

Article

Biology Intensive Orientation for Students (BIOS): A Biology “Boot Camp”

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The Biology Intensive Orientation for Students (BIOS) Program was designed to assess the impact of a 5-d intensive prefreshman program on success and retention of biological science majors at Louisiana State University. The 2005 pilot program combined content lectures and examinations for BIOL 1201, Introductory Biology for Science Majors, as well as learning styles assessments and informational sessions to provide the students with a preview of the requirements of biology and the pace of college. Students were tracked after their BIOS participation, and their progress was compared with a control group composed of students on the BIOS waiting list and a group of BIOL 1201 students who were identified as the academic matches to the BIOS participants (high school GPA, ACT score, and gender). The BIOS participants performed significantly better on the first and second exams, they had a higher course average, and they had a higher final grade than the control group. These students also had higher success rates (grade of “A,” “B,” or “C”) during both the fall and spring semesters and remained on track through the first semester of their sophomore year to graduate in 4 yr at a significantly higher rate than the control group.

INTRODUCTION

Incoming freshmen science majors are increasingly unprepared for college work (Upcraft *et al.*, 2005). The Biology Intensive Orientation for Students (BIOS) Program was designed to give incoming biology majors a short, intensive preview of the expectations in introductory biology at Louisiana State University (LSU) and to help them learn the skills required to succeed in biology, and in college in general. The program combined content lectures, examinations, learning styles assessments, study skills, study hall group work, and informational sessions over a period of 5 d.

Students enter college with optimistic goals of how much they will study as well as unrealistic ideas of how much work will be expected of them by college instructors (Upcraft *et al.*, 2005). They have been successful in high school with minimal effort and see no reason to change their study habits, or lack thereof, for university course work. Nationwide, 75% of high school graduates enroll in college within

2 yr of high school graduation, and 50% of these students must take remedial courses to learn the basic skills of reading, writing, math, or a combination (Somerville and Yi, 2002). Students who have to take more remedial courses will take longer to graduate (Levine and Cureton, 1998). Confounding the student’s misperception of his or her ability is a perception gap between high school teachers and college and university faculty in how prepared students are for college work (Sanoff, 2006). More than 44% of polled college faculty thought students were not well prepared for college work, whereas only 10% of the high school teachers questioned indicated they thought students were not well prepared.

Retention of students in the major field of choice, as well as retention at the college or university in general, is of increasing importance to postsecondary institutions (Cuseo, 2003). Retention indicators include academic preparation (measured by SAT [ACT] scores), academic ability (measured by high school academic rank [GPA]), and confidence in study habits (Tester *et al.*, 2004). The majority of new students entering higher education leave their initial college of choice without a degree, and the most critical time is the

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first year (Cuseo, 2003). The best predictor of student academic success is the individual student's academic preparation and motivation (Upcraft *et al.*, 2005).

Course failure is costly both to the university and to the student. Nationwide, college remediation is estimated to cost as much as \$1 billion a year (Somerville and Yi, 2002). Duplication of course work accounts for approximately 20–30% of the enrollment in the first course in LSU's introductory sequence (Introductory Biology for Science Majors I, BIOL 1201) each semester, according to data from the LSU Office of Budget and Planning (University and College Trend Data, 2006). Because this and other general science courses have high unmet demand, that is, many more students wish to enroll than there are spaces to accommodate, LSU and other large universities waste resources when students drop courses and re-enroll in subsequent semesters. When a student fails or drops a required course, he or she must enroll in that class again.

In the past few years, >25% of students in BIOL 1201 have been unable to earn a "C" or better grade in the course, leading to a high DFW rate (grade of "D," "F," or withdrawal from the course) (University and College Trend Data, 2006). Although many factors are likely involved in this high DFW rate, one critical factor seems to be the time required for new students to learn and implement the skills required to meet the expectations of college courses (Upcraft *et al.*, 2005). Because they lack an understanding of the expectations and the skills they need, many capable students perform poorly on the first, and sometimes second, exam. Thus, these students either drop the course or finish the semester with a low grade (University and College Trend Data, 2006). Students, in general, are taking longer to graduate. A 1998 report stated that fewer than two of five students are able to graduate in 4 yr (Levine and Cureton, 1998). At LSU, the 1998 4-yr graduation rate was 23.7%, with only 57.5% graduating after 6 yr. The 2002 class at LSU graduated only 26.2% of its students on track (University and College Trend Data, 2006).

