SUMMARY STATEMENT

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Application Number: **2 T32 GM008704-06**

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Review Group: **BRT-A (02)**
Biomedical Research and Research Training Review Subcommittee A

Meeting Date: **11/11/2002**
Council: **JAN 2003** ***PCC:*** **C7CMMZ**
Requested Start: **07/01/2003**

Project Title: **Molecular and Cellular Biology at Dartmouth**

SRG Action: **Priority Score: 181**
Human Subjects: **30-Human subjects involved - Certified, no SRG concerns**
Animal Subjects: **32-Animals involved - SRG comments**

Project Year	Direct Costs Requested	Estimated Total Cost
6	327,304	340,972
7	490,956	511,458
8	490,956	511,458
9	490,956	511,458
10	490,956	511,458
TOTAL	2,291,128	2,386,804

ADMINISTRATIVE BUDGET NOTE: The budget shown is the requested budget and has not been adjusted to reflect any recommendations made by reviewers. If an award is planned, the costs will be calculated by Institute grants management staff based on the recommendations outlined below in the COMMITTEE BUDGET RECOMMENDATIONS section.

REQ. STIPENDS: YR-06, 08; YR-07, 12; YR-08, 12; YR-09, 12; YR-10, 09
REC. STIPENDS: YR-06, 08; YR-07, 08; YR-08, 08; YR-09, 08; YR-10, 08

CURRENT SUPPORT FOR THIS PROGRAM
YR 05 07/01/2002-06/30/2003 $160,692 DIRECT COSTS 4 STIPENDS

SITE VISIT MADE BY BRT-A (02) Workgroup #5 (roster attached)

RESUME AND SUMMARY OF DISCUSSION: This application requests continued support for a cellular and molecular biology program at Dartmouth Medical School and Dartmouth College. This well-run training program provides a well-rounded training experience through course work, lab rotations, seminars and teaching experience. Students are attracted to Dartmouth because of the diversity and high caliber of the faculty, as well as the program's smaller size. Students are provided with written explanations of program requirements with a timeline so that students have clearly documented milestones they must achieve in order to complete their training. Each student's progress is followed closely through annual review by program administration. These attributes along with a collegial and active faculty provide for a supportive environment for both students and beginning faculty. Student interviews illustrated how this program helped to develop articulate young scientists from beginning students. This young program is also evolving and changing in a number of notable areas. The core course has been expanded from two to three terms so as to include instruction in all training areas covered by MCB. While not considered in the priority score, the reviewers felt that developments in two other areas were important. The course covering ethics in biomedical research was found to be deficient, but a newly outlined course would give students the fundamentals to deal with the ethical issues they will encounter in their careers, and the program has begun to take more seriously the issue of recruitment to their program of students from underrepresented minorities.

DESCRIPTION (provided by applicant): The goals of the proposed training program are to recruit and train outstanding young graduate students, and prepare them for productive careers in science. The "Molecular and Cellular Biology at Dartmouth" Training Program includes trainers from the majority of the faculty in Dartmouth's largest life science graduate program, the Molecular and Cellular Biology (MCB) Graduate Program. The MCB Graduate Program is an interdepartmental, interdisciplinary program consisting of 56 tenured or tenure-track faculty members and 104 students. Research areas include biotechnology, cell biology, computational biology, developmental biology, immunology, molecular pathogenesis, neurobiology, regulation of gene expression, signal transduction and cellular metabolism, and structural biology. The MCB Graduate Program is interdepartmental, consisting of students and faculty from the Departments of Biological Sciences and Chemistry at Dartmouth College; the Departments of Biochemistry, Genetics, Microbiology & Immunology, Medicine, Physiology, Pediatrics, and Pathology at Dartmouth Medical School, and the Thayer School of Engineering. The MCB Graduate Program was created in 1995 via the fusion of two existing graduate programs, the Biology Graduate Program at Dartmouth College and the Biochemistry Graduate Program at Dartmouth Medical School. Although the combined MCB Graduate Program is relatively new, many of the trainers have a long and established training record. The "Molecular and Cellular Biology at Dartmouth" Training Program includes 41 of the 56 MCB Graduate Program Faculty, who were selected based on the strength of their research programs, their commitment to training predoctoral students, and their willingness to participate in the training program. Trainees must satisfy the MCB Graduate Program requirements for the Ph.D., which include three research rotations, a two-term core course, four elective courses, one term of teaching, participation in journal clubs and seminars, a qualifying exam, a yearly research in progress presentation, and a thesis defense. In addition "Molecular and Cellular Biology at Dartmouth" trainees are required to take the "Ethical and Responsible Conduct in Research" course. The MCB Graduate Program regularly matriculates an average of 20 students/year. New efforts to recruit underrepresented minority students were implemented in the last year of the previous funding period.

