

UNIVERSITY OF MINNESOTA  
Graduate School

Minutes, Graduate School Executive Committee  
Meeting of Friday, December 9, 1983  
9:15 a.m., 331 Johnston Hall

Members present: Faculty representatives--Professors James R. Boen, Jerome W. Hammond, Dale L. Lange, Edward I. Sucoff, David R. Thompson, Gerhard H. Weiss; administrative representatives--Deans Robert T. Holt (chair), Judson D. Sheridan, Kenneth Zimmerman; student representatives--Elin Anderson, Stephen Linne, Robert Stevens; guests--David J. Berg, Rebecca Dorsett, Thomas I. Gilson, Stephen A. Hoenack, Gary L. Nelsetuen, Palmer Rogers; Civil Service representative--Paul Larson; staff--Dennis Clayton, Andrew Hein, Myrna Smith; secretary--Vicki Field

I. FOR ACTION

A. Approval of the Minutes of the Meeting of November 1, 1983

The minutes were approved as submitted.

At Dean Holt's request, Committee members agreed to amend the agenda and take up items II.A. and II.B. next.

II. FOR DISCUSSION AND/OR ACTION

A. Proposal for the Establishment of an M.S. (Plan B) Degree in Microbial Engineering

Professor Rogers introduced discussion by noting that the intent of the proposed degree program was to prepare individuals in the integrated use of microbiology for applications in the biotechnology industry. He briefly reviewed the proposal. Three Policy and Review Councils had discussed and approved the Plan B M.S. degree in Microbial Engineering, Professor Rogers reported. One, the Physical Sciences Council, had suggested that the preceptorship not be offered as a course, but that students be allowed to complete this work on an informal basis. It was further recommended that the preceptorship not be tied to industry and that arrangements be made to allow all students in the program to complete the preceptorship in a laboratory on campus if this should be necessary. Plans have already been made for this possibility at laboratories at the Gray Freshwater Biological Institute and in the Department of Chemical Engineering, Professor Rogers indicated. Professor Sucoff said that approval had been recommended by the Plant and Animal Sciences Council with the understanding that the proposed program would be amended to take into account matters of social and ecological responsibility, particularly as they apply to genetic engineering.

Questions were invited. Professor Weiss asked if similar degrees were offered at other midwestern universities. Professor Rogers said that none were. The University of Wisconsin has long had an interest in biotechnology, but no degree program has yet been developed there.

Mr. Stevens was concerned about the lack of advanced work in engineering. He did not perceive the proposed degree as an engineering degree with so little engineering training. Professor Rogers said this point had been raised by the Physical Sciences Council. The M.S. degree in Microbial Engineering is not an engineering degree *per se*, but will prepare individuals to discuss problems with engineers, he explained. Graduates of the program will be microbiologists primarily and will not be trained as engineers. The term "engineer" has a different connotation in the context of the proposed program, Professor Rogers said.

Mr. Stevens asked whether the same objectives could be realized with a major in Microbiology and a minor in Chemical Engineering. Professor Rogers said this would not be appropriate for two reasons. First, the program's visibility will be increased if it is offered as a distinct degree program. Second, the present Microbiology program is structured along conceptual lines that would not facilitate work in Microbial Engineering as described in the proposal. He mentioned incidentally that resources, faculty, and research possibilities are insufficient at present to offer the degree under the Plan A option.

Mr. Linne inquired whether Microbial Engineering would be available as a minor to students majoring in other fields. Professor Rogers said the faculty had not yet addressed this issue. At Dean Hein's suggestion, it was agreed that the minutes should show that Microbial Engineering would not be offered as a minor until the faculty had discussed and approved this.

Dean Hein asked how the faculty would prefer to list the degree, as a Master of Science (undesignated) or a Master of Science in Microbial Engineering (designated). In the physical sciences, a designated M.S. generally implies an engineering degree, he clarified. After brief discussion, it was decided that the degree should be listed as a Master of Science (M.S.).

The proposed Plan B M.S. degree program in Microbial Engineering was approved with two dissenting votes.

B. Request for an Internal Minor for the M.S. and Ph.D. Degrees in Biochemistry

Professor Nelsestuen called attention to a revised version of the proposal distributed at the meeting and introduced discussion. He emphasized that the change was intended primarily for the Ph.D. degree, and he briefly reviewed the history and evolution of the present Biochemistry degree program. The request for an internal minor was stimulated by the program review in which the external committee observed that coursework for the degree was excessive, and students were not beginning their research early enough in their careers. The proposal would reduce coursework for the degree by 5-6 credits (15 percent) and would allow Biochemistry majors electing an internal minor to spend their second year largely engaged in research. About one-half of the students in the program would seek an internal minor if the request is approved, Professor Nelsestuen estimated. The Biochemistry program at Minnesota would also be more attractive to prospective students with an internal minor. (The external review committee noted that the program here was rigid and inflexible in comparison with similar programs elsewhere.)