The BIOS Program has shown that a 5-d intensive orientation can positively impact the long-term success of biological science majors at LSU. The students who participated in the pilot year of the program showed increases in their Introductory Biology course grades, overall GPAs, and retention in the major and at the university.

METHODS

BIOS Recruitment

All LSU incoming freshmen biological sciences majors were eligible to apply to participate in BIOS. Students were recruited through e-mails sent to all incoming freshmen that identified themselves as a biological sciences major (biology, biochemistry, microbiology, premedical, and pre dental). A single face-to-face recruitment drive was conducted during LSU's Spring Invitational orientation session for high-achieving students. Participants were chosen on a first-come, first-served basis to a maximum of 60 students; these students were supposed to be registered as biology majors and enrolled in BIOL 1201 for the Fall 2005 semester. Fourteen additional applicants were placed on a waiting list, but they were not able to be admitted. The wait-listed students agreed to serve as part of the control group in assessing the success of the BIOS participants.

BIOS Funding

The BIOS Program was entirely self-funded. The registration fee was \$350, which included materials, the BIOL 1201/1202 textbook (\$135 retail), and meals. The fee also funded instructor and graduate students' stipends as well as other program costs. Housing was available for an additional \$100 for students who wished to live on campus.

BIOS Agenda

The 2005 BIOS Program was designed to give participants a realistic look at the pace of college life. The program dates corresponded with the beginning of the fall semester; therefore, BIOS was conducted during the last full week before the fall semester to help the participants to retain as much of the program content as possible into the fall as well as to facilitate a smooth transition to fall dormitory assignments for those who opted for BIOS housing.

The program began with a check-in dinner on Sunday evening, followed by an evening of introductions and assessment by way of focus groups. The agenda Monday through Thursday went from 8 AM to 9 PM. Friday's schedule ended at lunchtime with a banquet to which their parents were invited.

One of us (E.W.W., Coordinator of the Introductory Biology Program and BIOL 1201 instructor) presented seven 90- to 120-min lectures from the content normally presented during the first weeks of BIOL 1201, along with three short computer-based exams (15–30 questions each) on the material. The final exam was comprehensive. After each of the exams, the scores and exam questions were discussed with the students as a group.

Along with the biology content lectures, the students were given presentations by individuals representing relevant offices around the LSU campus as well as other professionals who offered advice in specific areas. The complete BIOS schedule is given in Appendix 1 in the Supplemental Material. Talks were given as follows:

Study Skills Discussion

- Note taking, listening, metacognition (associate dean, University College)
- Learning styles (learning strategies counselor, University College)

How to Be a Student

- What are your responsibilities as a student? (dean, College of Basic Sciences)
- What is the Center for the freshman year? (associate dean, University College)
- What is the College of Basic Sciences? (counselor, College of Basic Sciences)
- How do I get help? (director of Career Services, dean of students)
- How do I manage my money? (vice president, local bank)
- How do I survive? (wellness education coordinator, Student Health Center)
- What comes after you graduate? (associate dean, LSU Graduate School, instructor in biological sciences who has both Ph.D. and D.V.M.)

Five graduate students from the Department of Biological Sciences acted as mentors to groups of the BIOS participants during the program. Because the BIOS students had already registered for their fall classes, the BIOS students were assigned to groups based on their sections of BIOL 1201. Each group had three to five members, and each graduate student was given oversight of three groups. These groupings allowed the BIOS students to know a minimum of three to five other students who also were enrolled in the introductory class before the first day of class. This strategy enhanced the creation of "learning communities," which has been shown to give students a sense of belonging and contributes to retention rates (Laufgraben and Shapiro, 2004). The graduate students attended the study hall sessions, and they were available to help answer questions and explain material.

