Report of the Committee on General Education in Division III

1. Preface and Acknowledgements

The Committee on General Education in Division III was formed at the request of David Beveridge, Dean of the Sciences, in the Fall semester of the 1996/97 academic year. We were asked to examine the effectiveness of our current program of general education in the Division and to make recommendations which might improve it. The last comprehensive review of general education in Division III was undertaken more than a decade ago by a committee with Paul Haake as chair. Their report, which is included as Appendix I of this document, provided a solid basis for the present efforts. The current initiative is a direct outcome of the administration’s academic planning process which began last year with a series of essays and continued with the Academic Forum this year. In his summary document, ”Wesleyan Education for the 21st Century” President Bennet has noted that more emphasis needs to be placed on the education of first and second year students and has called for a review of the general education program. This report, therefore, is both timely and relevant in a Wesleyan context.

It is important to note, however, that renewed interest in general education in the sciences and mathematics is a phenomenon which is not limited to Wesleyan. Most members of Division III are aware that NSF, NASA, the National Academy of Sciences, professional societies, and other national groups are currently engaged in attempts to fundamentally change the way science, mathematics and technology is taught to general audiences at all levels in this country. It is appropriate and important that Wesleyan be a part of this movement, both for the benefit of society in general and for our own students. In Appendix II of this document we reprint the Summary and Recommendations section of the 1996 NSF Advisory Committee Report ”Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and Technology” which includes recommendations for University administrations, departments and faculty.

The review conducted by our committee indicates that there is room for improvement in Wesleyan’s general education program in Division III and we propose a set of actions which, if taken, should lead to such improvement. Our report is based on a series of interviews, surveys, statistical analyses and discussion in committee meetings, departments and at the Division III Friday lunches. It is based heavily on statistical analyses and reports done for us by Institutional Researcher John Pothier. Without his hard work and patient attention to detail, we would not have been able to accomplish nearly as much. He not only produced every analysis and re-analysis that we requested but attended numerous meetings to explain
the data and assist us in interpreting them.

In addition to John Pothier, we wish to thank the many others who contributed to our work. Joy McConnell provided extensive logistical support for the committee. Paula Lawson produced a report on pre-registration results. Rae Shortt and Karen Collins provided statistical expertise. Al Green and the Dean’s Office Staff and Barbara-Jan Wilson of the Admission’s Office submitted to interviews. Eric Williams and Linda Shettleworth of the Astronomy Department contributed important technical assistance to the committee. Ralph Baierlein and Peter Patton commented on drafts of certain sections. We thank them all for their assistance.

The Committee on General Education in the Sciences and Mathematics is on the Web. There is a Link through the Astronomy Department’s home page, under Other Miscellaneous Items. The URL is:

http://sun.astro.wesleyan.edu/workgroup/gened.html

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3. Executive Summary

The committee has uncovered both strengths and weaknesses in the NSM General Education program at Wesleyan. A major strength is that Division III has a clear sense of the program's purpose. Our goals have not changed much over the years and can be written down in considerable detail with consensus, as is done in Section II of this report. Physical scientists, life scientists and mathematicians agree about what it is we wish to teach the one-half of all Wesleyan students who will take only a minimal number of science and math courses. We also generally agree, although not entirely without dissenting opinions, that the present program structure of expecting three courses in at least two different departments is satisfactory for Wesleyan at present. This document does not propose, therefore, any radical changes in the NSM General Education program. However, there is no doubt that improvements can be made within the existing structure which will enhance our ability to provide the best possible general education for Wesleyan students given the resources available.

One area of concern is student satisfaction. While 83% of students rate NSM teaching as good or excellent on course evaluation forms, the Senior Survey shows greater levels of dissatisfaction with NSM education among graduating students than we would like. A breakdown of the numbers demonstrates that most of the dissatisfaction comes from students who take very few NSM courses - i.e. our general education population. As is discussed in Section IV of this report, there is not yet any consensus on what, if anything, could be done to improve these numbers. Refinement in the survey questions might improve our understanding of the source of the dissatisfaction. In the meantime, adopting the recommendations of this report is probably the best approach to addressing the issue.

A related concern is the large and growing numbers of non-science students who do not take even the minimum number of NSM courses (3) necessary to meet the General Education Expectations. Our survey of the graduating class of 1996, detailed in Section III of this report, showed that 96 of the 635 graduates who spent all four years at Wesleyan took two or less NSM courses. That is 15% of the graduates, but it is 27% of the non-science students! By contrast, the numbers of students who fail to meet their General Education expectations in HA or SBS divisions is very small - only a few students in 1996. Failure to meet the General Education expectations, therefore, is almost entirely a problem of failing to take enough NSM courses. Division III wishes to reverse the trend of recent years and increase the number of students meeting their expectations. Some of the recommendations in this report, will help accomplish this task, we believe. These include providing improved information on NSM general education for incoming frosh and their advisors and ensuring that sufficient NSM general education courses are available each semester to address class access issues.
Of central importance, naturally, is the quality of the courses that departments can mount as contributions to the general education program. A critical factor affecting quality is course size, which is itself a function of the number of students enrolling in the courses and the number of courses which can be offered. We estimate, in Section III of this report, that about 1000 students per year will enroll in NSM general education courses given the opportunity. (This does not include the similar number who meet their NSM expectations by taking introductory science courses.) A poll of Division III departments shows that we can mount about 20 - 25 NSM general education courses (not including introductory courses) each year, which results in an average class size for these courses of 40 to 50. The consensus of the division is that it is important to keep the class size at 50 or below in most cases if we are to effectively meet the goals listed in Section III. It is also important that departments coordinate their general education offerings so that enough courses are available each semester to meet the demand. We propose that each department in Division III, except Psychology which does not teach general education courses, commit to offering at least one NSM general education course (in addition to its introductory courses) each semester, towards a divisional goal of at least ten such courses each semester.

The long term health of the NSM General Education program is important and we urge the Dean to appoint a coordinator of the program and/or a standing committee to look after it. During the past decade, the program was hurt by cutbacks in faculty lines suffered by most departments and by creation of the FYI program. The divisional response to these pressures was uncoordinated and naturally dictated by each department’s need to meet the demands of its introductory, majors and graduate programs. The FYI program was an excellent initiative but came at a time of scarce and dropping resources. It had the unintended effect in Division III of splintering and diffusing our contribution to the education of first and second year non-science students. FYI courses drained teaching strength from the NSM general education program while doing little (because of small enrollment limits) to satisfy the demand for NSM courses from students wishing to meet their expectations. The net effect was to exacerbate the class access problem in Division III and force most students to meet their expectations in rather large enrollment classes. We suspect that some of the student dissatisfaction reflected in the Senior Survey arose from this circumstance.

The recommendations of this report are made in the context of current faculty resources. We believe that there is (barely) enough teaching strength to mount an effective NSM general education program with course enrollments of around 50. We note that the existence of graduate programs at Wesleyan provides the opportunity, already taken advantage of by some departments, to have smaller lab and class sections associated with the courses. The graduate students can act as Teaching Assistants in these courses to provide the kind of education in basic (including remedial) skills which are needed by some students and time intensive
to provide. They also allow the sort of hands-on, inquiry-based, interactive educational experiences which pedagogical studies have shown are much more effective than traditional lecture-only courses.

If a few more faculty lines were to become available in Division III, it would be possible to meet the needs of the FYI program in addition to the NSM General Education program. Assuming that our division would be asked to teach one-third of the FYI courses, and that the program goal was about 36 courses per year (one per entering frosh per year at the 20 student per course limit), it would require about 4 or 5 new faculty lines in Division III to allow us to mount both an FYI and an NSMGE program. Obviously this would be a significant improvement over the present situation in which we divide too few resources between the programs with the result that neither can be adequately staffed. If resources for additional teaching strength can be found we urge the administration to consider deploying them in this way, so that Division III can become a full partner in FYI without sacrificing the quality of our traditional role in general education. If additional resources are not available we recommend that Division III focus on improving its central role in the general education program even if this means elimination of some FYI contributions.
4. Introduction

4.1. Definitions and Scope of the Report

The committee’s charge was to review the state of “general education” in the sciences and math, and make recommendations for improvements, if warranted. We note at the outset that there are two distinct types of courses available for Wesleyan frosh and sophomores to take in Division III, both of which satisfy their NSM expectations. These are commonly called Introductory (or “gateway”) and General Education courses, respectively. Introductory courses are entry points to the major. Examples are: ASTR 155, BIOL 205, CHEM 143, PHYS 113 and MATH 121. In some departments, lower level versions of these courses are offered to students with poorer pre-college preparation (e.g., CHEM 141, PHYS 111 and the recently introduced BIOL 190). The principle objective of introductory courses is to prepare students for additional work in the department - another introductory course or upper level courses.

All Division III departments except Psychology also offer General Education courses which are specifically designed for non-science students who wish to meet their NSM expectations, but have no desire to prepare for upper level courses in the sciences. We hereafter refer to these courses as NSMGE courses. Examples are: ASTR 107, E &ES 103, BIOL 104, CHEM 117, MATH 111, MB &B 104, and PHYS 104. A complete list is given in Table 1 of Section VII (Recommendations) of this report. In the E &ES department, the distinction between gateway and general education courses is deliberately blurred for pedagogical reasons appropriate to that discipline and departmental practice. Additional descriptive material about their view and those of other departments is given in Section VI (Departmental Reports). Wesleyan students can and do meet their NSM expectations in Introductory or General Education courses, depending on their academic goals, level of preparation, and availability of space. The focus of the committee and this report, however, has been entirely on the education of “non-science students”, by which we mean those who take very few NSM courses - often even fewer than the three which are “expected” of them. We argue on the basis of a detailed study of course choices by Wesleyan graduates of the Class of ‘96 (see Section III) that about one-half of the Wesleyan student body can be characterized in this way as “non-science” students. Their education is primarily and appropriately in the NSMGE courses. The other half either majors in a Division III department or is “science-oriented” (e.g. pre-medical students who major in an HA or SBS department). Their education is primarily in the introductory courses, which are a subject for departmental, not divisional, attention and beyond the scope of this report. It was gratifying for the committee to find that there is widespread consensus in Division III on what the goals of NSMGE are. They are summarized in Section II of this Report. Without this consensus, there would have been
little hope of addressing the issue of NSMGE on a division-wide basis.