Professor Nelsestuen mentioned the diversity of the Biochemistry program and the proliferation of biochemists across the University due to the discipline's broad definition. He described the four subject areas within the program: general biochemistry, enzymology, physical biochemistry, biochemical aspects of molecular biology, and physiological chemistry. In addition, subdisciplines of lesser strength are represented in the program (for example, nutritional biochemistry). As a further rationale for the request, Professor Nelsestuen pointed out that Biochemistry courses are often educationally more diverse than similar courses offered by other programs. He noted incidentally that students entering the graduate program do not have an undergraduate major in biochemistry, since this is seldom available. Broad experience in biology and/or chemistry are required for admission to the Biochemistry graduate program.

Professor Sucoff reported that the Plant and Animal Sciences Council had approved the request on a split vote. Of concern were the place of the master's degree in the proposal and the intellectual cost of allowing all coursework for the degree to be taken in the area of the major. Professor Boen said that the Health Sciences Council had unanimously endorsed the proposal.

Questions were invited. Dean Hein called attention to the general policy governing composition of examining committees for Graduate School degrees completed with an internal minor (which requires at least one examiner to represent a field other than the student's major) and asked if the policy was intended to apply in the case of Biochemistry. Professor Nelsestuen said that it was, and he pointed to the third paragraph of the revised proposal which addressed this requirement. ("Regardless of the student's M.S. or Ph.D. program, at least one member of all examining committees must come from outside the Biochemistry program. That individual must be a thesis reader.") Professor Lange asked what fields external examiners would represent. Professor Nelsestuen said that an outside examiner might represent Chemistry in the case of a student whose internal minor was physical biochemistry, for example.

Committee members briefly discussed internal minors in general terms and the importance of exposure to an area or areas outside the major. Dean Holt suggested that the practice of allowing internal minors for graduate degrees might warrant examination in the future, and he mentioned that the Carnegie Foundation is studying current issues in higher education, among them increasing specialization at the Ph.D. level. Professor Nelsestuen said that exposure to disciplines outside Biochemistry for students with an internal minor may occur in research rather than coursework. He noted that many students will continue to pursue a traditional minor, which will be recorded on the transcript.

The request for an internal minor for the M.S. and Ph.D. degrees in Biochemistry was unanimously approved. (Copy of proposal attached)

## I. FOR ACTION

### B. Recommendations of the Task Force on Doctoral Programs

Attention was called to the recommendations as revised subsequent to the Committee's discussion on November 1. Dean Holt turned to Dean Zimmerman, who suggested that the Committee take up each recommendation in turn. No comments were made with respect to recommendations I., II.1., and II.2.a. The written secret ballot required by recommendation II.2.b. was debated at length. Professor Thompson reported that the Physical Sciences Policy and Review Council had questioned the purpose of a ballot that would not be reported to examining committee members. Professor Boen expressed support for the recommendation, noting that the outcome of

the preliminary oral examination may be influenced by a strong committee member. After further discussion, it was agreed that the recommendation should be restated to specify that an anonymous, non-binding vote shall be taken prior to discussing the examination. The need to distinguish this non-binding vote from the "final vote" "cast" by individual committee members in signing the report form and how this distinction should be made was also an issue. The Committee did not agree on the final wording of the recommendation. A further point raised in the discussion was how the initial non-binding vote would be enforced. Dean Holt suggested it would be the responsibility of the committee chair to see that the vote was taken.

Professor Lange expressed his concern over the nature and content of the preliminary oral examination, which in some fields may focus on the thesis proposal. Dean Zimmerman recalled that a survey taken by the Shapiro Task Force showed that approximately 25 percent of graduate programs use the thesis proposal as the examination's focus. Professor Lange believed that the preliminary oral serves to assess the student's disciplinary competence in the major and minor fields and that the final oral is intended for the thesis defense. Current Bulletin language permits inclusion of possible research plans in the preliminary oral examination, however.

(Discussion of the recommendations terminated due to the arrival of the group from the Management Planning and Information Services Office.)

(A COPY OF THE REVISED RECOMMENDATIONS IS  
APPENDED WITH THE MINUTES)

### III. FOR DISCUSSION

#### B. Presentation of MPIS Tuition Formula

Dean Holt asked the representatives from MPIS to explain to the Committee its cost model used to calculate departmental and collegiate instructional expenditures for purposes of setting tuition. Mr. Berg began by reviewing the recent legislative mandate that tuition at each of the state's higher education institutions cover a fixed percentage of instructional cost. For the University, this figure will be 32 percent at the end of the next fiscal year. Equalization within the University, with tuition for each college reflecting 32 percent of instructional cost, will not be achieved in this biennium, however. At present, the percent of instructional cost borne by students in the various colleges of the University varies widely. The Legislative Interim Task Force on Average Cost Funding will likely recommend a proposal to include extension and summer session classes in a faculty member's assigned teaching load. Extension and summer teaching would then

be figured into the tuition cost formula, Mr. Berg pointed out. Since this would increase the overall percent of instructional cost recovered by tuition, future tuition increases at the University would be lower. While the University may charge tuition at a rate higher or lower than 32 percent of instructional cost, the legislative appropriation to the University will nevertheless be based on the 32 percent figure. The Regents' tuition policy calling for students to pay a similar proportion of instructional costs and steps taken to move toward the 32 percent figure set by the legislature were mentioned.