BIOS Assessment

Several different methods were used to assess the value of the pilot year of the BIOS Program. A control group ($n = 56$) was selected by staff members in the LSU Center for Assessment and Evaluation (CAE) consisting of BIOL 1201 students who had not participated in BIOS, but who were academically matched (high school GPA, ACT or SAT score, major, and gender) to the BIOS participants. We also included the students who were on the BIOS waiting list ($n = 14$) because their inclusion would help to alleviate the variable of self-selection bias that often plagues studies into which participants must enroll themselves. There were no statistical differences between the control and BIOS groups in either ACT score or high school GPA (Table 1).

Exam grades of BIOS students during the subsequent fall semester in BIOL 1201 were compared with those of students in the control group. In addition, final grades for the fall and spring semesters in BIOL 1201 and 1202, and overall GPAs for both semesters of BIOS versus control group were analyzed. Biology majors within the two groups were tracked into the fall semester of their sophomore year to assess the rates at which they remained in the biology major as well as stayed on track toward graduation within 4 yr. To remain on track, LSU biological sciences majors are enrolled in one of two sophomore biology courses during each semester of their second year, General Microbiology (BIOL 2051) and Genetics (BIOL 2153). Students who were not enrolled in either of these courses in the fall semester of their sophomore year were considered off track, but they were still followed in subsequent semesters to ascertain whether they remained in the major and enrolled at the university.

To gain qualitative assessment of the immediate reactions to the BIOS Program, students completed an exit survey in the last session of the week-long program. Focus groups both before and after the program evaluated various aspects of the camp. The focus groups, convened by staff members from the CAE, were used to assess the impact of BIOS on the participants during their freshman year. The first focus group session was conducted during the opening evening of the program, and the second focus group session was conducted during the subsequent spring semester.

RESULTS

BIOL 1201 Grade Comparisons

Of the 60 students accepted into the program, 59 completed the program and enrolled at LSU; 58 enrolled in BIOL 1201 during the fall semester (one student did not matriculate into LSU and one student who completed BIOS did not enroll in BIOL 1201 in the fall). The performances of these 58 students on the first and second exams and their final grades in BIOL 1201 were tracked during the fall semester and compared with the control group ($n = 70$). Overall fall and spring semester GPAs also were compared.

The BIOS participants performed significantly better on the first exam (89.13 vs. 79.29; $p < 0.001$, Mann-Whitney

U-test) and second exam (85.02 vs. 79.30; $p \leq 0.011$, Mann-Whitney *U*-test), and they also had a higher final course average than the students in the control group (86.30 vs. 81.95; $p \leq 0.034$, Mann-Whitney *U*-test) (Figure 1).

The average final grade for the BIOS participants was also higher than the control group (3.21 vs. 2.95; $p \leq 0.001$, Mann-Whitney *U*-test). We compared the Fall 2005 semester GPA for each group, and the mean semester GPA for the BIOS participants was 3.34 versus 3.09 for the control group students and 2.90 for all BIOL 1201 students. These values were not statistically different ($p = 0.051$, Mann-Whitney *U*-test) (Figure 2).

At the end of Spring 2006 semester, we compared the performance of the students from both the BIOS and control groups who took the second semester continuation of Introductory Biology (BIOL 1202) as well as their semester and overall GPAs. No significant differences were observed in the performance metrics between these groups. However, these comparisons were confounded by the fact that only students successful in BIOL 1201 continued on in BIOL 1202. In an effort to assess the overall impact of this program on student success in the two-semester biology sequence, we compared the cumulative success rates (completing the course[s] with an "A," "B," or "C") of BIOS participants with those of the control group (Figure 3) as well as the total course enrollments. The BIOS participants had higher success rates for both BIOL 1201 (93.10% [$n = 54/58$] vs. 81.43% [$n = 57/70$]; $p \leq 0.015$, binomial test) and BIOL 1202 (77.59% [$n = 45/58$] vs. 62.86% [$n = 44/70$]; $p \leq 0.015$, binomial test).