CRITIQUE 1:

This is the first competitive renewal application from a very good to excellent training program in Molecular and Cellular Biology at Dartmouth that grew out of a more focused training program in protein structure and function. It is small (only 4 slots) and can best be viewed as a subset of the larger MCB Program at Dartmouth (approximately 20 students per year). It looks to increase to 8 slots in the first year and to 12 slots in each of the final 4 years. The applicant pool warrants 8 slots for the duration of the training period.

The director of the Molecular and Cellular Biology at Dartmouth is Professor Nancy Speck who has been an independent investigator at Dartmouth since 1989. She got her Ph.D. at Northwestern University in biochemistry and did postdoctoral work with David Baltimore at the Whitehead Institute and with Nancy Hopkins at Massachusetts Institute of Technology. She is recognized for her work on hematopoiesis and leukemia, where her focus is on core binding factors that are mutated in a large number of human leukemias. She has published on the order of 60 papers. She is an active teacher and is Associate Director for Basic Research at the Norris Cotton Cancer Center at Dartmouth. She has graduated 7 Ph.D.s and currently has 7 in training. She is a strong advocate for this program and is well qualified for the position of its director.

Governance of the MCB training program is the responsibility of Dr. Speck and two committees that are both appropriate and adequate for the job of governance. The MCB Graduate Committee that includes 6 faculty members from 4 degree granting programs (biochemistry, biological sciences, genetics and microbiology and immunology) and 4 elected graduate students. The MCB Graduate Committee is responsible for the program at large: identifying students for the program and monitoring their applications; meeting with program students to help plan various aspects of their training (courses, rotations, selection of thesis committee, identification and execution of the qualifying exam); helping to select teaching assignments, arbitrate in any disputes; and enforcing rules of the program.

The MCB Training Program Committee administers the NIH funded training program; it consists of the director and 5 faculty members (its membership overlaps with the graduate committee), and it is responsible for choosing both student trainees and faculty trainers.

These two committees and their relationship reflect the fact that the NIH-funded trainees are a small subset of the larger MCB program at Dartmouth.

Dartmouth has an excellent, well-published and well-funded faculty with diverse research interests and a rich history of training experience in the biomedical sciences. Forty-one trainers come from 8 departments and include a balance of academic ranks: 14 assistant professors, 7 associate professors and 20 professors. Collaboration among faculty appears strong and students appreciate the efforts of a number of their mentors in training. The training environment is highly and effectively nuturing. Faculty trainers are reviewed yearly by the MCB Training Program Committee based on the availability of research funds and participation in the training program. A disappointing feature of this program in molecular and cellular biology was the decision of a number of excellent geneticists to exclude themselves from the program. The strength of this program would be greatly facilitated with the addition of the genetics trainers even if they plan to participate in other training on campus.

The training program includes eight requirements for the Ph.D. 1) All students are required to complete no fewer that 3 rotations, though some flexibility accommodates students who come with prior experience (e.g. master's degree). On paper, the mechanism by which students are matched to trainers for these rotations seems inordinately complex, but both students and faculty, including junior faculty, are happy with the process and are convinced that it is highly effective. 2) Course work includes a three-term core course in biochemistry, cellular and molecular biology and five electives that include a distributional requirement for one course each in three disciplines of biochemistry and/or cell biology, genetics, and microbiology and/or immunology plus a fourth course in one of the disciplines. The fifth elective "course" is teaching (see below). For every term a student is enrolled, he/she is also

required to participate in a journal club that is an informal seminar designed to help students learn to read, analyze and orally present papers. Currently there are 9 extant journal clubs that focus on a wide range of topics from which students can choose. 3) All students are required to teach at least one (10-week) academic term, an experience upon which they are graded as a course. Most of the students find this experience most rewarding. 4) A flexible format qualifying exam (can be on the student's proposed research, related to that research, or completely independent of that research) has two components, a written proposal (a "Specific Aims" page has to be approved by the examining committee) and an oral defense. The MCB program specifies that this exam should be completed by the end of the first half of the 3rd year, and both students and faculty are kept acutely aware of and adhere tightly to this schedule. 5) Attendance is required at program functions including seminars, retreats and recruiting functions, and although there does not seem to be any real mechanism for assuring compliance, the majority of students appear to enjoy the activities of the program or at least the academic life of the various degree-granting units from which they are ultimately awarded their Ph.D.s. 6) The research that culminates in a thesis is deemed central to the training experience, and while no specific mention of expectation of publication is made in the proposal, students are acutely aware that the expectation is for two first-author papers. While the program itself is quite young, and it is therefore somewhat too early to tell, this unwritten, two publication policy appears to be enforced. The program should consider stating explicitly this expectation as part of the requirements for the Ph.D degree. Frequently two papers, per se, are not required, but the examining committee needs to be convinced that the student has completed two papers worth of work and will write them up and submit them in a timely fashion. A thesis advisory committee is designed to augment the expertise of the advisor on the research project and meets after a yearly Research in Progress (RIP) seminar. A spot check for compliance on the written reports that are required following the annual meeting suggests that compliance is outstanding. An outside examiner is added to the thesis committee for the thesis defense. 7) and 8) A thesis seminar and defense are also required.