Mr. Berg described by example the cost development model used by MPIS. Considered in the formula are the total 0100/0300 (state) budget of the department and collegiate unit; courses at the 1-, 3-, 5-, and 8-levels; the number of student credit and contact hours at the various course levels; and the professorial rank and salary of faculty teaching at the several course levels. The allocation mechanism used to distribute faculty salaries and support expenditures to course levels within departments was reviewed. Mr. Gilson pointed out that the course levels are weighted, with courses at the lower levels costing less than those at the higher levels. Five-level courses are priced at a single rate, even though they contain a mix of undergraduate and graduate students. Faculty time is related to student contact hours, not credit hours, Mr. Berg clarified, and time spent by teaching assistants in actual instruction is also included in the formula. Allocation of expenditures for TA's who have no direct student contact (who may grade papers, for instance) is calculated by a special formula. Only state funding for support and instruction is used in determining instructional costs, Mr. Berg emphasized, thus instructional costs will be lower in departments with a high proportion of external research support. Professorial rank and faculty contact hours are reported by departments on the quarterly course inventory. Salaries used in the cost formula represent the average salary for a particular professorial rank within a particular department, Mr. Gilson indicated. If the average salary is higher at one course level than another, the cost of tuition will also be higher. He acknowledged that although the course inventory is generated centrally, it is subject to review and amendment by departments. The number of students and average faculty salary are very important in determining the cost of instruction at the various course levels, Mr. Berg stressed.

Professor Thompson asked how thesis credits will figure into the cost model. Mr. Berg replied that thesis credits should reduce costs at the 8-level, since they will replace some 8-level courses. Thesis credits will not alter the tuition formula, however, because contact hours will not be known.

Dean Holt asked how the benefit of graduate education to undergraduates is reflected in the tuition formula. Also, since teaching by TA's is less costly for the University, this should be viewed as a contribution of graduate education to undergraduate education. Mr. Berg agreed that instruction by graduate assistants benefits the University financially, but he was not certain how to account for this in the cost model. He mentioned that graduate students benefit with respect to 5-level courses, since these are treated as upper division courses, and costs are charged against undergraduates. Mr. Stevens pointed out that research grants to the University are a direct result of graduate education and research, and he suggested that the benefit to the University from the presence of a graduate program should somehow figure into the tuition formula.

Mr. Anderson wished to know whether it is assumed that all of a faculty member's salary is devoted to teaching, and he observed that full professors especially might be expected to have fewer contact hours if they are engaged in research. Mr. Gilson explained that costs not attributable to instruction (including research expenditures) are eliminated from the calculations. Dean Holt noted that in some areas of the University, such as the College of Agriculture, research and teaching budgets are clearly divided, while in other areas they are not and research is carried out on the 0100 salary. Mr. Berg said that all of the 0100 salary is assigned to instructional costs unless cost sharing is indicated, and then this portion of the salary is excluded from the calculations. The problem of accounting for research effort in the cost model was discussed at length.

Professor Sucoff inquired about the advantages, if any, of high tuition coupled with increased stipends for graduate assistants. Mr. Berg said such a policy would allocate higher costs at the lower division level. It would also permit selective assistance to the best graduate students, resulting in a higher quality graduate program.

[Following further brief discussion, the MPIS group left the meeting.]

Dean Holt summarized the presentation by Mr. Berg and posed four questions for the Executive Committee's consideration:

1. To what degree does the Committee wish to argue that the percent of instructional cost met by tuition at the graduate level should be lower than that at the undergraduate level?

2. To what extent should graduate education be subsidized by low tuition as opposed to a policy of higher tuition offset by increased student financial aid?
3. What are the effects of high tuition, especially if charged on a per credit basis, to students' selection of coursework?
4. Should there be a minimum tuition cost for the Ph.D. degree?

Dean Holt stressed the need to agree quickly on both the principles underlying graduate tuition and specific tuition proposals so that these may be put to central administration as early in 1984 as possible for an early decision. This will allow the Graduate School maximum time to plan for the coming fall quarter.

Professor Hammond speculated that the University is losing tuition income because of the increased per credit cost and the resulting tendency of graduate students to register for fewer courses. This will contribute to a tuition increase for 1984-85, he feared.

Given the urgency of the situation, it was decided to call a special Executive Committee meeting to continue discussion of graduate tuition and the tuition structure proposed in the draft statement dated November 23, 1983. Professor Sucoff suggested that it would be helpful if a list of possible uses of increased financial aid could be provided prior to the meeting. Professor Thompson said he would like a clarification of how thesis credits will figure into the tuition formula.