It is perhaps appropriate to say a word here about Freshman Year Initiative (FYI) courses. While the goals of this University-wide program are different from those of NSMGE, FYI courses are generally considered by departments to be contributions to the NSMGE program. Valiant attempts have also been made to fit Division III NSMGE courses into the FYI mold. For example, the category of FYI “Special Initiative” courses has been created for larger enrollment NSMGE courses which have small sections, sometimes limited to frosh. It was not the charge of this committee to study the Division III contributions to the FYI program, and we have not done so. However, we note that NSMGE and FYI courses draw from the same pool of teaching strength available in departments and that the pool is not currently large enough to support both programs to the extent required (see Section III). If the recommendations of this committee are adopted, the NSMGE program will be strengthened, but possibly at the expense of some divisional contribution to the FYI program. In the sense that the goal of both programs is to improve the education, particularly in the first two years, that we offer Wesleyan students, this is perhaps not bothersome. The committee’s approach has been to recommend what we think is needed for an effective NSMGE program, consistent with current resources. In our view, some expansion of teaching strength would be needed to effectively mount a full divisional contribution to the FYI program as well. We believe that, in the long run, it will be better strategy for the division (with administration support) to focus on doing one thing for frosh and sophomores well - teach NSMGE courses - than two things ineffectively. A small expansion of teaching strength might, in the future, allow the division to fully staff the NSMGE and FYI programs, but that is not possible now.

4.2. Historical Perspective at Wesleyan

The last major review of NSM General Education was conducted in 1984 by a committee with Paul Haake as chair. The report of that committee is in Appendix I. This report was included in the administration’s October, 1984 “Report on Academic Planning” which led the faculty to adopt a new set of Expectations for General Education in the spring of 1985. Previously there had been a 4-4-2 set of expectations which resulted in most non-science majors taking only two NSM courses. The expectations adopted in 1985 are still in effect: non-science students are expected to take three NSM courses in at least two different departments.

In the decade since the Haake report, several things have happened at Wesleyan which collectively have made it much more difficult for Division III departments to meet the de-
mands of an effective NSMGE program. The expanded expectations for NSMGE led to an increase in demand for NSMGE courses by at least 33%. However, this came at a time of institutional cut-backs in faculty slots which by now have impacted on most Division III departments. Given the relatively fixed demands of a major and graduate curriculum, departments often had no choice but to cut back in the area of general education. Then the University instituted the FYI program and asked departments, including those in the sciences, to teach small courses for frosh, without any increase in teaching staff. Division III departments who wished to be good citizens and participate in this University-wide program generally had to draw the teaching strength for it from their General Education program. By 1996, there were clearly inadequate numbers of NSMGE courses, and this is part of the reason that the NSMGE committee was created.

Another motivation for this study is the general Academic Review process initiated by the current administration. At least two papers dealt with NSMGE issues: ”The Ideal Curriculum: One Scientist’s View” by William Herbst and ”One View of Science Education at Wesleyan” by Irina Russu. A theme emphasized by President Bennet in his first draft of the summary document ”Wesleyan Education in the 21st Century” is that, while we do a good job educating our juniors and seniors within the majors programs, there is room for improvement in the way Wesleyan educates its underclassmen. The purpose of this study is to suggest ways in which Division III can contribute to an improved program of education for non-science majors which will have its greatest impact on the frosh and sophomore classes. In fact, President Bennet has singled out General Education as an area of particular concern and asked for a report on the issue by December, 1997. The current review and set of recommendation is, therefore, timely.

4.3. The National Context

There has been a resurgence of interest across the country in improving science education for all citizens. It has become widely recognized and lamented that while the U.S. is the world leader in training scientists, it lags most of the developed world in science education for non-scientists. A few disturbing statistics from Andrew Fraknoi’s recent address to the American Astronomical Society help make the point. Only 32% of American adults in a recent survey could correctly state that the Earth goes around the Sun and takes one year to do so. Nine out of ten seventeen year olds could not calculate the cost of a carpet given room measurements and the price per square foot. 47% could not convert the fraction 9 out of 10 to a percentage. And the problems are not limited to the lower echelons of society. The following quote is from the Congressional Record: ”[...There is no need for a radio
astronomy search for extraterrestrial intelligence because] UFO records reveal that aliens are already here and they can, therefore, be contacted at no expense to the government.” To take another example from government, Donald Regan has stated publicly that, ”Virtually every move and decision the Reagans made during my time as White House Chief of Staff was cleared in advance with a woman in San Francisco who drew up horoscopes to make certain that the planets were in favorable alignment for the enterprise....”

A number of national scientific societies and government agencies have finally heeded the call to action in the 1983 Report by the National Commission on Excellence in Education "A Nation at Risk: The Imperative for Educational Reform". A new set of national educational standards in the sciences has been prepared by the National Academy of Sciences. The National Science Foundation has announced that it will place increased emphasis on science education in coming years. The report of its Advisory Committee "Shaping the Future: A Review of Undergraduate Education in the Sciences, Mathematics, Engineering and Technology” has recently been published. It contains a series of recommendations for University administrators, science departments and faculty to improve undergraduate science education, particularly for non-scientists. The Executive summary and recommendations from that Report are attached as Appendix III to this document. The full report can be accessed through a link on our committee’s Web page.

From the perspective of the NSF, a citizenry which is not well educated about what science is and is not, what it can and cannot do, will not easily be persuaded to continue to support the scientific enterprise in this country, as the Cold War mentality fades. The NSF’s contract with society for nearly forty years has been based on the belief that science and the advanced technology it brings with it are of critical importance to our security as a nation. A changing world has made that argument less forceful and the NSF recognizes that a deeper understanding of science and its value to society is essential if public support is to continue. The NSF wishes to rewrite its contract with society, but widespread scientific illiteracy in this country will make that difficult to do. Wesleyan has an important role to play in this. We educate tomorrow’s leaders in many fields and it is imperative that they move into their careers with a solid grounding in science, math and technology.

Wesleyan has a long history of contributions to the national discussion of general education. Gerald Holton ’41, a Harvard professor and Wesleyan trustee emeritus, was a member of the committee that wrote "A Nation At Risk". In the winter 1997 issue of Wesleyan’s University Alumni Magazine, some of his views on general education are reported. Sheila Tobias, a former Associate Provost, has authored several well known books on the subject of teaching science to non-scientists. Earl Hanson, former Professor of Biology and founder of the Science in Society Program, was a highly visible spokesperson for general education in
the sciences on the national scene during his lifetime. On our current staff, Ralph Baierlein, Charlotte Augusta Ayres Professor of Physics, who worked as an assistant for Holton, and teaches immensely popular NSMGE courses, has written widely on the subject. We include one of his articles in Appendix III of this report. It is the hope of this committee that Wesleyan can continue to make contributions to NSMGE both on the campus and in a national context. While the committee made no effort to systematically study what is happening in NSMGE at other, comparable institutions, it is clear from anecdotal evidence that many are being influenced by the national movements described above. One description of an initiative at Princeton is particularly interesting, and we include it as Appendix IV.
5. Goals of General Education in Division III

The first issue addressed by the committee was: what are the goals of general education in the sciences and mathematics? It was felt that if we could not agree on the goals, there was no point in discussing a program to achieve them. It was gratifying to find, therefore, that there is widespread consensus in Division III about the characteristics of courses which we would like non-science students at Wesleyan to take. There was also a consensus that the current minimum expectations (three courses from at least two different departments) was satisfactory, although it is deplorable that such a large fraction (more than 25%) of the non-science students do not meet them. The following set of goals was formed by combining the reports of previous committees with the experience and suggestions of instructors of successful NSMGE courses. Refinements and additions were made in discussions at Division III lunches and in meetings of the committee. It is divided into "essential" components, which the committee feels should be part of all courses fulfilling a general education role in the curriculum, and "desirable" components, which could be part of many such courses. We recommend that this set of goals be widely publicized to students, faculty who teach the courses, faculty advisors, and the administration. It should be included in all appropriate Wesleyan documents, such as the Course Book and Guide to Course Selection for New Students, and should be presented and discussed at the annual meeting of frosh advisors. It is important that students, faculty and the administration be "on the same wavelength" when it comes to discussing NSMGE courses. When we speak of NSMGE courses in this report we mean courses which meet the following set of goals:

A. Essential:

1) Intellectually Important Subject Matter

Courses should focus on intellectually important ideas in science. They should be of obvious interest to students - things they have heard of, and will hear about again. Topics covered should be fundamental to their fields and of active research interest today. It is generally better to cover a small number of topics in detail than a larger number in cursory fashion.

2) Methodology of Science and Evaluating Science

There should be at least as much emphasis on how we know what we know as on the facts themselves. Examples of the scientific method at work should be highlighted. How is science done? How can it be distinguished from pseudo-science? The development of hypotheses, design of experiments that critically test them and the need to constantly refine hypotheses should all be taught by example. Students should learn to determine how tightly an investigator’s conclusions follow from experimental data. Are there alternative
explanations for an experimental finding? Was there a better way to design an experiment so that alternative interpretations could be ruled out? Does an experimental result suggest a general law of nature, or do the conclusions apply only to a specific model system?

3) Rigor

Students should gain experience with clear, logical thinking - the professor’s in lecture and their own in homework or lab assignments. Courses should be intellectually rigorous without being jargon-filled or overly complex. Students should expect to have to work as hard in an NSMGE courses as they would in any other course - maybe harder.

4) Doing Science

Opportunities should be provided for students to DO science, through laboratory or homework exercises. To the greatest extent possible, these should be actual experiences with field or lab work involving critical scientific thinking. Cook book style labs should be avoided. Students should experience how scientists and mathematicians think, work and evaluate their world. They should experience the joy of discovery for themselves.

5) Experience with Quantitative Reasoning and Basic skills.