A weak point of the training program was that only students supported by training grants are required to take an Ethical and Responsible Conduct in Research Course, sending the message that such training is not an integral part of scientific training. This course should be expanded to both be more rigorous in its content and to include all students in the MCB Graduate Program, a policy move that the students interviewed would approve. Ironically, the ethical training was not included in the one-paragraph summary of proposed training, further suggesting ethical training is getting short shrift.

The main and perhaps only positive feature that distinguishes training grantees from other MCB students (aside from the fact that they are required to take the ethical training course) is that each trainee invites and hosts an outside speaker for the seminar series.

Dartmouth contributes $415,000 per year to support the MCB program and its students, and the training environment is excellent and appropriate.

Students apply to and are accepted into the MCB program (approximately 20 matriculates per year). Dartmouth supports all entering students in their first two years. Most training-grant-eligible (TGE) students come from undergraduate institutions in the Northeast, but there is some geographical diversity. Dartmouth appreciates its abilities to attract students from the Northeast and actively pursues applicants through attendance at recruiting fairs held at mostly local liberal arts colleges and universities. For the class entering in 2002, there were 491 applicants, 90 of whom were training grant eligible. A number of students were interviewed and/or offered acceptance, though it was not clear to what extent the interview process was used to recruit vs. evaluate applicants. In contrast to programs at other institutions where individual students are ranked, Dartmouth keeps no such rankings, so it is not clear whether or not they are getting their top recruits. They should start to keep such records; it will help them evaluate their effectiveness in attracting their top candidates. Nevertheless, the program retrospectively ranked their candidates based on total GRE scores, and it appears as if they are getting applicants from throughout the range to matriculate (20% of the top 20 and 20% of all students

matriculated). A significant number of TGE students who were accepted for admission had verbal GRE scores below 500.

Trainees from the entire pool of MCB program students are selected after their RIP seminars given at the end of the second year. Criteria for selection are: performance in course work; commitment to research based on enthusiasm for their research and the research of others; ability to communicate based on seminar presentations and class participation; undergraduate GPA; and GRE scores.

Students are chosen late in their second years from the overall pool of MCB students and are, as a consequence, excellent. At the site visit, selected MCB students were interviewed, and they made an excellent impression at all levels, suggesting that there was depth for additional slots in the training program. The first-year students were enthusiastic about their decision to attend Dartmouth. The middle students were engaged in their research and enthusiastic about their futures. The senior students were thoughtful about their futures, and the group even included one recent graduate who was back visiting from her postdoc. Overall, the impression was that the training program had a positive effect on the student pool.

This is a small program (4 slots for two years of support in years 3 and 4) that is only in its 6th year of existence. There are only 4 past trainees; 2 have 3 published papers, one has 6 publications (including a Science paper), and 1 had only 1 paper. Though publications are not a formal part of the requirements for degree, the students see two first-author papers as a desirable and at least tacitly required goal.

Budget: On the one hand, there is a pool of strong students already in place that might go onto this grant. However, the site visitors met a select group, and it is not clear from the written record that the program is ready to expand from 4 to 8 and then 12 slots. Eight slots are recommended for each of the five years of this funding cycle.

CRITIQUE 2:

Dr. Nancy Speck is a professor of biochemistry at Dartmouth Medical School (DMS). She has served as the director of the Molecular and Cellular Biology at Dartmouth (MCBD) training program since its inception in 1998. Dr. Speck's research interests are focused on the regulation of hematopoiesis and she is currently serving on the HEME1 NIH study section. She has trained 7 Ph.D. students and has 7 students currently in training. Dr. Speck has also served on the governing committee of the parent program that provides trainees for MCBD, the MCB graduate committee, and was chair of this committee for two years. Recently, Dr. Speck has recognized a need for more effective recruitment strategies for underrepresented minority (URM) graduate students and has developed several initiatives to address this need. Thus, Dr. Speck is committed to both graduate education and recruitment and has a vested interest in the success of this training program. She is an outstanding choice for the leadership of MCBD.