In addition, the number of BIOS biology majors remaining on track in the major as of the fall semester of their sophomore year was significantly higher than that of the control group biology majors (Figure 4). In the two introductory courses, there was no significant difference in the retention rates between the two groups (BIOL 1201, $p = 0.176$, binomial test; BIOL 1202, $p = 0.059$, binomial test). However, by

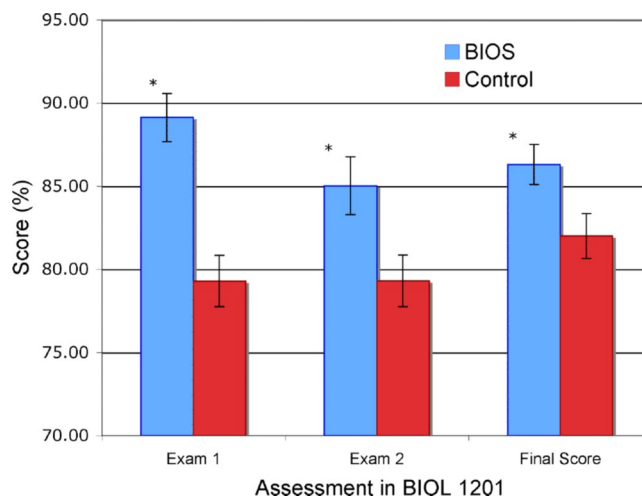


Figure 1. Comparisons of average grades on BIOL 1201 exams 1 and 2 and final course average (mean \pm s.e.) for all BIOS participants ($n = 58$) (blue) and all control group students ($n = 70$) (red). *, significantly different from control group ($p < 0.05$, Mann-Whitney *U*-test).

Table 1. Comparison of academic backgrounds of BIOS participants and other biology majors

Group	n	ACT score	High school GPA
BIOS	58	26.54	3.65
Control	70	26.87	3.64
All BIOL 1201	1,097	26.32	3.48
BIOS biology majors	52	26.45	3.45
Control biology majors	54	26.98	3.68
BIOL 1201 biology majors	573	26.50	3.53

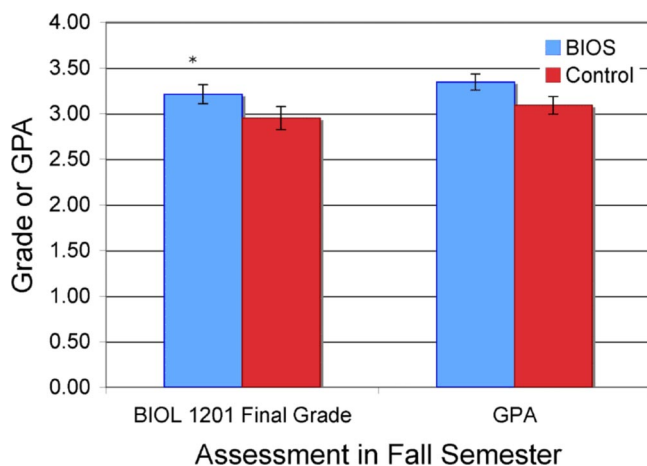


Figure 2. Final grade in BIOL 1201 and first semester GPA (mean \pm s.e.) for BIOS participants ($n = 58$) (blue) and control students ($n = 70$) (red). *, significantly different from control group ($p < 0.05$, Mann-Whitney U -test).

the first semester of the sophomore year, there was a significant difference between the two groups. In the BIOS group, 31 of 52 biology majors (60%) successfully completed either BIOL 2051 or BIOL 2153, whereas only 21 of 54 control biology majors (39%) successfully completed one course or the other ($p = 0.001$, binomial test).

Exit Survey

During the last session of the program, students completed an exit survey to assess their immediate feelings regarding the BIOS Program. Their responses indicate that the BIOS Program was a success and that it would be a benefit to future classes of biological sciences majors as well as to other students across the LSU campus. The students' answers to specific questions indicate the following:

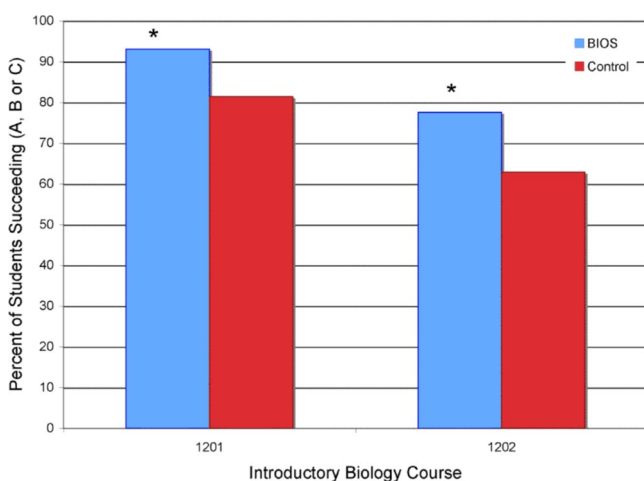


Figure 3. Percentage of students successfully completing BIOL 1201 and 1202 (with a grade of "A," "B," and "C"). BIOS participants ($n = 58$) (blue) and control students ($n = 70$) (red). *, significantly different from control ($p \leq 0.05$, binomial test).

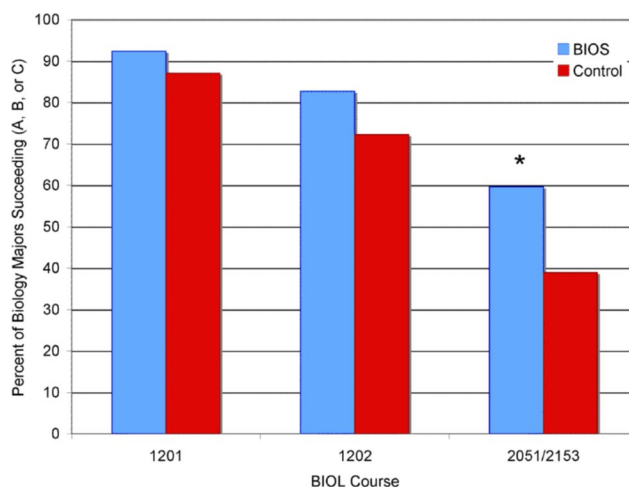


Figure 4. Percentage of biology majors in each group, BIOS (blue) and control (red), succeeding (achieving a grade of "A," "B," or "C") in each of the Introductory Biology courses (BIOL 1201 and 1202) and the first biology course of the fall sophomore year (either BIOL 2051 [Microbiology] or BIOL 2153 [Genetics]). Incoming freshmen BIOS biology majors, $n = 52$; control biology majors, $n = 54$. *, significantly different from control ($p \leq 0.05$, binomial test).

- 87% said the program clarified expectations of them as students;
- 69% said they gained a great deal in their study skills;
- 74% felt much more comfortable taking college exams;
- 70% felt better about their abilities to study;
- and 72% stated that they had much greater self-confidence for the upcoming semester.

Students were asked about their general BIOS experience. Fifty-one of 54 responded "yes" to the question, "In hindsight, would you do BIOS again?" Only three students indicated that they would be unlikely to choose to participate again. The last three questions on the survey asked for the favorite and least favorite parts of BIOS and requested advice to help improve the program for next year. Sample answers follow.

Favorite

Being able to get ahead in the college "experience."

Going home to study – doing it the wrong way and bombing the test which sounds awful but I know now what I need to do to improve myself.

Getting to know faculty and other students early.

Least Favorite

The long schedule.

Some of the How to Be a Student sessions were repetitive.

Study hall. I want to study by myself.

Advice for Next Year

Do more "fun" activities and less how to study.

Possibly making the BIOS Program longer so we could have more time learning more topics.

Some kind of hands-on or lab introduction.

Focus Groups

Each student who attended the BIOS “boot camp” participated in a focus group on the first evening of the program designed to offer insight into his or her preparedness for studying in college. In the fourth week of the subsequent spring semester, 12 students were randomly chosen by staff members from the LSU CAE to participate in a second focus group to assess students’ self-analysis of the effectiveness of BIOS.

We had hypothesized that a major reason for many new students’ lack of success in entry-level biology classes is their lack of effective study habits. These focus groups were an attempt to address the validity of that hypothesis. The protocol was created by the CAE with our input.

The results from the initial focus group as compiled by the CAE staff suggest that the students who came to biology boot camp were poorly prepared to study in college. The focus group facilitators report that the students’ responses indicate that they had never been taught systematic ways to listen, take notes, study textbooks, or retain material. They seem eager to learn, but they simply do not know how. They have never developed a regular study schedule, and they seem to think study is something one only does as an act of desperation when a test approaches. In high school, they typically relied on rote memorization to get them through tests. They never learned to analyze data through use of higher-order thinking skills. These traits are likely to be major factors affecting their success in introductory college biology courses.