While mathematical methods may need to be somewhat limited, the experience of using quantitative reasoning to reach important conclusions is essential. Quantitative analysis and statistical argument should be taught and expected of students. Special forms of support, perhaps involving the Math Workshop, should be provided for students with weaker backgrounds and talents, including those who suffer from ”math anxiety”.

6) Basic Knowledge

It is important to be sure that all students are grounded in the fundamental concepts of science, such as force and motion, atomic structure, genetics, evolution, basic structure of the earth and universe, etc. While NSMGE courses should not be ”remedial” in nature, they should touch briefly on basic knowledge and ensure that all students have some minimum level of understanding which will help them be effective citizens in this technological age.

7) Positive experience with science

Many students in NSMGE classes are refugees from an unfortunate experience with high school science and mathematics. They will only have a couple of chances to correct their negative impressions before they move into society - some in positions to influence science policy. It is in their best interest and in the best interests of science and society that they have a positive, realistic experience with science while at Wesleyan. This will provide the essential basis for a lifetime of learning about, support for and appreciation of science.
B. Desirable

8) Acquaintance with Historical Context

Relieved of the need to cover all of the basic material necessary in an introductory course, there should be time in NSMGE courses to provide the historical context of the subject as well as some of its sociological aspects, when appropriate. It is important to relate science to the society out of which it emerges. This might include, for example, discussions related to the issue of underrepresented groups among scientists.

9) Ethical Perspectives

Some subjects particularly lend themselves to discussion of the ethical issues which can arise from science. This is a valid, important area to cover in NSMGE courses. Again, there is not usually time in introductory courses to deal with this.

10) Scientific Literacy and Library Skills

Each scientific discipline has a rich and rapidly changing body of information, comprised of primary as well as secondary and tertiary sources. One of the most important tasks for even the most casual student of science must be the ability to locate, evaluate and integrate this information in some meaningful and systematic way. It becomes increasingly important as we enter the Information Age that students know how to use the tools which provide access to the information, regardless of whether they are in traditional or electronic formats.

11) Writing and Communication Skills

One of the things that many NSM students struggle with is organizing the information they have acquired in a structurally sound and logical framework. In other words, they have the pieces and they have the big picture but they cannot quite grasp how the pieces relate to the big picture. An emphasis on structured writing assignments as part of NSM courses will help to demystify this aspect of science for students and make the various disciplines more accessible to the students. Writing is also an excellent tool for teaching critical thinking in a scientific context. Experience in mathematics facilitates analysis of any textual argument and helps develop precision in writing.
6. A Snapshot of NSM General Education: The Class of 1996

At the committee’s request, John Pothier analyzed the transcripts of the graduating class of 1996 to help us ascertain how the Division I and II majors were educating themselves in science and math. His full report is given in Appendix V. In subsection A we summarize and interpret his findings. Also, Paula Lawson reported to us on preregistration “Failed Enrollments” in NSM courses during 1994/95 and 1995/96 (Appendix VI) and we summarize those results in subsection B. Finally, in subsection C, we use Pothier’s data to estimate the demand for space in NSMGE courses.

6.1. Distribution of NSM Course Selections by Non-science Majors

There were 707 graduates of the Class of ’96, of which 72 were transfer students. Since it is difficult to analyze the records of transfer students, we focus on the 635 non-transfer graduates. Of these, 467 did not major in a Division III department and they constitute the basic sample of “non-science majors”. Since it is a Division III department, Psychology majors are not included in this sample. The 467 non-science majors generated 2,346 enrollments in courses offered by Division III departments, excluding Psychology courses which carry the SBS general education designation (e.g. PSYC 105). Therefore, the mean number of science and math courses taken by non-science majors is close to 5. However, the distribution is such that the median number of courses taken is 4 and the mode (most common value) is 3. Furthermore, 96 students (more than 20% of the sample) took 2 NSM courses or less meaning they did not satisfy Wesleyan’s general education expectations. There were also 32 students who took 3 or more NSM courses but did not distribute them among two or more departments. Therefore, 128 students (27% of the sample) failed to meet the Stage II expectations in NSM. [By contrast, only 5 NSM majors (less than 3% of the sample) failed to meet the general education expectations in SBS or HA.]

The frequency distribution of numbers of courses taken by the 467 non-science majors is shown in Table 1.

Perhaps the most surprising thing about Table 1 is the fair number of non-science majors who take a large number of NSM courses. Note that these are NOT double majors. Analysis shows that they come from a wide range of major departments, spread across Divisions I and II. Four students took more than 20 NSM courses and none of them was a ”failed major” in the sense that they had ever declared a major in an NSM department. Their declared majors were: ANTH, ECON, ENGL, and GOVT. The 108 students who took 7 or more NSM classes generated more than one-half of the total enrollments and are responsible for
the significant difference between the mean, median and mode in the distribution. We refer to this group of non-science majors, many of whom may be pre-meds, as "science-oriented" students. At the other end of the distribution, students who take 2 or less NSM courses are not heavily clustered in certain departments or one of the other Divisions.

How do the non-science majors distribute their course choices among Division III offerings? The first two columns of Table 2 show the figures for the top 25 courses enrolled in by the 467 students in the sample. These constitute 58% of the total enrollments. The remaining courses can be found in Pothier’s original report. Since the focus of this report is NSMGE courses, we have identified these with asterisks in Table 2. Courses without asterisks are either gateway courses or upper level science courses, except MATH 107, which is a remedial course carrying no general education credit. It is apparent that in the full sample, the most popular courses are not of the NSMGE variety, but are the introductory courses in Math, Biology and Chemistry. However, when the "science-oriented" population identified above is removed from the sample, a different picture emerges. This is shown in columns three and four of Table 2 where we show enrollment figures for the 359 non-science majors who took 6 or less NSM courses. Altogether they account for 1161 NSM enrollments and the top 25 courses account for 63% of those. Within this group of non-science majors who are not science oriented, five out of the top six courses selected are of the NSMGE variety.

The obvious pattern which emerges from Table 2 is not surprising. Science-oriented students tend to meet their NSM expectations by taking the standard introductory courses that are required of pre-meds and would be expected to be taken by others with a strong science orientation. NSMGE courses are intended for students who will take only a few NSM courses, not those taking 7 or more. The Table shows the trend expected if students were choosing their courses intelligently, and this is gratifying. Students who take only a few NSM courses tend to choose ones which are specifically designed for non-science majors.

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</tbody>
</table>

Table 1. Numbers of Science and Math Courses taken by Non-Science Majors
Table 2. Science and Math courses that generated the highest enrollments among majors from other divisions (Asterisks indicate NSMGE courses)

<table>
<thead>
<tr>
<th>Course</th>
<th>Full Sample</th>
<th>Excluding Science-Oriented Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 117</td>
<td>88</td>
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who take 7+ NSM courses, on the other hand, tend to choose standard introductory courses, not the NSMGE courses. This suggests that the actual size of the clientele for NSMGE courses is not the full set of non-science majors, 467 students (73% of the class). It is, rather, about 350 students (50% of the class). The other half either majors in a Division III department or takes considerably more science than required by the expectations and would probably not choose NSMGE courses even if more were available to them.

6.2. Class Access in Division III

The committee also received a report from Paula Lawson of the Office of Academic Affairs giving preregistration results from the 1994/95 and 1995/96 academic years. In particular, she provided a list of all NSM courses which had failed preregistrations during those years. It is important to note that there is no simple conversion between the number of failed registrations and the number of students who wished to take the course and would have taken it if space were available (the "excess demand"). Failed enrollments overestimate the excess demand because students can and often do list a course more than once on their pre-registration forms. Therefore, they may fail to get into the same course more than once. On the other hand, pre-registration failures are not the only source of excess demand. Students also fail to get in during the Drop-Add period. These may be the same students who failed during pre-registration, in which case they do not add to the excess demand, or they may be different students. Furthermore, in some courses such as BIOL 206 and, indeed, most or all gateway courses an effort is made to accommodate all students who wish to take it. Sometimes this may mean switching to a larger room. It is impossible, therefore, to reach any quantitative conclusions about excess demand on the basis of the numbers in Lawson’s report, as she notes. Two qualitative conclusions are valid, however, and are illustrated in Table 3 (at end of report), where we list the courses principally responsible for failed enrollments each semester. First, the large majority of the failed enrollments come from a small number of courses. Second, these are usually NSMGE courses.

A conservative conclusion from Table 3 is that the demand for NSMGE courses currently outstrips our ability to provide space in them. Every semester there are large numbers of pre-registration failures in a variety of NSMGE courses. It is clear that offering more NSMGE courses will help ease the problem of failed enrollments. However, it would be misleading to attempt to make a quantitative estimate of the number of additional spaces required based on the numbers in Table 3, for the reasons cited above. To make that estimate, we take a different approach, as outlined in the next subsection.
6.3. The Demand for NSMGE Courses

A rough estimation of the number of general education courses that we require to meet the demand may be made in the following manner. We use the data from John Pothier’s report on the Class of 1996, summarized above, and assume that the Class of ‘96 is representative of the current Wesleyan student body. From Pothier’s numbers we infer that roughly one-half of each Wesleyan class would prefer to meet their NSM expectations by taking NSMGE courses as opposed to introductory or gateway courses (i.e. we assume that Division III majors and science-oriented students will take the gateway courses). Since the expectation is for 3 courses taken over 4 years, we require \( \frac{1}{2} x \frac{3}{4} x 2800 = 1050 \) spaces/year in NSMGE courses. If the goals of general education are to be met - including rigorous courses with an active component and sufficient help in the form of TAs, etc. - class limits should be around 50. This implies the need for about 20 NSMGE courses per year. As is discussed in Section VII (Recommendations), this is a number that could be offered by the Division with existing resources. We note, however, that the demand could not be met by FYI courses with enrollment limits of 20. More than 50 courses would be required in this scenario and that is well beyond the limits of current or foreseeable teaching strength.
7. Surveys

The committee examined results from two surveys. One is the "Senior Survey" administered by the University each year to graduating seniors. It was analyzed by John Pothier whose full report is included as Appendix VII. This report was discussed extensively in the committee and at two of the NSM Friday Lunches. We summarize our findings and interpretations in subsection A. The committee also felt that it would be useful to survey a current group of students in NSM courses to get their perspective on certain issues. Our own survey, results and interpretation are described in subsection B.