Trainees in the MCBD program represent a subset of the students in the parent program, MCB. The MCB program is an umbrella organization that handles recruitment and admissions for the graduate programs in biochemistry (DMS), microbiology and immunology (DMS), genetics (DMS), and biological sciences (Dartmouth College). Hence, the administrative structure of MCB is relevant to the training program. The MCB Graduate Program Committee consists of 6 faculty members who represent each of the four graduate programs involved in the combined program and four student representatives who are elected by the student body. The MCB Graduate Program Committee oversees the daily operation of the program, including recruitment, monitoring of first-year students, assignment of rotations and teaching assistantships, and approval of qualifying examination topics and committees. Four of the six faculty on the MCB Graduate Program Committee are also trainers in the MCBD training program.

Institutional support for the MCB program amounts to $415,000 per annum. These funds are used for recruitment and to support first-year Ph.D. students. In exchange for first-year support, trainees serve as teaching assistants during year 2.

The specific training program is administered by a distinct committee that consists of the program director and four additional faculty, one from each area of concentration in the MCB program. One of these individuals, Dr. Barlowe, is the chairman of the MCB Graduate Program Committee. Committee members serve for five years. The major functions of this committee are to appoint trainers and trainees and to annually review the progress of both cohorts of individuals.

Overall, the administrative structure of the training program is appropriate. It is especially noteworthy that the Training Program Committee includes the chairman of the governing body of the parent MCB program, Dr. Barlowe and one of the directors of the core course.

Participating faculty for this program are a subset of the faculty associated with the MCB program and include 20 full, 7 associate, and 14 assistant professors. These 41 individuals were chosen from the 56 MCB faculty based on their interests in graduate education and areas of research expertise. The pool of trainers has been expanded since the last submission, and this has broadened the focus of the training program. Thus, the title has been changed from “Biochemistry and Molecular Biology of Protein Complexes” to “Molecular and Cellular Biology.” The training faculty are well distributed among the graduate programs that comprise MCB, and their research interests are at the cutting edge of modern biology. There is adequate evidence of collaboration among the training faculty. Most are heavily funded, and those who are not are actively seeking additional funds. There are 7 other training grants that include members of the MCB training faculty, but none is as broad as the MCB program, and therefore there is little or no overlap between MCB and the other programs. All trainers have previous training experience, many at both the predoctoral and postdoctoral levels.

Both junior and senior faculty were enthusiastic supporters of the MCB program and the training grant. The MCB program is viewed as a good source of excellent students and was cited as an impetus for accepting a faculty position at Dartmouth. Junior faculty indicated that the MCB program has assisted them with the development with their mentoring skills as it promotes interactions among the faculty and this results in a “shared responsibility” for student mentoring. This is reflected in the active participation of training faculty in such formal activities as the RIP presentations, journal clubs, retreats, and informal happy hours as cited by the students. Although none of the junior faculty had had students supported by the training grant, they were not concerned about this and indicated that they felt they had access to the training program. In fact, one junior faculty member indicated that he has been approached about one of his students being placed on the training grant. Junior faculty members organize the fall retreat and spring recruitment weekend and are involved in the core course. Thus, they have ample opportunity to directly interact with the students.

Overall, this training faculty is viewed as very good to excellent. These individuals have good training records and substantial funding and represent a diverse array of disciplines in molecular and cellular biology. Together with the informal social activities that occur among students and faculty, this provides a fertile and supportive environment for student development.

TGE applicants to the MCB program are drawn from a nationwide pool, but primarily come from the eastern US. Recruitment strategies include the Dartmouth website, posters, and brochures. In addition, Dartmouth hosts an annual Symposium for Life Sciences that draws students from other institutions in the Northeast. Potential trainees are also identified through the exchange of student lists with colleagues at other institutions, including Indiana and Texas A&M. These recruitment activities are conducted by the parent MCB program with institutional funds. Applicants are screened both based on an application form and a two-day interview process (the recruitment weekend). In 2002, 66 offers were made and 27 students enrolled (41% acceptance rate); 18 of these are eligible for support on the training grant. This class size is consistent with previous years; enrollment has remained relatively

steady since 1997. Based on GRE scores and undergraduate GPAs, the credentials of the entering class are very good to excellent. The applicant has requested an increase in slots from 4 to 12. Based on the quality and size of the applicant pool it seems reasonable to double the number of slots to 8.