Answers to the specific questions indicated several problem areas, including the following:

- Most only studied 2–3 h per week, and the majority agreed that they almost never studied on weekends.
- The most common study aids were flash cards and rereading lecture notes.
- The most common note taking was verbatim from lecture or board.
- Several students indicated that studying helped them to feel more prepared, but they agreed that this did not always result in better grades.
- Almost none of the students interviewed had used any reading–note taking–study skill aids, such as SQ3R, Brainstorming, Charting Data, Distractions List, Cornell, or T-Notes.

By the second focus group, students’ perceptions of what was required for success had changed. All of them credited the BIOS Program for making them realize that the playtime atmosphere of high school was over and that college biology was going to require a quantum leap in effort just to keep up in class. Most of the students interviewed felt that the biology boot camp was a “kick start” to their college career. Without exception, they cited the vast difference in pace of a college biology class from a high school class. Several told stories of their nonboot-camp colleagues getting off on the

wrong foot because they were not used to the pace of their biology class. They cited the advantages to BIOS as 1) making them aware of the accelerated pace of college so as not get off to a bad start; 2) covering much of the same lecture material that was covered in class before the first test, making the first test less intimidating to participants; and 3) helping familiarize them with the location and procedures for computer-based testing. On the whole, they cited the camp’s bringing them to the realization that study for college classes must be an everyday process. Students also mentioned that BIOS made them realize how important it would be to pay attention during lectures to avoid falling behind. Program attendees were quick to point out that many of their classmates who did not attend the camp have to learn these lessons the hard way by failing the first test.

Participants in the second focus group also pointed out their change in attitude toward study groups. Although most of the BIOS students tended to study alone, when they did study in groups they often sought out people from their camp experience as study partners. Those who preferred group study always studied with their former boot camp colleagues.

Seventh Week E-Mail Responses

During week 7 of the Fall 2005 semester, BIOS participants were contacted by e-mail and asked to respond to the following question: “Please send me back any feedback you think would be useful for next year’s freshmen, What did we do right, what could we have done better?, Was BIOS worth a week of your summer in hindsight?” Fifteen students responded, and their e-mail messages can be found in Appendix 2 in the Supplemental Material.

In the e-mail responses, several students commented that the advantage of BIOS was getting part of the course work ahead of time (see students 1, 2, and 4), and they cited this as the reason they performed well on the first BIOL 1201 exam. Others pointed to their new understanding and practice of study skills, commenting that they also did better in their other first semester classes as well (see students 4–7).

Friendships and study groups that were formed during BIOS lasted into the fall semester (see students 2–4). Student 8 indicated a particularly strong study group tie. He summed up his feelings by saying, “To this day, over half way through the semester, some of my best friends are the ones I made at BIOS.”

DISCUSSION AND CONCLUSIONS

The Future of BIOS

The success of students who participated in the pilot year of the BIOS Program supports our hypothesis that a 5-d orientation can have a beneficial impact on student performance and retention. The BIOS participants scored better on BIOL 1201 exams (89.13 vs. 79.29 on the first exam and 85.02 vs. 79.30 on the second), and they had higher final grades in the Introductory Biology course (86.30 vs. 81.95) compared with non-BIOS students. It could be argued that the differences in the first exam scores were due to repetition of content covered in BIOS, but the increase, although less, persists through the second exam in the course. Perhaps the most

striking difference between the BIOS students and their academic matches is the persistence in the major into the sophomore year. At LSU, for a student to be considered on track to graduate in the biological sciences major in 4 yr, he or she must complete the core sequence of four courses by the end of the sophomore year. These courses are Introductory Biology (BIOL 1201 and 1202), General Microbiology (BIOL 2051), and Genetics (BIOL 2153). The BIOS participants showed a significantly higher rate of being on track by their third semester of college than students in the control group.