7.1. The Senior Survey

Wesleyan administers a survey to graduating seniors every year at a graduation rehearsal. Many questions are asked, some of which are relevant to this committee’s work. Identical surveys are given at some other, comparable institutions which are members of COFHE (Consortium on Financing Higher Education). Study of Pothier’s report (Appendix VII) leads to the following conclusions:

1) Wesleyan graduates from 1989 to 1996 consistently report that they are less satisfied with NSM courses than with HA or SBS courses.

2) Wesleyan students and those from "peer colleges" report that they are equally satisfied with HA and SBS courses. However, Wesleyan students report lower satisfaction levels with NSM courses than those attending peer colleges.

3) In 1994, students at virtually all COFHE institutions, including colleges and Universities, reported less satisfaction with NSM courses than with HA or SBS courses. There was a wide range of satisfaction levels. Wesleyan placed at the bottom of the peer group colleges and near the median level of the peer group Universities.

4) In 1995, Wesleyan science majors report substantially higher satisfaction levels with NSM courses than do non science-majors.

There was considerable discussion within the committee and the division, and especially among members of the Math department who are experts in statistics about the meaning of these survey results. The conclusions listed above are conservative and have deliberately not been quantified. We believe that it is misleading to attempt to quantify them beyond what is stated. In response to suggestions from the Math department, John Pothier kindly provided additional figures and tables which display the data more appropriately and these are included in Appendix VII. In the opinion of the committee, no quantification of the
results beyond what is presented on those revised figures or summarized in the four points above is warranted.

While the conclusions stated seem relatively secure, their interpretation is unclear. It is fair to say that the consensus of the division is that we are not happy with the survey results but it is not clear what they imply about Wesleyan and what, if anything, can be done to improve satisfaction levels. At a minimum, we recommend that the Office of Institutional Research work with Division III to expand the Senior Survey to include questions which will help elucidate the cause or causes of relative student dissatisfaction with NSM education. The improvements to the NSMGE program recommended here may help, since the dissatisfaction level is highest among non-science students. We record some other comments and speculations about what the results may be telling us and what should be done:

Dissatisfaction with NSM teaching is not just a Wesleyan phenomenon - it is a national phenomenon - and it is precisely this problem that the NSF initiatives and other national initiatives mentioned in Section IC are addressing. Adopting the recommendations in the NSF report (Appendix II) would probably help.

Wesleyan students may be intrinsically more difficult to satisfy in NSM courses than students at other COFHE colleges. Pothier reports that there is survey data which indicates that entering Wesleyan students have less confidence in their own math skills and lower interest in learning about science as a life goal than do students at comparable institutions. (The committee regards this as a challenge, not an excuse.)

There may be a mis-match between expectation and reality owing to the perception of Wesleyan as a school without "requirements". Anecdotal evidence suggests that Wesleyan students often believe they do not need to take science courses here and they may even choose to come here for that reason. They also may expect to find primarily small classes, but this is not what they encounter in the lower level science courses.

Wesleyan is the only institution that gives this survey every year, and essentially "forces" the students to participate by making it a graduation requirement. As a result, there is a high yield, but perhaps at the expense of lower scores on some issues.

An attempt should be made to learn which other comparable institutions are leaders in student satisfaction with NSM courses and to see if anything can be learned from their approach. This may be difficult since the COFHE reports are coded in a way that allows one to identify only their own institution.

Clearly, further study of and attention to this issue is warranted. The committee feels that it should be a divisional and institutional priority to better understand what this survey
is telling us and to take the steps necessary to raise the satisfaction level with NSM courses if that is possible. Again, we note that a first step in that direction should be adoption of the recommendations in Section VII of this Report.

7.2. The NSMGE Survey

The committee determined that it might be useful to survey students currently enrolled in lower level NSM courses which serve the NSMGE need. J. Varekamp and J. Seamon constructed a brief survey which was distributed in NSM general education and introductory courses near the end of the first semester of this academic year. Issues to be addressed in the survey were determined during fall meetings. The survey form is included as Appendix VIII and results are recorded on it. The forms were handed out in class at the end of the courses, but not coincident with teaching evaluations. Some professors distributed the surveys during the final exams. Survey forms were collected by the professors and forwarded to a secretary in North College who accumulated them and mixed them together. In this way, we (deliberately) lost all information on particular courses.

The responses were tabulated by the Astronomy Department secretary during the semester break, analyzed by the committee, and discussed at an NSM Friday Lunch meeting. A total of about 1250 forms were distributed and 362 (29%) were returned. Respondents were divided into three samples - I: All Returns, II: General Education students, and III: Science or Potential Science students (undecideds). The division was made on the basis of the answers to questions 1 and 2. The General Education sample is students who responded "took it for a Gen Ed requirement" (answer 3) to question 1 ("Why did you take this course?") and gave their Declared major status (question 2) as "nondeclared" (answer 1) or "Nonscience major" (answer 3). Everyone else was considered a Science or Potential Science student. The principle conclusions are as follows:

1) Little difference was observed between the ratings of the General Education sample and the science sample on questions 5 (demonstrated use of scientific method?), 6 (intellectually rigorous?), 8 (provided historical context?), 11 (increased interest in science?), and 12 (improved ability to evaluate science reports?).

2) Science students, however, rated the courses higher on questions 7 (provided an opportunity to do science), 10 (student was interested in science before the courses), and 13 (student worked hard in the course).

3) On Question 10 (interest in science before the course) the difference between the General Education and Science samples was largest. The former expressed an opinion near
the mid-point of the scale (3.8), while the latter expressed a much more favorable opinion (5.8).

4) General Education students rated the courses stronger on reviewing ethical issues (Question 9) than did the Science students.

5) Overall, the ratings of both the General Education samples and the Science sample were near the mid-point of the range, slightly to the positive side. The science sample was, as a whole, slightly more positive that the General Education sample, except on Question 9, the ethical content.

The general impression of the survey was that it by and large confirms the results of the Senior Survey. Our students find that the courses are alright, but there is room for improvement, especially among the less science-oriented students. Future surveys of this sort should be undertaken in coordination with the Office of Institutional Research.
8. Perspectives on NSMGE

The committee sought perspectives on NSM general education issues from three sources: the Dean’s Office, the Admission’s Office and the junior faculty of Division III. Here we report what was learned.

8.1. The Dean’s Office

F. Cohan met with representatives of the Dean’s Office and the discussion primarily focused on the failure of non-science majors to fulfill the University’s expectations in General Education. As the statistics reviewed in Section III showed, 133 students in the most recent graduating class failed to meet their expectations, and in all but 5 cases, the area in which they were deficient was NSM. Failing to meet expectations is clearly an NSM problem and, obviously, an NSMGE problem. The 128 students who did not meet their expectations in NSM represent only 20% of the (non-transfer) class, but 27% of the 467 non-science majors and 35% of the target population for NSMGE courses.

The deans suggested that the University sends messages to the students at several different levels that General Education expectations are not requirements, and that these expectations are not to be taken seriously. First, the General Education expectations are never explicitly called requirements. Second, while frosh Faculty Advisors are clearly asked to discuss the General Education expectations with their advisees, some faculty advisors take these expectations more seriously than others. Third, major advisors in Divisions I and II frequently support their advisees’ efforts to avoid science classes. When a second-semester sophomore has failed to meet the Stage I expectations, the student is required to submit a plan for compliance or a justification for not complying; no matter how frivolous a student’s justification may be, it is accepted by the Deans’ Office as long as it is co-signed by the student’s major advisor. Clearly, many faculty in Divisions I and II are willing to sign less than compelling justification statements.

On the other hand, there are some places on campus where the General Education expectations are taken very seriously. For example, one cannot be a major in Latin American studies, COL, or CSS without fulfilling General Education expectations. Also, University Honors requires fulfillment of the expectations, as does Phi Beta Kappa.

The deans suggest that if we are to raise compliance levels, we must change the attitudes of faculty advisors as well as the attitudes of the students. The deans made several specific suggestions. The first two involved a coordinator of Division III General Education courses. First, we might have the coordinator of Division III General Education courses present at
the Academic Forum of Freshman Orientation. The coordinator would be prepared to go beyond a discussion of the content of General Education courses to tell students about the level of preparation expected of students for each course, and the kinds of skills that students would learn. The coordinator would also make this information available in a chart of all Division III General Education offerings.

The deans also suggested that a general statement about the goals of General Education courses in science could be made part of the freshman advising packet. Maureen Heacock has volunteered to help us adapt our statement of goals for the freshman advisors’ handbook and has asked that she be sent a copy of the goals statement when it is ready. Another idea is to have more General Education courses that are team-taught across divisions.

8.2. The Admissions Office

J. Reid communicated with Barbara-Jan Wilson of the Admissions Office to ask her for any insights that her office might have into the issue of NSMGE courses. Specifically, she was asked whether FYI courses were useful for recruiting, if candidates express interest in such things, and what might be the impact of a reduction of such offerings or a cessation of such offerings. She was also asked to make any comments on NSMGE courses she might have. Barbara-Jan’s responded that small courses designated for frosh with contact with a real faculty member are very important for recruiting. What we call them is not important. Students come to Wesleyan for strong teaching, smallish classes and the chance to do research at a level that is greater than other colleges. Committee discussion revolved around the importance of keeping the Admissions Office well informed about the reality of the frosh and sophomore experience in science classes here so that there is no mismatch between expectation and reality. It was suggested that Barabara-Jan should be invited to meet with the NSM faculty at a Friday lunch once a year.

8.3. Junior Faculty from Division III

[No report received.]
9. Department Reports

Each Division III representative to the committee was asked to prepare a report discussing NSMGE from the perspective of that department. The reports are attached here. Some summary information is extracted and given in Tables 1 and 2 of Section VII (Recommendations.)