Trainees receive support for two years and are typically appointed to the training grant at the end of year 2 of graduate study after they have presented their first RIP. Appointment is based on undergraduate and graduate GPAs, GRE scores, a letter of recommendation from the advisor, and enthusiasm for science (as demonstrated in the presentation). To date (1998- present), 10 trainees have received support from the training grant. Of these, three have graduated and the rest are still in training. Two of the graduates are engaged in postdoctoral research projects and the third is a high school teacher. All of the graduates had at least one first-author publication, and of the students still in training, all students beyond year 4 have at least one first-author paper. Thus, the training grant has been successful and has generated competent and productive scientists.

As the four MCBD trainees comprise a small subset of students in the MCB program, it is appropriate to consider the credentials of the larger group as well. MCB trainees appear to be well distributed among the four graduate programs. Although some students identify themselves as MCB students, most seemed more connected with their individual graduate programs. Most MCB students complete the Ph.D. in 5-6 years and have at least one first-author publication. Although a few students have graduated without first-author papers, even these had middle authorship on at least one paper. A remarkable number of MCB graduates are still employed in science. However, as the program is relatively new and the data go back to only 1996, it is difficult to predict what the attrition rate will be in the long term.

Beginning students cited the size, location, and breadth of research at Dartmouth as reasons for choosing this institution. In addition, the students appreciated the flexibility of the Dartmouth program and the collegial interactions with faculty. Most of these students had been admitted to other upper-middle-tier institutions but rejected at top tier schools. The students were pleased with the rotation schedule, and most indicated that they were able to work with their first- or second-choice advisors. First-year students, in particular, were enthusiastic about the ethics class, and most indicated that they were planning to take the class at some point whether or not they were admitted to a training grant. All of the intermediate students had formed advisory committees and knew the procedures for the annual research progress report and qualifying examinations. The intermediate students had completed their TA assignments and indicated that this was not a substantial burden. Most indicated that they regularly attend the RIPs and the fall retreat. All of the intermediate students appeared to making substantial progress in their research projects and could speak fluently about their work. At least three of the intermediate students had presented at meetings, and at least two had submitted manuscripts. The senior students were even more impressive, as all were focused and had a good sense of where they were in their fields. The senior students were aware of the leaders in their fields and most could name their major competitors. Most were actively seeking postdoctoral positions; only a few were unsure about their future plans.

Overall, both the MCB students and the subset supported by this training grant are quite strong. They are talented, enthusiastic, and career focused. Most have made the ideological leap that separates students from scientists. The trainees are viewed as a major asset of this training program.

Unique aspects of the MBCD training program include the opportunity to invite and host seminar speakers and a travel budget. As the MCBD trainees are a small subset of the larger MCB program, it is appropriate to discuss the training in the context of the larger parent program. MCB comprises four degree granting programs: biochemistry, biological sciences, microbiology and immunology, and genetics. Students are admitted to MCB based solely on their academic credentials and performance during the two-day recruitment weekend; there is no attempt to balance the numbers of students likely to enter each of the four graduate programs that comprise MCB. However, the students appear to be well distributed among the four programs. MCB students are supported by institutional funds in the first

year in return for service as teaching assistants during year 2. Each student is required to perform one quarter of TA, which amounts to approximately 200 hours of service. The MCB Graduate Program Committee makes the TA assignments and attempts to balance the interests of the students with the needs of the institution. To this end, the faculty view teaching assistants as an essential component of the teaching mission of Dartmouth. The trainees benefit from this activity as well, as they practice their presentations with the course directors and receive formal evaluations of their teaching skills at the end of the course. Hence, the TA is viewed as a "value added" experience for the trainees. During year 1, trainees take a core course in biochemistry, cellular and molecular biology. This course has recently been expanded from two to three quarters in order to include instruction in each of the training areas that are covered by MCB. As the first offering of the revised course is this year, it is not possible to judge the outcome of this change. However, it should provide trainees with more time and the flexibility to tailor their academic programs to suit their needs. Trainees are also required to complete 3 rotations during the first year of training. The rotations are organized through a matching system in which both students and faculty submit their choices and the MCB Graduate Program Committee makes the assignments based on these choices. Both students and faculty indicate that this system is working well and that most students are matched with either their first or second choice. Research advisors can only be chosen after the third rotation is completed. Trainees are required to pass an oral qualifying examination after year 2. The examination is based on a written proposal and both the proposal and examining committee must be approved by the MCB Graduate Program Committee. MCB students are required to present one research seminar, RIP, per year. It appears that these events not only provide the students with valuable presentation experiences, but also serve as a mechanism to bring students and faculty together. This strategy appears to work quite well as students indicated that many faculty attend the RIP sessions and that they continue to interact with the students after the formal presentations at informal happy hours. It appears that these informal interactions have forged a sense of collegiality between students and faculty, and this is one of the strengths of the MCB program. MCB students appear to see themselves as scientists and not merely as students. This perception probably contributes to their intellectual development. It is likely that these bonds are also enhanced through trainee service on the MCB Graduate Program Committee. MCB students are also required to attend journal clubs and seminars and there are many of these to choose from. It appears that MCB serves as a clearinghouse for these events, as MCB staff communicate with trainees and keep them informed of the journal club and seminar presentations that are scheduled.