#### IV. FOR INFORMATION

##### C. Distribution of Tuition Grants for 1984-85

Dean Holt reviewed the draft proposal (dated November 30, 1983) for distribution for 1984-85 of the \$500,000 received by the Graduate School in additional recurring fellowship funds. He said he hoped to distribute a portion of the funds immediately to about twenty departments selected by the Graduate School, and he mentioned the factors to be taken into account in the selection process. Professor Thompson emphasized that smaller programs with outstanding students should not be overlooked in the allocation of funds. Dean Zimmerman pointed to the need to assist marginal programs that are striving to improve. Dean Holt said marginal programs would not necessarily be excluded in the distribution of funds. (Copy of proposal attached with these minutes)

Dean Holt distributed for inspection the first of the new professionally designed brochures and posters made available to departments by the Graduate School at reduced cost. The Graduate School will call department's attention to these recruiting materials, he said.

The meeting was adjourned due to the late hour.

Respectfully submitted,

Vicki Field  
Assistant to the Dean

December 20, 1983

Professor Gary L. Nelsestuen  
Department of Biochemistry  
140 Gortner Laboratory  
St. Paul Campus

Dear Professor Nelsestuen:

Following recommendation by the Plant and Animal Sciences and the Health Sciences Policy and Review Councils, the Graduate School Executive Committee unanimously approved the request for an internal minor for the M.S. and Ph.D. degrees in Biochemistry. For either degree completed with an internal minor, at least one member of all examining committees will represent a graduate program other than Biochemistry. This individual will be a thesis reader for students seeking the Ph.D. or M.S. (Plan A) degree.

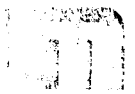
This action was taken at the Executive Committee meeting of 9 December, 1983 and is recorded in the official minutes of that meeting.

Sincerely yours,

Robert T. Holt  
Dean

RTH:mt

SEP 22 1983



UNIVERSITY OF MINNESOTA  
TWIN CITIES

Department of Biochemistry  
College of Biological Sciences  
140 Gortner Laboratory  
1479 Gortner Avenue  
St. Paul, Minnesota 55108

September 21, 1983

MEMO

TO: Kenneth Zimmerman, Associate Dean, Graduate School

FR: Gary Nelsestuen

*Gary Nelsestuen, OGS*

RE: Internal Minor in Biochemistry

Attached is a request for an internal minor in Biochemistry. This is slightly revised from the preliminary document sent to you on August 23, 1983. This proposal has received the overwhelming support of the biochemistry graduate faculty and was passed by a unanimous vote at the graduate faculty meeting held on Sept. 19, 1983.

The proposed change will affect the programs of our future students. We seek an expeditious hearing of this proposal to minimize confusions in student programs. Specifically, if this proposal is acted on in Fall, 1983, we will be able to implement it for students entering this quarter without need for revising their programs later. This proposal will also greatly aid in our recruiting of new students for 1984-85. Consequently, I would like to do everything that I can to aid in consideration of this proposal. For example, I would be happy to attend the Policy and Review Council meeting to answer any questions that might arise. If this is appropriate, please notify me of the time and place for the meeting. Thank you very much for your time and consideration of this matter.

## OUTLINE OF JUSTIFICATIONS FOR AN INTERNAL MINOR IN BIOCHEMISTRY

The Graduate Program in Biochemistry at the University of Minnesota wishes to institute an internal minor for the graduate degrees. A list of all possible justifications for this request could fill a large volume. However, we will try to be brief and will rely heavily on recent documents produced by the review of the Biochemistry Graduate Program (attached as an appendix to this application).

Biochemistry at Minnesota is a large, diverse graduate program with 53 graduate faculty members. It was formed less than 20 years ago by consolidation of two programs formerly known as Agricultural Biochemistry and Physiological Chemistry. Biochemistry at Minnesota serves many roles. A glance at our neighboring institution, the University of Wisconsin-Madison reveals departments of biochemistry (with a group of molecular biologists housed in a separate building), Physiological Chemistry and Molecular Biology-Oncology. Minnesota no longer has a separate program in Physiological Chemistry and does not have a graduate program in Molecular Biology. In addition, Minnesota is recognized as being very strong in the area designated Physical Biochemistry (see appendix materials).

In the preceding paragraph I have underlined four terms, three of which are used repeatedly by both the internal and external review committees of biochemistry to designate recognized disciplines. The term Physiological Chemistry does not appear in their report but is often used to designate a separate department and program (see above). We have organized our internal minor/supporting program around these four areas: General Biochemistry/Enzymology, Physical Biochemistry, Biochemical Aspects of Molecular Biology and Physiological Chemistry. The small documentation provided here should indicate that these are recognized by scientists from all over the country as essentially separate but related disciplines.