Astronomy Department William Herbst January, 1997

At present teaching strength (3 FTE) the department can commit an average of 3 course per year to GE. This does not include our Introductory Astronomy (AST 155) and our Observational Astronomy (AST 211) courses both of which enroll some non-science majors. We encourage science oriented students to take AST 155, and those who clearly will not major in the sciences to take a GE course. Current GE courses include:

AST 105 (Salzer) Descriptive Astronomy
AST 107 (Herbst) The Universe
AST 109 (Upgren) Revolutions in Science and Astronomy
AST 111 (Upgren) Topics in the History of Astronomy
AST 135 (Upgren) Descriptive Meteorology

Enrollment limits vary from 50 to about 100 for these courses, so on the average our department could teach about 200 GE students per year. Unfortunately this is not enough to meet the demand for such courses. Every time we offer a GE course, no matter which one, the demand exceeds the spaces available by about a factor of two.

The only course with formal lab work is AST 107, where students register for a mandatory session (1.5 hrs/wk). However, in the other courses, observing labs and projects are regularly given along with homework assignments in AST 105. No special accommodation for GE students is made in AST 155. Our philosophy is that students who want the GE-type course should take one of the GE courses, and that students who take AST 155 know they are getting a standard introductory course. This helps keep the level of AST 155 more uniform and appropriate as an introduction to the major. The majority opinion in the department is that GE courses should be rigorous and as demanding as any other course for students.

The Astronomy Department is happy to carry a good share of the general education responsibility of our division. Our subject is well suited to the task, since it is inherently interdisciplinary and was central to the development of the scientific method. We are also a vibrant, cutting-edge science today which captures and fuels the imagination of the general public. We would definitely teach more GE courses if we had additional resources. The problem is not TA’s - we probably have enough, but faculty FTE’s. In our opinion, the FYI program takes away from the teaching strength available for NSM-GE and is counterproductive. Obviously, it is good for faculty, since it is easier and more pleasant to teach a class
of 20 than a class of 80. However, the demand for our courses being what it is, we feel it would be irresponsible of us, as a department, to teach FYI courses at the expense of larger GE classes.

Responsibility for teaching GE courses is shared by all faculty, including junior faculty. Ability to teach GE courses is an important factor in gaining tenure. Recognition is given to the difficulty of doing this well (as measured by teaching evaluations). Since teaching GE classes is part of the job here it would be foolish, however, to "protect" junior faculty from this.

Biology Department Report on General Education Fred Cohan

I. Course offerings

These are Biology’s General Education courses that are not intended for Biology majors:

Biological Communication (Bio 102), Allan Berlind Human Biology (Bio 103), Jason Wolfe Animal Architecture (Bio 104), Spencer Berry Drug Action in the Nervous System (Bio 105), C. Duman (adjunct) Understanding your Genes (Bio 107), James Donady

Our new introductory course is intended to serve both non-majors and prospective majors who do not feel ready for Bio 205:

Introductory Biology (Bio 190), staff

These are the core courses for the Biology and Neuroscience & Behavior programs. They have also served as General Education courses for non-majors:


The following is an upper-level, multidisciplinary course with no prerequisites. This course may serve for General Education, for majors and non-majors alike. It does not count toward fulfillment of major requirements.

Biology, Politics, and Psychology of Reproduction (Biology/Women’s Studies 280), Laura Grabel and Jill Morawski

II. Rationale

A. Rationale for offering Gen. Ed. courses

The Gen. Ed. courses for non-majors give students with little or no background an opportunity to study an important area of research in biology in depth. These courses
provide a valuable shortcut for non-majors. If it were not for these courses, students would have to take three semesters of introductory courses before they would be eligible to take an upper-level course that focuses on an area of special interest. Also, the Gen. Ed. courses are valuable for non-majors in that they have no prerequisites, implicit or explicit. Many non-majors would be uncomfortable taking the first semester of our introductory course, because some very basic knowledge in chemistry is helpful. None of the Gen. Ed. courses for non-majors expect this knowledge of the students. We feel that our General Education courses have been very successful in bringing interesting and challenging areas of current research within the grasp of non-specialists. Some of our Gen. Ed. courses have covered material at the same level of rigor as in our majors’ courses, although at a slower pace and with more background information. The course Biology, Politics, and Psychology of Reproduction (Biology/Women’s Studies 280) is rigorous in its coverage of material across several disciplines. While we feel that our Gen. Ed. courses have provided non-majors very good opportunities for education in science, we also feel that the rationale for providing Gen. Ed. courses is not nearly as strong in Biology as in the physical sciences. Whereas the majors’ courses in the physical sciences absolutely require some background in mathematics, there is really no need to have a background in science or math before taking Biology’s introductory series. Many of our bright students who have had no college-level background in science do very well in this series. One rationale for Gen. Ed. we must not ignore is that the administration would like the science departments to offer more General Education and FYI courses. Apparently, FYI courses in the sciences are thought to be important for undergraduate recruiting. This may be true, but our department believes that Admissions would do better in recruitment by marketing Wesleyan science for its greatest strength: that Wesleyan science majors have the greatest opportunity in the country to participate in government-funded research with a faculty mentor. Perhaps if Admissions were to realize this and to pass on this information to prospective students, the FYI program would seem much less urgent.

B. Rationale for including majors’ introductory courses as Gen. Ed.

The introductory series in Biology does not require any previous knowledge in the sciences, although some students find some previous chemistry background helpful. These courses are thus self-contained and serve to provide an introduction into biology for any interested student. A recent survey showed that about one-third of the students in the majors’ introductory courses NS&B 213 and Bio 206 have enrolled in these courses to fulfill NSM Gen. Ed. expectations.

III. Rigor of Gen. Ed. courses

These courses are less rigorous than our upper-level offerings in the same subjects, and
some of them are less rigorous than the introductory series; others are taught at the same level as the introductory series but at a slower pace (see above). The introductory courses for Biology majors each have an associated lab course. The introductory course for the NS&B major (213) could have a challenging computer simulation component if the Haslab were expanded. The Gen. Ed. courses for non-majors do not have a laboratory component.

IV. Department’s ability to staff Gen. Ed. courses

The Department can probably maintain its current level of staffing for Gen. Ed. courses, but an increase in Gen. Ed. offerings would compromise our ability to provide 1) upper-level courses for our majors and/or 2) opportunities for research education in our laboratories (see below).

V. Administration support for department’s teaching program

The Department’s strategy for course offerings must take into account the strengths of our institution as well as our limitations. First, let us consider the strengths. The science departments at Wesleyan are able to support a competitive, government-funded research enterprise (like the major research universities) and to allow most majors to participate in this research with their faculty advisors (like more typical liberal arts colleges). This combination is unique in American higher education. Wesleyan has traditionally supported this educational opportunity by allowing the life sciences professors to teach one regular classroom-course each semester. Because Biology is a medium-sized department teaching one classroom-course per professor each semester, we are obviously constrained in our course offerings. Because we have so many majors (about 50 per class)*, we have an obligation to teach several upper-level courses each semester for our majors. This limits our Department’s ability to supply a larger number of General Education courses and precludes consideration of FYI courses. We would appreciate the administration’s support to keep our teaching strength in upper-level courses where it is. Pressure to redeploy our teaching strength at the General Education level would either compromise our ability to teach our majors (if we were to substitute Gen. Ed. courses for majors’ courses) or compromise our ability to provide research education for our majors (if we were to increase our classroom teaching loads). We believe that while our Gen. Ed. offerings have served our students well, there is no compelling rationale for increasing our offerings in this area.

VI. Junior faculty in General Education courses

Our General Education courses have generally been staffed by senior faculty, but one introductory course, NS&B 213, has been staffed regularly (and successfully) by an assistant professor.
* This number includes the course demand of 35 Biology majors and 30 NS&B majors, who take half of their upper-level courses from Biology.

Chemistry Department Al Fry

1. Courses relevant for General Education students.

1996-1997

The following courses are available this year for students desiring to satisfy the general education requirement. [None of these courses has a laboratory component at the present time, although John Sease included some laboratory in Chemistry 117 when the enrollment was only 20 students] :

* Chemistry 117, ”Chemistry, the Consumer, and the Environment” (John Sease). The course is focussed on scientific, environmental, and public policy aspects of the uses of the various types of energy, including nuclear, fossil fuel, and alternative sources. The intent is to supply students with the information they need to understand and make decisions about the value of the various sources of energy. The course has been well received, as a result of which John has been forced to limit it to 75 students for Spring ’97.

* Chemistry 118, ”Plant Biochemistry” (Phil Bolton). This small Fall semester course (ca 15-20 students) is accessible to and is mostly taken by freshmen. The course covers elementary concepts of biochemistry and genetics as they relate to the development stages of plants. Topics include photosynthesis, evolution, and genetic engineering of plants. This year Phil has added cooperative learning discussion sessions and weekly papers which he grades both for content and quality of writing. The course is intended to educate the students not only on plant growth processes but also the social and ethical issues surrounding genetic manipulation of plants.

* A substantial number of students (possibly as many as 75) in Chemistry 141 (Pete Pringle), the first semester of our lower-level introductory chemistry sequence, take it to satisfy the general education expectation and do not continue into the second semester course. In this course Pete describes environmental applications and implications of the course material rather extensively so that students can see the relevance of the material to other aspects of their lives. However, Chemistry 141 was never designed as a stand-alone one semester course, so next year Pete is offering a new one semester course for non-science majors, Chemistry 114 ”Essential Chemistry” (see below). This course will probably attract many of the individuals who have been using Chemistry 141 as an NSM generalization course.

*”The Scientific Method” (David Beveridge and Joy McConnell) was offered for the first time in Fall ’96. It is a writing-intensive course classified as FYI (First-Year Initiative).
Seven freshmen registered for it as such as Chemistry 150. It was also possible for upperclassmen to register for it as Chemistry 350, and eleven students did so. The course examines the qualities, concerns, and intellectual foundations of scientific reasoning, including (a) an historical review of the development of the scientific method, (b) case studies of significant scientific discoveries (e.g., natural selection, structure of DNA, and quantum mechanics), and contemporary critiques of the validity and objectivity of science. The intent is for students to understand how scientists reach conclusions and test them.

