neuroscience courses offered to graduate and undergraduate students at the University might identify courses that would meet the needs of first year graduate students and senior undergraduates, and if so a saving of faculty teaching effort could be achieved.
8. The NEUBEH Program appears to benefit all of the participating departments, and they should encourage faculty participation in this program. Expectations for faculty participation in the NEUBEH Program should be articulated and these expectations should be enforced.
9. Some coordinated consideration of the strengths of different subareas of neurosciences at the University needs to be done periodically and incorporated into discussions as hires by the relevant departments are made.