We feel that several diverse observations recently made by the review committees and Vice President Kenneth Keller are related to a need for an internal minor program in Biochemistry. 1) The external review committee felt that coursework taken for the Ph.D. seemed excessive. 2) The Biochemistry Program teaches a number of graduate courses with low enrollment. 3) Vice President Keller observed that individuals who could be described by the broad term, biochemists, are located in many programs in the University. Ph.D. students in biochemistry generally take about as many lecture credits outside of the Biochemistry Program as within the program. Due to the continued criticism of too much coursework (this was not new to the recent program review) the Biochemistry Program has kept the number of required biochemistry courses to a minimum. During this same time, the growing diversity of biochemistry has dictated that courses in subdisciplines be developed. The natural result of these conflicting pressures is that our graduate courses in the subdisciplines of biochemistry cannot be taken by biochemistry majors because they would exacerbate the apparently excessive coursework. As a consequence, our graduate courses in the subdisciplines of biochemistry often have low enrollments. We do not agree that the courses are redundant and unnecessary.

The broadly-defined discipline of biochemistry is important to many areas and, as noted by Vice President Keller, faculty who have received their training in biochemistry are found in several programs in the University. These faculty teach courses in the programs where they are employed. It is the opinion of a large majority of the Biochemistry Graduate Faculty that some of these courses provide less educational diversity than our own special topics courses. The result is that topics taught by biochemists in other programs are currently used by biochemistry graduate students as minor subjects; special topics taught in biochemistry by persons with training in areas from genetics and microbiology to physical chemistry and physics can only be taken as "major" courses in Biochemistry. This situation makes no educational sense. An internal minor in Biochemistry will allow our students to obtain a diverse education in areas important to their major without requiring excessive coursework. It will not impede students from minoring in other subjects as they currently do.

A few words about each of the four areas:

General Biochemistry/Enzymology is recognized as a strong area of our program. It represents the traditional center of this diverse field. This area must also accommodate subdisciplines (e.g. Nutritional Biochemistry) which are not represented in adequate strength to warrant a separate area.

Physical Biochemistry is a well-developed subdiscipline at Minnesota. The core sequence has been taught in conjunction with the Chemistry Program and has been used as a popular minor or supporting program by our students. Introduction of this area as an internal minor will not introduce major changes from present and past student programs.

Biochemical Aspects of Molecular Biology is a complex designation for persons in the biochemistry program who are referred to as molecular biologists. This designation is necessary to indicate that molecular biologists are located in many programs at Minnesota. Some faculty members feel that a interdepartmental graduate program in molecular biology should be developed. Our designation should not deter this in the future. Examination of our graduate faculty reveals that this is a major area of recent expansion. It is anticipated (and recommended by the external review, see appendix) that future positions will emphasize this area as well.

Physiological Chemistry is a strong area in the Medical School Biochemistry Department. Broad definition of this area can include persons in cell science and biology. These are also recommended areas of future expansion (see the external review). In addition to established courses, two new courses (Muscle Contraction and Biochemistry of Neuronal Signalling) have been added recently.

The core sequence which we have called simply "General Biochemistry" (BioC/MdBc 5-751, 5-752 and 5-753) is actually a series of three introductory graduate level courses in the areas of: Enzymology (5-751), Physiological Chemistry (5-752) and Molecular Biology (5-753). We anticipate renaming these courses to reflect their contents. This situation, together with our existing special topics and advanced topics courses in each area, allow this reorganization without introduction of new courses at this time.

PLAN FOR IMPLEMENTATION OF AN INTERNAL MINOR IN BIOCHEMISTRY  
for the M.S. and Ph.D. degrees

Students can specialize in any of four subject areas and take other areas as an internal minor, supporting program or partial internal supporting program. The requirements for a Ph.D. are given. Coursework requirements for an M.S. degree in any area are the same as those given for the Ph.D. These requirements automatically satisfy the minimum minor or supporting program for the M.S. degree. For further information on requirements for the M.S. degree, consult the Graduate School Bulletin. Regardless of the students program, at least one member of all examining committees must come from outside the Biochemistry Program. That individual must be a thesis reader.

I. General Biochemistry/Enzymology

A. Major requirements (An additional 18 or more credits must be taken in the minor or supporting program.)

1. BioC/MdBc 5-751
2. A minimum of 2 courses (6 credits) from the following:  
BioC/MdBc 8-232 Advanced Topics in Protein Biochemistry  
BioC/MdBc 8-233 Advanced Topics in Enzymes  
BioC/MdBc 8-215 Advanced Topics in Lipids  
BioC/MdBc 8-211 Advanced Topics in Carbohydrates  
MdBc 8-230 Membrane Biochemistry  
BioC 5-744 Biochemical Techniques  
BioC 8-225 Radiotracers
3. At least 9 credits (or DGS approval) of laboratory rotation  
BioC/MdBc 8-290
4. Participation in two biochemistry seminars per week (in addition to group research meetings) for the entire graduate career.
5. The courses BioC/MdBc 5-752 and 5-753 must appear on the graduate transcript but can be taken as a part of a minor or supporting program.

B. An internal minor can be taken in this area

C. Graduate faculty qualified in this area (see Table) are determined by the Biochemistry Coordinating Committee.

II. Physical Biochemistry

A. Major requirements (An additional 18 or more credits must be taken in a minor or supporting program).

1. The Biophysical sequence:  
BioC/MdBc 5-522  
BioC/MdBc 5-523
2. At least one of the following courses:  
BioC 8-260 Advanced Physical Biochemistry  
BioC/MdBc 5-524 Biochemical Dynamics  
BioC/MdBc 8-764 Metalloproteins
3. At least 9 credits (or DGS approval) of laboratory rotation  
BioC/MdBc 8-290
4. Participation in at least two biochemistry seminars (in addition to group research meetings) per week for the entire graduate career.