* Chemistry 180/380 "Writing About Science" (Joy McConnell) is being offered in Spring 1997 as an FYI course. The pre-enrollment at this point consists of 10 freshmen and 5 upperclassmen. The course is structured similarly to Chemistry 150/350. The course will emphasize writing about science for a general audience. In addition to reading assignments in the genre, students will be given a series of writing assignments leading to the development of a complete science article. Features of the course will include interviews with professional science writers and uses of the internet in accessing information.

1997-1998 As mentioned above, Pete Pringle is offering a new course "Essential Chemistry" (Chemistry 114) next year. It will be a one-semester course with no enrollment limitation. It will be a one-semester survey of general chemistry intended for non-science majors. It will probably have an significant discussion element, carried out in smaller sections.

Anne Baranger is also introducing a General Education course, Chemistry 356, titled "Drugs: Mind, Body, and Molecules", next year. It consist of an introduction to the mechanism of action of drugs (pharmaceuticals) and the development of the modern pharmaceutical industry.

With the hiring of a new faculty member, Anne Baranger this year, we will be in a better position to expand our offerings in General Education. This is already happening: see the preceding paragraph. Anne was not hired with this as a specific duty, but even when she is teaching courses for majors and graduate students, her presence will free me and others to introduce courses for non-science majors. Thus, in 1998-1999, I expect to teach a course titled "Molecules of Nature", which will cover a) chemical ecology (chemicals used by insects, animals and plants to communicate or control their interactions with their environment), (b) elementary biochemical topics such as the determination of the double helical structure of DNA and the genetic code), and (c) biosynthesis of antibiotics and other natural products. We should note that John Sease, who is retired and donates his time to Chemistry 117 as a service to the department, has indicated that he will not be teaching this course much longer. Other members of the department will have to step into the role he now plays.

I hope to take up with the department the idea of student self-study courses. A group
of students could be given a broad question to study. They would divide various aspects of the topic among themselves and carry out an extended literature search on their part of the problem. Each would become a mini-expert on their problem, and would meet on a regular basis with each other and, perhaps less often, with the faculty course advisor to build their individual parts into a larger whole. Topics would be chosen which exhibit a variety of dimensions: scientific, social, political, cultural. Ideally, groups would be made up of individuals with widely varying backgrounds. I suspect that most Division III faculty members would be competent to oversee a group studying, for example, topics as evolution vs creationism, the desertification of North Africa, global warming, the merits and hazards of genetic engineering, etc. This type course would rely heavily on the students learning to use the information resources available to them, including the library and internet. I hope we can have a discussion of this type of course on the GenEd committee.

2. Quantitative Aspects. In 1996-1997, the Chemistry department is offering five courses (Chemistry 117, 118, 141, 150/350, and 180/380) in General Education with a total enrollment of about 200, if we assume that the ca. 75 students of Chemistry 141 who don’t continue into the second semester were taking it to satisfy the Gen.Ed. expectation. In 1997-1998 the department is scheduling five courses (Chemistry 114, 117, 118, 150/350, and 356). An unknown number of students may still take 141 as a GenEd course, although we will recommend 114 over 141 to such students. The total GenEd enrollments will probably be slightly higher next year because of the addition of Chem 114 and 356. As mentioned above, other members of the department will have to take up the gap created when John Sease stops offering Chem 117. The department will continue to offer five or six courses per year intended for non-science majors, continuing to serve about 200 students. More TA help would definitely help expand our offerings in this area, for example permitting us to add laboratory and discussion components to the larger GenEd courses.

3. Administration and Departmental Support. The administration, through the Dean, has been supportive of our efforts in General Education. Dave Beveridge and Joy McConnell have introduced two such courses, Chem 150 and 180, and Dave is helping to fund Chem 114 next year as an experiment in General Education which might ultimately be the replacement we need for John Sease’s large Chem 117 course. General Education courses have generally been taught by tenured faculty. This is probably a good general practice, because they call for skills at running small discussion sections, which take time to develop. But we have not actively discouraged junior faculty from offering such courses if they wish. Dave Westmoreland offered a course in Scientific Ethics in the past, and Anne Baranger will offer a GenEd course next year.

E&ES Department Johan C. Varekamp
The E&ES department offers many General Education courses specifically designed with the non-science major in mind. We feel it is essential that the majority of all Wesleyan students get exposure to science dealing with the earth and the natural environment. Each faculty member in E&ES teaches on average one General Education course per year, in addition to the intro-to-the-major, major-level and advanced/graduate courses. With our faculty lines, this amounts to 4-8 courses at the 100-level per academic year. Our GenEd courses are largely based on a concept theme (e.g., History of the Earth, History of Life, Volcanoes of the Earth, Geology of Connecticut) and we incorporate a fair amount of general information about our discipline as well. Our two gateway courses into the major ("Our Dynamic Earth" and "Oceanography") are accessible enough that many students take one for NSM GenEd credit. The Oceanography course has an associated optional lab class, "Investigations in Marine Science", whereas the Physical Geology introduction course, "Our Dynamic Earth", has a required lab for which the students receive no extra credit. We stress the quantitative aspects of E&ES in our GenEd offerings, but we keep the course material within reach of the non-science student. Almost all our courses have an active learning component, be it field trips and/or laboratory work. The "Geology of Connecticut" course is largely field-based and takes students in two vans for an afternoon/week into the field. The size of the classes varies from 20 (e.g., "Volcanoes of the Earth" class; "Investigations in Marine Science" lab) to 30-40 for classes like "Earth Resources" to 60-80 for the gateway courses and in excess of 200 for some of the GenEd offerings (e.g., "Global Change"). We prefer formats from 20 to 80, and it is unlikely that we will offer very large GenEd classes again. Current E&ES GenEd Course listing


Math Department Jim Reid Jim Lipton

Mathematics is a language, the language in which the book of the universe is written according to Galileo. It is a language of great power and utility. But it is also a language of beauty, with its own idioms, its own poetry, its own elegance. General education in Mathematics therefore must address (at least) these two facets, it seems to us, and the Mathematics Department has tried, is trying, and will continue to try to provide courses to reflect this fact.

For purposes of organization four categories are listed below, but it should be clear
that both major themes—the useful and the beautiful—will be found, perhaps to a greater or lesser degree, in each of the courses. Note that the department provides service courses for many constituencies and, in its view, all these are legitimately termed "general education", whether carrying the label NSM or not.

1. Remedial: (No NSM credit.)

   - Math 107. Frequently taught by a graduate student or a moonlighter, though for Spring semester 97 Lew Robertson has agreed to take it on. This is a course covering items needed for example for calculus or statistics. All of this material is normally taught in high school.

2. Courses for Non-Science Majors:

   - Math 109 (Renamed Math 119 for 1997 and thereafter). A blend of the continuous and the discrete, attempting to illustrate how some of the deep ideas of the calculus (and other parts of Mathematics) might arise from rather simple, natural problems concerning whole numbers, their representation and their applications in algebra and geometry. The emphasis is on connections, on the ways in which elementary problems evolve into avenues of significant discovery. Some emphasis on writing, particularly as it applies to the development of ideas. When staffing considerations permit, a continuation of this course as Math 120 will be offered.

   - Math 111 Introduction to Mathematical Thought: Statistical Techniques in the Real World. A study of the use of mathematical techniques (probabalistic and statistical) in medical, political, commercial and educational decision-making. The focus is on analyzing the presentation of facts and the ways in which data can be presented to support claims. Some topics: the use that tobacco lobbies make of studies about smoking; the use made of the Census to apportion government funds; the use of medical studies to determine health risks; the use of expert witnesses in the courts; etc.

   - Math 112 Introduction to Mathematical Thought: To the Calculus and Beyond. Designed especially for those with interests in the humanities. The subject matter of Calculus is treated in an historical context stressing the nature of Mathematics as a cultural achievement and the place of Mathematics in the liberal arts curriculum.


3. Potentially "Gateway" Courses:
Math 117 Introductory Calculus, Part I. An introduction to the basic ideas and techniques of calculus. Covers the differential calculus of algebraic, exponential, logarithmic and trigonometric functions. The course has recently been redesigned in order to incorporate some new and innovative changes in the teaching of calculus. Emphasis is on group work and discussion rather than lectures. Use of calculators is an integral part of the course. The structure of the course is modeled on that in use at the University of Michigan. The text is that developed by the Harvard Consortium. Early indications are that the effort is a success. It should be noted however that this is a very labor intensive format.

Math 118 Introductory Calculus, Part II. A continuation of Math 117, covering in this part integration, some elementary differential equations and infinite series.

Math 121 Calculus I, Part I. Designed for students who have completed a high school calculus course of approximately one year, and who might pursue study in an area for which calculus is an essential tool. This course is a deeper and broader study of calculus than the parallel sequences; theoretical issues are not the main focus but are not avoided. The course, together with Math 122, treats limits, derivatives, and integrals; the calculus of exponential and logarithmic functions, trigonometric and inverse trigonometric functions; techniques of integration; plane analytic geometry; various applications of calculus; sequences and series, including power series and intervals of convergence.

Math 122 Calculus I, Part II. A continuation of Math 121.

Math 132 Elementary Statistics. An introduction to statistics. Covers organization of data; central measures; measures of variation; distributions; sampling and estimation; conditional probability and Bayes’ Theorem; hypothesis testing; simple regression and correlation; analysis of variation.

Math 221 Vectors and Matrices. The algebra of real n-dimensional space with emphasis on the concrete and geometric. Covers vectors and matrices; systems of linear equations and subspaces of n-dimensional space associated with them; determinants; eigenvalues and eigenspaces; questions of orthogonality. Application are included.

Math 222 Multivariable Calculus. The calculus of functions of several variables. Cross product; vector and scalar valued functions of several variables; directional and partial derivatives; total derivative; the gradient; Jacobian matrices; chain rule; implicit differentiation; maxima, minima and saddle points; Lagrange multipliers; line integrals; potential functions; multiple integrals; Green’s Theorem and surface integrals; Stoke’s Theorem; divergence theorem.