Overall, the MCB program is viewed as very strong. One minor weakness concerns career development activities. Although the Office of Graduate Studies provides a list of career development events, it appears that few students have taken advantage of these opportunities. One student indicated the need for a career day and has taken the initiative to organize such an event. It may be advisable for the MCB Graduate Program Committee to consider including career development activities in the annual retreat.

This is viewed as a strong, student-focused program that promotes significant collegial interactions between trainees and trainers. Major strengths include an excellent faculty, a highly motivated and talented cohort of students, and sufficient flexibility to allow students to tailor the program to suit their individual needs. Weaknesses are noted in the current strategies for training in the ethical conduct of research, the small number of faculty involved in the recruitment of underrepresented minorities, and activities focused on career development. It appears that the program administration will be responsive to these concerns, and therefore enthusiasm for this program is very high. The applicant has requested an increase in slots from 4-4-4-4-4 to 8-12-12-12-12. The strength of the program supports an increase in slots, but based on the number of TGE enrollees, it would be more appropriate to provide support for 8-8-8-8-8 slots.

CRITIQUE 3:

The strengths of the program include: (1) it is tightly organized and seems to run well; (2) the program has recently expanded and improved its core first-year course(s); (3) the participating faculty members

are of high quality; (4) the students are interactive, excited about their work, productive and on schedule; (5) the student pool is of high quality; (6) new, junior faculty members hired at Dartmouth are very good; (7) the program seems to have considerable institutional support.

The weaknesses include: (1) an ethics course that is not required of all students - only NIH training grant students; (2) career guidance that is not overly aggressive; (3) minimal programmatic activities after entrance; (4) lack of effort and performance in minority recruiting. The vision for the future of the program is to keep it much the same with an improvement in minority recruiting.

The overall MCB training program is directed by Dr. Nancy Speck, a professor in the Department of Biochemistry at Dartmouth. She first came to Dartmouth in 1989 as an assistant professor from MIT, after training with David Baltimore. Her research on hematopoiesis and leukemia is well regarded and is funded by the NIH via 3 R01-type grants. She lists more than 20 publications since 1999. She has trained 7 Ph.D. students and currently supervises 7 Ph.D. students and 2 postdoctoral fellows.

The overall "Molecular and Cellular Biology" training program will be administered by an executive committee that includes faculty from the 4 degree-granting programs. These individuals are Drs. Ronald Taylor (microbiology), Charles Barlowe (biochemistry, Chair), Charles Cole (biochemistry and genetics), Thomas Jack (biological sciences and genetics), C.R. McClung (biological sciences and genetics) and William Wade (microbiology). These individuals are appointed by the chairs of the participating departments. The responsibilities of this committee is to: (1) advertise the program, evaluate and admit students; (2) organize rotations for the incoming students via a lottery process; (3) approve thesis committees and qualifying exam committees; (4) assign students to their teaching roles; (5) arbitrate disputes; (6) ensure all rules and regulations of the program are followed.

There is a separate committee that administers the NIH grant funded portion of the program. This committee consists of Drs. Nancy Speck, Charles Barlowe, Mary Lou Guerinot, Jennifer Loros and William Wickner. The responsibilities of this group are to select the trainers for the NIH portion of the program, appoint students to the training grant, evaluate progress, and recruit and retain underrepresented minority students. The trainees selected by this committee are generally supported for 2 years, and they will be monitored by the executive committee until they pass the doctoral qualifying examinations.

The training faculty for the NIH funded program consists of 41 members (20 professors, 7 associate professors, and 14 assistant professors) representing 8 departments. Faculty selection (by the above training grant committee) is based on a combination of interest in training, the training record, strong current grant support, and research in an area related to modern biology.

All students in this program must complete a common set of requirements. These include core courses in biochemistry, cellular and molecular biology, and at least 5 elective courses that must fulfill the requirements for their respective programs. Students also have to teach one term (about 200 hours) of an undergraduate class during their career at Dartmouth. Students must complete 3 rotations of about 2.5 months each. These rotations are distributed by the graduate committee using a lottery system.