5. The courses BioC/MdBc 5-751, 5-752, and 5-753 must appear on the graduate record but can form a part of the minor or supporting program.
- B. An internal minor may be taken in Physical Biochemistry.
- C. Graduate faculty qualified in Physical Biochemistry (see Table) are determined by the Biochemistry Coordinating Committee.

### III. Biochemical Aspects of Molecular Biology

- A. Major requirements (An additional 18 or more credits must be taken in a minor or supporting program).
  1. BioC/MdBc 5-753
  2. A minimum of 2 courses (6 credits) from the following:  
 BioC/MdBc 8-210 Advanced Topics in DNA Biochemistry  
 BioC/MdBc 8-212 Advanced Topics in RNA Biochemistry  
 Biol 5-125 Recombinant DNA Laboratory\*  
 Botany ???? Molecular Biology of Plants\*
  3. A minimum of 9 credits (or DGS approval) of laboratory rotation  
 BioC/MdBc 8-290
  4. Participation in two seminars per week (in addition to group research meetings) for the entire graduate career.
  5. The courses BioC/MdBc 5-751 and 5-752 must appear on the graduate record but can form a part of the minor or supporting program.
- B. An internal minor in biological aspects of molecular biology will be offered in the near future.
- C. Graduate faculty in Molecular Biology (see supplement table attached) are determined by the Biochemistry Coordinating Committee.

### IV. Physiological Biochemistry

- A. Major Requirements (An additional 18 or more credits must be taken in a minor or supporting program).
  1. BioC/MdBc 5-752
  2. At least two courses (6 credits) from the following:  
 MdBc 8-219 Biochemistry of Specialized Tissues  
 MdBc 8-240 Biochemistry of Neuronal Signalling  
 MdBc 8-206 Advanced Endocrinology & Steroid Chemistry  
 MdBc 5-444 Muscle Contraction  
 MdBc 8-230 Membranes
  3. At least 9 credits (or DGS approval) of laboratory rotation  
 BioC/MdBc 8-290
  4. Participation in at least two seminars per week (in addition to group research meetings) for the entire graduate career.
  5. The courses BioC/MdBc 5-751 and 5-753 must appear on the graduate record but can form a portion of the supporting program or minor.
- B. An internal supporting program may be taken in this area.
- C. Graduate faculty in Physiological Chemistry (see attached table) are determined by the Biochemistry Coordinating Committee.

\* These courses were instituted and are taught by biochemistry graduate faculty.

AREA(S) OF  
QUALIFICATION

The Program Faculty

Minneapolis Department

NAME	Academic Rank (Professorial)	Graduate Faculty Rank	1. General Biochem/ Enzymology	2. Physical Biochemistry	3. Molecular Biology	4. Physiological Chemistry
Adolph, Kenneth	Assistant	Associate		x		x
Bodley, James	Full	Full	x		x	
Dempsey, Mary	Full	Full	x			x
Edstrom, Ronald	Associate	Full	x			x
Hogenkamp, Harry	Full	Full	x	x		
Howard, James B.	Full	Full	x	x		
Koerner, James F.	Full	Full	x			x
LaPorte, David	Assistant	Nominated	x		x	
Lipscomb, John D.	Assistant*	Full	x	x		
Livingston, Dennis	Assitant*	Associate			x	
Roon, Robert J.	Associate	Full	x		x	
Thomas, David	Assistant*	Full		x		x
Towle, Howard	Assistant	Full			x	x
Ungar, Frank	Full	Full	x			x
Van Pilsum, John	Full	Full	x			x

St. Paul Department

Anderson, John S.	Associate	Full	x			x
Bloomfield, Victor	Full	Full	x	x		
Chapman, Peter J.	Full	Full	x			
Dagley, Stanley	Full	Full	x	x		
Fuchs, James A.	Associate	Full	x		x	
Glass, Robert L.	Full	Full	x			
Kirkwood, Samuel	Full	Full	x			
Liener, Irvin	Full	Full	x			x
Lovrien, Rex	Full	Full	x	x		
Messing, Joachim	Associate	Full	x		x	
Nelstuen, Gary	Full	Full		x		x
Schottel, Janet	Assistant	Associate			x	
Warner, Huber	Full	Full	x		x	
Woodward, Clare	Full	Full	x	x		

Program Faculty (cont.)