4. Additional Courses: Some of these courses have not been offered recently due to staff
shortages but remain nevertheless “on-the-books”. For a description of some we refer to the course catalog.

–Math 106 The Nature of Mathematical Thought. See catalog
–Math 212 Problem Seminar. (A more advanced level has been offered as Math 213). See catalog.
–Math 219 Historical Perspectives on Calculus. See catalog.
–Math 228 Discrete Mathematics. An introduction to discrete and combinatorial mathematics and to abstraction. Topics may vary but include mathematical induction as a method of proof, number theory, counting principles and applications, set theory, elementary group theory as applied for example to a study of symmetry.

5. General Education Courses Offered in Computer Science

Even though these courses are primarily for non-majors, some students taking COMP 111 or 131 do decide to become majors.

COMP 131 has drawn students from widely dispersed fields: music, anthropology, english, psychology, languages and theater.

COMP 111

The purpose of COMP 111 is to provide an overview of some important ideas in the field of computer science and to develop some specific computer and programming skills. In particular, the course discusses the basic features of an imperative programming language (Pascal) and provides a broad overview of how computers work including a discussion of circuits and machine architecture. The architectural overview is supplemented by writing programs using a special assembly language simulator.

The assignments for the course consist of programs written in either the Pascal language or the simulator’s special assembly language. The course does not assume any particular background in either computers or programming (in fact, if you have extensive background, you are in the wrong class !)

The textbook currently used in the course is ”Great Ideas in Computer Science” by
Alan Biermann; the first thirteen chapters are usually covered.

COMP 131 (FYI)

COMP 131 seeks to introduce students of varying backgrounds and majors to seminal mathematical ideas that led to the development of modern computer science and mathematical logic. In particular, the course looks at some of the theoretical breakthroughs that preceded the so-called computer revolution, such as the treatment of computability given by Turing, Church and Goedel. Students are given some mathematical and historical perspective, and learn how these ideas are a direct response to specific open questions of the times.

A basic premise of the course is that intelligent freshmen of different backgrounds and inclinations in the arts, humanities or sciences can learn about these developments by DOING. Students write formal and informal proofs of some theorems about sets and numbers, and learn to program in a programming language called "Scheme". Some three rather intense weeks are devoted to learning formal logic and writing rigorous proofs.

Students cover close to 50% of the content of an introductory programming course for majors, and a significant percentage of the content of freshmen courses on sets and discrete mathematics. This quite demanding technical side of the course is supplemented by readings and discussions on the import of the material for cognitive science, linguistics, and philosophy, surrounding such questions as "Can machines think?", and "What is creativity?"

The course is taught as a seminar; a great deal of classroom discussion takes place. Students are encouraged to debate and question the material, and to conjecture results and discover proofs. Debate is essential in this course for several reasons. First-year students do not always appreciate the importance in mathematics of challenging a conjecture, and searching for counterexamples. At the beginning of the semester, few students feel confident enough to raise objections to implausible conjectures. By the end, if an implausible suggestion is made in classroom discussion, ten or fifteen hands go up to voice objections and supply counterexamples.

MB&B Department Bill Firshein

INTRODUCTION:

The Department’s overall view of general education is one of commitment and responsibility to assure that a sufficient number of such courses are available every academic year to any non major who wishes to register for them. There are no limits to registrations. In addition, we do not first assign our facility to what some call "higher" priorities such as courses for majors, graduate students and entry level beginning courses. In all our deliberations
we recognize four constituencies: Majors, Non Majors, Graduate Students and Beginning entry-level students. Because the size of our department is relatively small to begin with and because of the fact that we have a relatively large number of majors to service as well as a sabbatical and leave schedule that reduces the already small size of the department to an even smaller size it has been a struggle to meet all of our commitments consistently. It is a tribute to our persistence and experience that we have been able to do so most of the time.

OVERALL OR GENERAL EDUCATION COURSES:

We divide our general education offerings into two classes: Introductory courses that can be taken by majors and non majors, and courses specifically designed for the non-major. There is no overall theme for the specifically designed non-major courses. They are the result of the special interests of our faculty members.

All of the General Education courses are offered without prerequisites on a rotating basis. These include: MB&B 104 Molecules, Microbes and Mann (Firshein) MB&B 106 Recombinant DNA and Genetic Engineering (Lukens) MB&B 107 Physics of the Living Cell (Russu) MB&B 115 Molecular Basis of Nutrition or its equivalent (Haake) MB&B 157 Origins of Modern Life Science (Haake) MB&B 158 Biochemical Basis of Pharmaceutical (Haake)

The introductory courses for majors MB&B 205, 206, 215, 216 are also available for non major students with appropriate backgrounds. However, it is important to note that no special privileges are given to non major in these introductory courses. They participate equally with the potential majors and are not graded in any special matter.

All of the specially designed courses are rigorous but have no special laboratory sections except for demonstrations. With the relatively large enrollments in most of them there is simply little room and space to organize a separate laboratory. We do not have the logistics (lab assistants, equipment, etc.) to do this in a consistent manner that is up to the levels of our major and gateway courses laboratories.

Nevertheless, student evaluations for the non majors courses have always been high. One of the reasons for their success is faculty have chosen topics of current importance and developed them in depth while at the same time making certain that profound scientific principles are discussed and absorbed.

COURSES GIVEN PER YEAR:

It is not possible to schedule more than two Gen Ed courses per year given our responsibilities to our other constituencies (pointed out above) and the relatively small number
of FTE’s available in MB&B. Thus, one course each semester (besides the Introductory courses) has been our standard norm for a number of years. The number of non major students serviced (depending on the course) varies from 70 to 140 per year (not counting the Introductory courses). This, we believe, is a satisfactory ratio of courses to students for our small department. We are not carrying an extra heavy load of non majors courses, but it is highly appropriate for our department’s size in relation to courses in other Science Departments with Graduate programs. Our full FTE is 8, one less than that envisioned when the Department was formed. This cut has hurt us badly and still continues to do so for all of our student constituencies. Of course, it goes without saying that any addition to our course load, as for example FYI courses is simply not possible at this time. However, given one more faculty appointment it might be possible to factor them into our deliberations in the future.

FACULTY WHO TEACH GENERAL EDUCATION COURSES:

Thus far, only the senior tenured faculty have taught General Ed Courses. This, however, does not imply that junior faculty can not be so engaged. They definitely can. However, we felt that new Assistant Professors should establish their own fields first with respect to course offerings and then be asked to teach Gen. Ed. or Gateway Introductory courses.

Physics Department Rick Jensen

The Wesleyan University catalog lists 36.5 credits of Physics courses. 18 of these are courses that satisfy the NSM General Education expectations. Each year the Physics Department offers 24-26 undergraduate and graduate courses by 8 faculty members. Fully half (12-13) of these courses are specifically listed as satisfying the NSM General Education expectations. In other words each physics faculty member has offered on average 1.6 General Education courses each year for the past few years.

The General Education courses are divided into three categories:

1) Courses Designed for Nonmajors: 4-5 courses are offered each year for nonmajors. These include the large Introductory (non-calculus) Physics courses and their associated laboratories with unlimited enrollments (PHYS 111, PHYS 112, PHYS 121, PHYS 122) and both large and small ((FYI) courses on special topics of interest to Wesleyan students (PHYS 104 Trail of Light, PHYS 106 Light and Lasers, PHYS 108 FYI Course on Chaos, PHYS 192 Musical Acoustics). These later courses have limited enrollments (usually dictated by the size of available class and seminar rooms) and are always over-subscribed.

2) Introductory Courses for Potential Physics Majors and Serious Science Students: The rigorous (calculus based) Introductory Physics course (PHYS 113 and PHYS 116) and
its honors equivalent (PHYS 115) and the associated laboratories (PHYS 123 an PHYS124) represent an additional 3.5 courses each year.

3) Advanced Physics Courses on Special or Interdisciplinary Topics that are accessible to students with strong science backgrounds.: 3.5 to 4.5 courses are offered each year on topics of interest to scientifically literate students throughout the university such as introductory courses in Relativity (PHYS 215), Quantum Mechanics (PHYS 214), Computational Neuroscience (PHYS 333) and Applied Mathematics (PHYS 213 and PHYS 224).

The Physics Department is clearly committed to offering nonmajors a wide variety of NSM choices. Approximately 500-600 Wesleyan students enroll in these 12 to 13 courses each year. All of the physics faculty share equally in this commitment. For a number of years the Physics Department has had the luxury of allocating an average of 8 faculty members each year to this effort. However, since the official teaching strength of the Physics Department has been determined to be only 8 FTEs, the effective reduction of available teaching faculty to 7 (on average one faculty member is on sabbatical each year) will necessitate a re-evaluation of the numerous NSM General Education offerings.

Psychology Department John Seamon

An examination of the University catalogue reveals that the Psychology Department offers a variety of courses designated as general education. The majority of these courses are listed as SBS; a minority are listed as NSM.

GATEWAY COURSES

The department offers two gateway courses that can serve as an entry into the major or satisfy a general education requirement. Those courses, both listed as SBS, are PSYC 101: Psychological Science (Seamon) and PSYC 105: Introductory Psychology (Scheibe and Brody).

GENERAL EDUCATION COURSES

The department does not offer any courses specifically designed for non science majors.

FIRST YEAR INITIATIVE COURSES

Only one course, PSYC 101, has been regularly offered as an FYI course for first-year students. This course also serves as a gateway course into the major.

FIRST YEAR SPECIAL INITIATIVE COURSES

One course has been offered as an NSM GenEd course for first-year and upper-class students. This course is PSYC 380 (cross-listed as BIOL 280): Biology, Politics, and the
THE PSYCHOLOGY DEPARTMENT’S POSITION ON GENERAL EDUCATION COURSES

The position of the Psychology Department on general education is probably best captured by the division of its course offerings into the SBS and NSM divisions. As a department, we straddle both divisions in the university. Moreover, as indicated by our involvement in different major programs, some of us have close ties to sociology, some to neuroscience and behavior, and some have links to the humanities in women’s studies.