After completion of the rotations, core courses and two years of graduate school, the students are required to take a qualifying examination. This exam has two parts: (a) a written proposal and (b) an oral defense. The composition of the examination committee is approved by the graduate committee. On passing the exam, a thesis is done under the watch of an advisory committee. This committee is chosen by the student and mentor and has an annual meeting with the student. This meeting is reported to the graduate committee. During the thesis years, each student is required to give one seminar each year on his/her work to the public. This talk is attended by students, faculty and fellows. One of the factors that differentiates the NIH-funded students from the others is that each student is allowed (required) to invite a seminar speaker to Dartmouth. The students felt that this was a privilege. They also receive money for travel to meetings.

Students are selected for the NIH training program at the end of the second year and are supported for 2 years. The selection criteria are: (a) performance in course work; (b) commitment to research; (c) effect communication skills; (d) quality of their undergraduate record.

For the last five years, the overall program has received about 60-90 eligible applicants, accepted about 35-40 of these and enrolled 13-18 of those accepted (roughly 25-45% enrolled depending on the year). The students interviewed at the site visit reflected the high-quality of this pool. Students who decline the offer of admission went to other high quality graduate programs. A relatively large number of applicants go to other quality programs such as University of Washington, UCSD, MIT, Harvard, Chicago and Yale.

Dr. Speck is a recognized expert in the study of leukemia and has provided strong leadership of the program for the first 5 years. She has experience training students and fellows and is an excellent choice to direct this training program. The members of the steering committee represent a number of different departments, appear committed to, and involved in, the program and can provide Dr. Speck with appropriate advice. Indeed, the program is running well and seems poised to continue to do so.

As a group, the participating faculty members have excellent records of publication; an impressive history of past accomplishment in training biomedical scientists; active research programs in areas appropriate for training in cell and molecular biology and high levels of external research support. In addition, faculty appear to be involved in a number of research interactions.

This is clearly an interdisciplinary training program, and one of its strengths is the opportunity it provides to students in the four departments to participate in the core courses and get excellent grounding in the major areas of molecular science. With the exception of the ethics course requirement, most of the formal aspects of the training program are well thought out and work very well. Additional strengths include the requirement for 3 laboratory rotations and the flexibility and freedom trainees will have to choose their electives, rotation laboratories and Ph.D. mentors. The recruiting program does not seem to be overly aggressive, but the quality of the applicants is excellent.

The credentials of many of the students who are currently associated with participating faculty are very good. The students interviewed at the site visit had excellent credentials and they were articulate and enthusiastic. Most had applied and been accepted at other excellent programs. Reasons stated for choosing Dartmouth included the enthusiastic and approachable faculty and that the graduate students had a good deal of input into the program.

On the other hand, there seemed to be no formal standard for publications, although the students were aware that publications were "important." The career advice was not aggressive, and there had not been a career fair in a while.

The resources and environment at Dartmouth are very good. The institution has been supportive of the MCB graduate program and provides a great deal of support for stipends and tuition for the first-year class. The institution plans to continue this level of support. The Dean’s office has been very supportive of the program and, in particular, has provided a strong response to the minority recruiting issue with the creation of a new position to strengthen this aspect of graduate education at Dartmouth.

COMMITTEE BUDGET RECOMMENDATIONS: Based on the size and the quality of the TGE applicant pool, support for this program is recommended for five years with 8 positions in each year.

RECRUITMENT OF UNDERREPRESENTED MINORITY (URM) STUDENTS: Acceptable
In 2000, the program received 11 applications from URM students out of a total of 88 training grant eligible (TGE) applicants. Three of the 36 students accepted were from an URM; 17 students enrolled of which 1 was from an URM. In 2001, the program received 60 TGE applicants of which 6 applicants

were from an URM. Forty-eight students were accepted of which 2 were URM students. In 2002, 90 TGE applications were received and 4 of these were URM applications. Thirty-five offers were made that included 3 URM students. Eighteen students matriculated of which 1 was from an URM.

The minority recruiting at Dartmouth is marginally acceptable but in a state of flux. For the first 4 years of NIH support, the recruiting efforts and results were clearly not acceptable. Over the past year, at the urging of all the NIH training program directors, the university has agreed to make some changes. A major one is to fund a Dean's office position for minority recruiting. The program's history with minority applicants is not good, as indicated by the data from the updated Table 7. The program understands that this is a poor record and is trying to improve their recruitment activities through a number of mechanisms. However, there are few minority faculty members, and there do not appear to be any special support mechanisms in place (yet) for minority students once they might reach Dartmouth. Finally, it bears repeating that the proposed mechanisms are conventional and have been in place at many other institutions for years. Thus, while there is potential for an improvement in minority recruiting at Dartmouth, all of the claimed activities are currently in the unproven category. NIGMS program staff should carefully monitor these activities over the following 5 years and expect a demonstrated and significant improvement in the effort of the program in URM recruiting activities.