AREA(S) OF  
QUALIFICATION

JOINT APPOINTMENTS

Minneapolis Department

Name	Academic Rank (Professorial)	Graduate Faculty Rank	Primary Department	1. Gen Biochem/Enz	2. Phys. Biochem	3. Mol. Biol.	4. Physiological Chem
Gray, Ernest D.	Associate	Full	Pediatrics	x			x
Frantz, Ivan D.	Full	Full	Medicine				x
Holman, Ralph T.	Full	Full	Hormel Institute	x			
Oegema, Theodore	Associate	Full	Orthopedic Res.	x			x
Rosenberg, Andreas	Full	Full	Lab Med Path		x		
Unger, Leon	Full	Full	Dentistry				x
Schlenk, Herman	Full	Full	Hormel Institute	x			
Smith, Quenton T.	Full	Full	Oral Biology				x
St. Paul Department							
Gray, Gary R.	Associate*	Full	Chemistry	x			
Guilfoyle, Thomas	Associate	Full	Botany			x	
Louis, Charles F.	Associate	Associate	Vet Medicine	x			x
Muenck, Eckard	Full	Full	Freshwater		x		
Rogers, Palmer	Full	Full	Microbiology	x		x	
Seal, Ulysses S.	Full	Full	Vet. Admin.				x
Ugerbil, Kamil	Assistant	Associate	Freshwater		x		
Wood, John M.	Full	Full	Freshwater	x			
Duluth Department							
Anderson, Paul M.	Full	Full		x			
Drews, Lester	Associate	Associate					x
Huntley, Thomas	Associate	Associate					x
Prohaska, Joseph	Associate	Associate		x			
Salo, Wilmar L.	Associate	Associate		x			

\*Promotion pending

PLAN FOR IMPLEMENTATION OF AN INTERNAL MINOR IN BIOCHEMISTRY  
for the M.S. and Ph.D. degrees

Students can specialize in any of four subject areas and take other areas as an internal minor, supporting program or partial internal supporting program. The requirements for a Ph.D. are given.

Coursework requirements for an M.S. degree in any area of Biochemistry are the same as those given for the Ph.D. except parts IA, IIA, IIIA and IVA should read "Major requirements (an additional 8 or more credits must be taken in the minor or supporting program)". For further information on requirements for the M.S. degree, consult the Graduate School Bulletin.

Regardless of the student's M.S. or Ph.D. program, at least one member of all examining committees must come from outside the Biochemistry Program. That individual must be a thesis reader.

I. General Biochemistry/Enzymology

- A. Major requirements (An additional 18 or more credits must be taken in the minor or supporting program.)
  1. BioC/MdBc 5-751
  2. A minimum of 2 courses (6 credits) from the following:
    - BioC/MdBc 8-232 Advanced Topics in Protein Biochemistry
    - BioC/MdBc 8-233 Advanced Topics in Enzymes
    - BioC/MdBc 8-215 Advanced Topics in Lipids
    - BioC/MdBc 8-211 Advanced Topics in Carbohydrates
    - MdBc 8-230 Membrane Biochemistry
    - BioC 5-744 Biochemical Techniques
    - BioC 8-225 Radiotracers
  3. At least 9 credits (or DGS approval) of laboratory rotation  
BioC/MdBc 8-290
  4. Participation in two biochemistry seminars per week (in addition to group research meetings) for the entire graduate career.
  5. The courses BioC/MdBc 5-752 and 5-753 must appear on the graduate transcript but can be taken as a part of a minor or supporting program.
- B. An internal minor can be taken in this area by students specializing in other areas of Biochemistry.
- C. Graduate faculty qualified in this area (see Table) are determined by the Biochemistry Coordinating Committee.

II. Physical Biochemistry

- A. Major requirements (An additional 18 or more credits must be taken in a minor or supporting program.)
  1. The Biophysical sequence:
    - BioC/MdBc 5-522
    - BioC/MdBc 5-523
  2. At least one of the following courses:
    - BioC 8-260 Advanced Physical Biochemistry
    - BioC/MdBc 5-524 Biochemical Dynamics

3. At least 9 credits (or DGS approval) of laboratory rotation BioC/MdBc 8-290
  4. Participation in at least two biochemistry seminars (in addition to group research meetings) per week for the entire graduate career.
  5. The courses BioC/MdBc 5-751, 5-752, and 5-753 must appear on the graduate record but can form a part of the minor or supporting program.
- B. An internal minor may be taken in Physical Biochemistry by students specializing in other areas of Biochemistry.
- C. Graduate faculty qualified in Physical Biochemistry (see Table) are determined by the Biochemistry Coordinating Committee.

### III. Biochemical Aspects of Molecular Biology

- A. Major requirements (An additional 18 or more credits must be taken in a minor or supporting program).
1. BioC/MdBc 5-753
  2. A minimum of 2 courses (6 credits) from the following:
    - BioC/MdBc 8-210 Advanced Topics in DNA Biochemistry
    - BioC/MdBc 8-212 Advanced Topics in RNA Biochemistry
    - Biol 5-125 Recombinant DNA Laboratory\*
    - Botany ???? Molecular Biology of Plants\*
  3. A minimum of 9 credits (or DGS approval) of laboratory rotation BioC/MdBc 8-290
  4. Participation in two seminars per week (in addition to group research meetings) for the entire graduate career.
  5. The courses BioC/MdBc 5-751 and 5-752 must appear on the graduate record but can form a part of the minor or supporting program.
- B. An internal minor in biological aspects of molecular biology will be offered in the near future to students specializing in other areas of Biochemistry.
- C. Graduate faculty in Molecular Biology (see supplement table attached) are determined by the Biochemistry Coordinating Committee.