Issues of science literacy are not specifically addressed by the Psychology Department in the form of course offerings to non-science majors. Nor are we likely to offer such courses in the future. A reading of the background material on general education and NSM indicates that the issue of general education courses for non-science majors was never intended to apply to psychology. The initiative to get students to gain some understanding of natural science and mathematics courses is an important mission, but it is one to which we can offer no contribution.

Our approach to general education is different. Our gateway introductory courses are open to all students, regardless of their intentions about a major. In addition, many of our 200 level courses are also open to non majors allowing students from different backgrounds to gain understanding about different areas of psychology. Because these courses have no prerequisites, many of them are heavily subscribed by students who are non science majors. We think this approach works well, and we recognize that it differs from that of other NSM departments.

The material was reviewed by the department at its meeting on December 4, 1996.
10. Recommendations

Although the current NSMGE program has strengths, we believe that adoption of these recommendations would improve it. The underlying goal is to ensure that a sufficient quantity of high quality NSMGE courses is available to meet the need for improved scientific literacy in Wesleyan graduates. The recommendations are based on our assessment of current resources and demands for NSMGE at Wesleyan. Their adoption does not require any expansion of teaching strength, but does involve setting priorities.

1) NSMGE courses – those courses created specifically for non-science students (see Table 1) – should be specially labeled in the Course Book and other Wesleyan publications as such.

2) The meaning of the NSMGE label – namely that the course is designed for non-science students and has the pedagogical goals described in Section II of this report – should be clear to everyone. This includes students, faculty advisors from other divisions, NSM departments, faculty offering the courses and the administration. To help accomplish this, we recommend that the goals be given a prominent place in appropriate Wesleyan literature such as the University Catalog, the Course Book and Guide for New Students, etc.

3) A representative of Division III should address the annual meeting of Frosh Advisors to be sure that accurate information on how students may meet their NSM expectations and why they should do so is provided to faculty advisors, particularly those from other Divisions, at this critical point in time. In particular, students should be urged to meet the Stage I expectations by taking an NSM course (NSMGE if appropriate) in their first year and another before the end of their second year.

4) At present, Division III has sufficient teaching strength, as estimated by the departments (see Table 2), to offer 20 to 25 NSMGE courses each year. We recommend the following simple rule to ensure an adequate supply and distribution of offerings across departments: each NSM department (except Psychology, which does not teach NSMGE courses) will offer at least one NSMGE course every semester. Division III as a whole will offer at least ten NSMGE courses every semester. Our estimate is that this will create enough spaces to meet the demand for NSMGE courses in classes with an average size of about 50 students.

5) A corollary to Recommendation 4) is that Division III departments should not be expected by the administration to contribute to the FYI program. The NSMGE program proposed here supersedes and improves upon the FYI program as the divisional response to addressing the educational needs of non-majors, particularly frosh and sophomores. It also allows for courses oriented specifically towards upperclass students in which some of the non-essential, but desirable, goals of NSMGE courses (e.g. expanded historical and eth-
ical content, strong writing component, etc.) can be achieved. If the recommendations of this report are adopted, there will be little additional teaching strength available in Division III departments for other initiatives. We recommend that the administration support THIS program, which provides clear objectives consonant with our historical approach, and a structure for further improvements. We believe that solid administrative backing for the NSMGE program will ultimately lead to the best possible science and math education for non-science students at Wesleyan, given the resources currently available. If the administration wishes to mount an FYI program in addition to the NSMGE program, additional teaching strength will be required.

6) Emphasis should be placed on improving the quality of NSMGE courses. With solid administrative support, widespread dissemination of the goals, and departmental commitment to the quantitative aspects of the program, the quality of the courses will probably rise on its own. Faculty energy can be focused on the relevant issue of how best to meet the goals of NSMGE courses in classes with a typical size of 50 students. Departments, the division and the administration should encourage pedagogical discussion and experimentation in every way possible. Some ideas were proposed in the NSF Advisory committee report, portions of which appear in Appendix II of this report.

7) NSM faculty and the administration should be encouraged to participate in and benefit from the robust national discussion of these issues currently in progress. In particular, the recommendations of NSF’s Advisory Committee given in the report ”Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and Technology” (see Appendix II) should be carefully considered. One recommendation which the administration should definitely adopt is to review its reward system. It is important that effective teaching and other pedagogical contributions be valued by the University to a similar degree as research contributions.

8) It is important that the rhetoric about our courses and programs which comes from the Admissions Office and from the Campus Tours be in tune with reality. Of particular concern with regard to the tours is the common remark that there are no science requirements at Wesleyan, which may be strictly true but misleading. We recommend that the Admissions Office be regularly updated on the status of NSMGE and, indeed all NSM courses, and that they advertise our strengths realistically.

9) There are many opportunities for external funding to support pedagogical initiatives in science at present. We recommend that the administration seek external funding in support of our proposed NSMGE program. This could involve, for example, funds to support technology needed to improve NSMGE courses, money for Teaching Assistants and Apprentices - both graduate students and undergraduates - to support active components (e.g. labs
and cooperative learning discussion groups) in such courses, or funds for pedagogical training
sessions and seminars for faculty and/or TA’s.

10) Finally, we recommend that an administrative structure (e.g. a Coordinator and/or
a Divisional Standing Committee with a Chair appointed by the Dean) be created to oversee
implementation of the recommendations, coordinate activities and engage in continued study
of the issues visited in this report. In other words, NSMGE should be a continuing concern at
the divisional level, not something that is re-visited every ten years. A specific example of the
need for continued work is the Senior Survey. We recommend that the NSMGE committee
work with the Office of Institutional Research to refine the Senior Survey in order to improve
our understanding of why Wesleyan seniors have been less satisfied with their NSM courses
than with those in other divisions and what might be done to improve the situation. This
may include a study of how NSMGE is accomplished at other institutions which are more
successful than Wesleyan.

NSMGE Courses Currently Taught by Division III Departments

ASTRONOMY AST 105 (Salzer) Descriptive Astronomy AST 107 (Herbst) The Uni-
verse AST 109 (Upgren) Revolutions in Science and Astronomy AST 111 (Upgren) Topics
in the History of Astronomy AST 135 (Upgren) Descriptive Meteorology

BIOLOGY Biological Communication (Bio 102), Allan Berlind Human Biology (Bio
103), Jason Wolfe Animal Architecture (Bio 104), Spencer Berry Drug Action in the Nervous
System (Bio 105), C. Duman (adjunct) Understanding your Genes (Bio 107), James Donady
Biology, Politics, and Psychology of Reproduction (Biology/Women’s Studies 280), Laura
Grabel and Jill Morawski

CHEMISTRY * Chemistry 117, ”Chemistry, the Consumer, and the Environment”
(John Sease). * Chemistry 118, ”Plant Biochemistry” (Phil Bolton). *”The Scientific
Method” (David Beveridge and Joy McConnell) * Chemistry 180/380 ”Writing About Sci-
ence” (Joy McConnell) * Chemistry 356 ”Drugs: Mind, Body, and Molecules” (Anne Baranger)
Al Fry plans to introduce a course entitled ”Molecules of Nature” in 1998/99

E&ES E&ES 103 History of the Earth E&ES 104 The History of Life E&ES 105 Geologic
Catastrophes E&ES 107 Environmental Geology E&ES 108 Volcanoes of the Earth E&ES
109 Geology of Connecticut E&ES 110 Investigations in MarineScience E&ES 150 Energy,
Mineral, & Water Resources E&ES 152 Earth Resources E&ES 199 Global Change: An
Introduction to Environmental Science

and Calculus. – a continuation of this course as Math 120 will be offered. –Math 111
Introduction to Mathematical Thought: Statistical Techniques in the Real World. -Math 112 Introduction to Mathematical Thought: To the Calculus and Beyond. -Math 113 Finite Mathematics. -COMP 111 Intro to Computer Science -COMP 131 Intro to Logic and Computation (FYI)

MB&B 104 Molecules, Microbes and Man (Firshein) MB&B 106 Recombinant DNA and Genetic Engineering (Lukens) MB&B 107 Physics of the Living Cell (Russu) MB&B 115 Molecular Basis of Nutrition or its equivalent (Haake) MB&B 157 Origins of Modern Life Science (Haake) MB&B 158 Biochemical Basis of Pharmaceutical (Haake)

Physics (No report yet)

Psychology Does not teach NSMGE courses.

Numbers of NSMGE courses per year that can be taught with Current Resources. (Estimates by the departments; no guarantees at present!)

- ASTRONOMY 3
- BIOLOGY 2
- CHEMISTRY 2 to 3
- E&ES 4 to 8
- MATH 7*
- MB&B 2
- PHYSICS 2
- PSYCHOLOGY NA

*2 of which are Computer Science

Totals: 22 to 27 NSMGE courses per year.
Table 3. Division III courses with large numbers of Failed Enrollments in Pre-registration

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Enrolled</th>
<th>Failed Enrollments</th>
<th>Percent of Total Failed Enrollments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, 1994</td>
<td>*BIOL 280</td>
<td>68</td>
<td>217</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td>*ASTR 109</td>
<td>80</td>
<td>39</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>E&amp;ES 101 and *105</td>
<td>89</td>
<td>28</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>306</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring, 1995</td>
<td>*PHYS 104</td>
<td>86</td>
<td>173</td>
<td>49%</td>
</tr>
<tr>
<td></td>
<td>NS&amp;B 213</td>
<td>93</td>
<td>115</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>BIOL 206 and 216</td>
<td>163</td>
<td>41</td>
<td>11%</td>
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<tr>
<td></td>
<td>Total</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fall, 1995</td>
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</tr>
<tr>
<td></td>
<td>*E&amp;ES 104</td>
<td>87</td>
<td>71</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Spring, 1996</td>
<td>*ASTR 105</td>
<td>111</td>
<td>179</td>
<td>37%</td>
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<td>PSYC 201 and 242</td>
<td>128</td>
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<td>*E&amp;ES 152</td>
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<td>NS&amp;B 213</td>
<td>75</td>
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