RESPONSIBLE CONDUCT OF RESEARCH: Unacceptable

At present, Dartmouth offers one course, Phys. 124, Ethical and Responsible Conduct in Research that is intended to satisfy the Public Health Service Requirement for trainees enrolled in graduate programs and supported by Institutional National Research Service Awards. This course consists of 8 one-hour sessions that are purported to consist of lecture followed by open discussion. Students are provided with copies of “On Being a Scientist” (and are expected to read this) and a handbook of “Course Notes.” Course topics include responsibilities and academic freedom, sponsored research, scientific misconduct, issues in research methodology, and the ethical use of animals and human subjects. Student attendance is required at 75% (6 hours) of these sessions and is the sole basis for the grade (credit/no credit). A single session is devoted to “case studies and discussion”; presumably this is based on the three cases that are included in the course notes. However, it is not evident that discussion/case-based activities are incorporated into the topical sessions, and these omissions are viewed as serious flaws in the design of the course. Furthermore, as the grade is solely dependent on attendance, it appears that there is little or no impetus for students to take this course seriously, and this is also viewed as a flaw. Over all, the current ethics course is viewed as unacceptable as a venue for training in the ethical conduct of research.

During the site visit, it became evident that the beginning and intermediate students were not only interested in the ethics course, but were surprised that ethics training was not required in the MCB program. Based on this information, the MCB faculty have reconsidered their stance and are considering making the course a requirement. They have also proposed developing a new course to be offered through the Department of Biological Sciences. The proposed course is a significant improvement over Phys. 124. In addition to the topics covered in the original course, it also includes discussions of collaboration and mentoring, publication and peer review, and the implications of genetic technology. Two textbooks, Rachel’s *The Elements of Moral Philosophy* and Macrina’s *Scientific Integrity* will be used in addition to selected readings. Students will be graded on attendance, participation and a case presentation. These modifications will not only provide the students with a broader view of scientific ethics, but will also legitimize the course by making it more rigorous.

In addition, the MCB Graduate Program Committee is considering making ethics a requirement for all Ph.D. students and not just those supported by training grants. This is viewed as a very positive development. At present, it appears that either the original or proposed course could be used to fulfill this requirement. As noted above, the original course has a number of deficiencies and is viewed as inadequate for ethics training. Hence, the strategies for training in the ethical conduct of research would only be deemed acceptable if trainees are required to take the new course.

PROTECTION OF HUMAN SUBJECTS FROM RESEARCH RISKS: Prior to the participation of an individual supported by this grant in a project that involves human subjects, the specific research protocol must be reviewed and approved by the Institutional Review Board and certification submitted to the awarding institute. The project must also conform to the NIH policies on data and safety monitoring and on the inclusion of women, minorities, and children in study populations (and a description of, and rationale for, the plans must be provided to the awarding institute).

VERTEBRATE ANIMALS: Prior to the involvement of an individual supported by this grant in a project that utilizes laboratory animals, the specific research protocol must be reviewed and approved by the Institutional Animal Care and Use Committee and verification submitted to the awarding institute.

NOTE ON ROSTER: On the attached roster, regular members may be from either BRT-A or BRT-B.

NOTICE: The NIH has modified its policy regarding the receipt of amended applications. Detailed information can be found by accessing the following URL address: http://grants.nih.gov/grants/policy/amendedapps.htm

NIH announced implementation of Modular Research Grants in the December 18, 1998 issue of the NIH Guide to Grants and Contracts. The main feature of this concept is that grant applications (R01, R03, R21, R15) will request direct costs in $25,000 modules, without budget detail for individual categories. Further information can be obtained from the Modular Grants Web site at http://grants.nih.gov/grants/funding/modular/modular.htm

MEETING ROSTER

Biomedical Research and Research Training Review Subcommittee A
National Institute of General Medical Sciences Initial Review Group
NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES
BRT-A (02) Workgroup # 5
October 21, 2002 - October 22, 2002

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Consultants are required to absent themselves from the room during the review of any application if their presence would constitute or appear to constitute a conflict of interest.

MEETING ROSTER

Biomedical Research and Research Training Review Subcommittee A
National Institute of General Medical Sciences Initial Review Group
NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES
BRT-A (02)
November 11, 2002 - November 12, 2002

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* Temporary Member. For grant applications, temporary members may participate in the entire meeting or may review only selected applications as needed.

Consultants are required to absent themselves from the room during the review of any application if their presence would constitute or appear to constitute a conflict of interest.