### IV. Physiological Biochemistry

- A. Major Requirements (An additional 18 or more credits must be taken in a minor or supporting program).
1. BioC/MdBc 5-752
  2. At least two courses (6 credits) from the following:
    - MdBc 8-219 Biochemistry of Specialized Tissues
    - MdBc 8-240 Biochemistry of Neuronal Signalling
    - MdBc 8-206 Advanced Endocrinology & Steroid Chemistry
    - MdBc 5-444 Muscle Contraction
    - McBc 8-230 Membranes
  3. At least 9 credits (or DGS approval) of laboratory rotation BioC/Md Bc 8-290

\* These courses were instituted and are taught by biochemistry graduate faculty.

4. Participation in at least two seminars per week (in addition to group research meetings) for the entire graduate career.
  5. The courses BioC/MdBc 5-751 and 5-753 must appear on the graduate record but can form a portion of the supporting program or minor.
- B. An internal supporting program may be taken in this area by students specializing in other areas of Biochemistry.
- C. Graduate faculty in Physiological Chemistry (see attached table) determined by the Biochemistry Coordinating Committee.

AREA(S) OF  
QUALIFICATION

The Program Faculty

Minneapolis Department

NAME	Academic Rank (Professorial)	Graduate Faculty Rank	1. General Biochem/ Enzymology	2. Physical Biochemistry	3. Molecular Biology	4. Physiological Chemistry
Adolph, Kenneth	Assistant	Associate		X		X
Bodley, James	Full	Full	X		X	
Dempsey, Mary	Full	Full	X			X
Edstrom, Ronald	Associate	Full	X			X
Hogenkamp, Harry	Full	Full	X	X		
Howard, James B.	Full	Full	X	X		
Koerner, James F.	Full	Full	X			X
LaPorte, David	Assistant	Nominated	X		X	
Lipscomb, John D.	Assistant*	Full	X	X		
Livingston, Dennis	Assitant*	Associate			X	
Roon, Robert J.	Associate	Full	X		X	
Thomas, David	Assistant*	Full		X		X
Towle, Howard	Assistant	Full			X	X
Ungar, Frank	Full	Full	X			X
Van Pilsum, John	Full	Full	X			X

St. Paul Department

Anderson, John S.	Associate	Full	X			X
Bloomfield, Victor	Full	Full	X	X		
Chapman, Peter J.	Full	Full	X			
Dagley, Stanley	Full	Full	X	X		
Fuchs, James A.	Associate	Full	X		X	
Glass, Robert L.	Full	Full	X			
Kirkwood, Samuel	Full	Full	X			
Liener, Irvin	Full	Full	X			X
Lovrien, Rex	Full	Full	X	X		
Messing, Joachim	Associate	Full	X		X	
Nelsestuen, Gary	Full	Full		X		X
Schottel, Janet	Assistant	Associate			X	
Warner, Huber	Full	Full	X		X	
Woodward, Clare	Full	Full	X	X		

The Program Faculty (cont.)

AREA(S) OF  
QUALIFICATION

JOINT APPOINTMENTS

Minneapolis Department

Name	Academic Rank (Professorial)	Graduate Faculty Rank	Primary Department	1. Gen Biochem/Enz	2. Phys. Biochem	3. Mol. Biol.	4. Physiological Chem
Gray, Ernest D.	Associate	Full	Pediatrics	x			x
Frantz, Ivan D.	Full	Full	Medicine				x
Holman, Ralph T.	Full	Full	Hormel Institute	x			
Oegema, Theodore	Associate	Full	Orthopedic Res.	x			x
Rosenberg, Andreas	Full	Full	Lab Med Path		x		
Singer, Leon	Full	Full	Dentistry				x
Schlenk, Herman	Full	Full	Hormel Institute	x			
Smith, Quenton T.	Full	Full	Oral Biology				x

St. Paul Department

Gray, Gary R.	Associate*	Full	Chemistry	x			
Guilfoyle, Thomas	Associate	Full	Botany			x	
Louis, Charles F.	Associate	Associate	Vet Medicine	x			x
Muenck, Eckard	Full	Full	Freshwater		x		
Rogers, Palmer	Full	Full	Microbiology	x		x	
Seal, Ulysses S.	Full	Full	Vet. Admin.				x
Ugerbil, Kamil	Assistant	Associate	Freshwater		x		
Wood, John M.	Full	Full	Freshwater	x			

Duluth Department

Anderson, Paul M.	Full	Full		x			
Drews, Lester	Associate	Associate					x
Huntley, Thomas	Associate	Associate					x
Prohaska, Joseph	Associate	Associate		x			
Salo, Wilmar L.	Associate	Associate		x			

\*Promotion pending