Evidence for the value of freshman enhancement programs is documented in the literature. However, the BIOS Program at LSU seems to be unique in its 5-d intensive approach. Only one other short program, the 3-d SUCCESS Week at Southern Illinois University (Carbondale, IL), offers a similar time frame but more social and fewer academic activities (Chevalier *et al.*, 2001). That program reported a 12% increase in total retention over 4 yr. Early in our tracking BIOS students show a total increase of 21% over the control group.

There is little in the literature describing a 5-d stand-alone intensive format similar to the BIOS Program. Administrations of many universities across the United States have recognized the need for some sort of intervention to bolster student success and retention rates in specific majors. They use combinations of different approaches, including short (less than 2-wk) orientation sessions or multiple-week summer programs in conjunction with freshman year seminars and/or specific course loads; and sometimes even complete undergraduate academic intervention (Malave and Watson, 1998; Reyes *et al.*, 1998; Chevalier *et al.*, 2001; Fletcher *et al.*, 2001b; Gordon and Bridgell, 2004). Participation in a first-year seminar has been shown to have a statistically significant positive impact on student success (House and Kuchynka, 1997; Minchella *et al.*, 2002). Longer-term bridge and orientation programs are common and effective in specific fields or for targeted groups, such as all engineering majors (Soulsby, 1999), minority engineering (Reyes *et al.*, 1998), women in engineering (Fletcher *et al.*, 2001a), and first-generation college attendees (Pascarella *et al.*, 2004).

Examples of well-assessed freshman enhancement programs include the following:

1. The 3-d SUCCESS Week at Southern Illinois University offers a short, intensive time frame with more social and fewer academic activities (Chevalier *et al.*, 2001) than BIOS. This program begins the week before classes in the fall semester, and its main focus is to provide "a solid footing in the academic and social activities within the College of Engineering and among their peers" (Chevalier *et al.*, 2001, p. 7E8-1). Hands-on engineering projects during the week offer students group interaction as well as academic support. Program administrators tracked students to degree and showed a trend toward higher retention rates among participants. The fourth-year retention rate for the 1996 cohort was 36 versus 24% for non-participants.
2. Women in Applied Science and Engineering (WISE) at Arizona State University (Tempe, AZ) sponsors a Summer Bridge Program for incoming female engineering majors (Fletcher *et al.*, 2001a). This program is also held the week before the freshman fall semester, and it offers reviews in science courses as well as computer sessions and student services. This bridge program serves as the first step in continuing support for participating students during the academic year. WISE program administrators credit these efforts for both an increase in the enrollment of women in the engineering program (up from 17% in 1992 to 21% in 2000) and an increase in retention rates (up from 52% in 1992–1995 to 64% in 1996–1999).
3. The Freshman Integrated Curriculum at Texas A&M University (College Station, TX) (Malave and Watson, 1998) provides a common curriculum for all engineering students, beginning with the freshman year. Tracking of upper-class students who had been in the program from the beginning of their college careers showed 10–15% higher freshman GPAs and grades through their first 2 yr than nonparticipants.
4. A first-year, course-specific, one-credit seminar at Purdue (West Lafayette, IN) (Minchella *et al.*, 2002) combined academic and orientation aspects for freshman biology majors. Program participants did significantly better on exams in the Introductory Biology course and on final grades for that course. Retention rates in the major after three semesters were 48% for the participants and 36% for nonparticipants.
5. A freshman bridge program and seminar course at Arizona State University (Reyes *et al.*, 1998) was created by the Office of Minority Engineering Programs to increase enrollment and retention of minority engineering students. The retention rates in the first year were 66% for program participants and 54% for nonparticipants.
6. At the University of Connecticut (Storrs, CT) an optional first-year course for freshman engineering majors has contributed to a 10% increase in retention of students in the engineering major after their freshman year (Soulsby, 1999).

We placed the BIOS participants in groups according to their sections of BIOL 1021 for the fall semester to facilitate the formation of study groups. Based on student comments, they have formed and sustained learning communities through their freshman year. Subjective answers to the qualitative questions in the exit evaluation and the seventh-week e-mail question indicated that they learned valuable study habits and felt more comfortable about starting college than they had before BIOS.

Our evaluation of the pilot year of this program revealed three areas of concern for subsequent years: 1) the short-term nature of the assessment, 2) the impact of the cost of the program on student participation, and 3) the potential of the program to gain administrative support and become more sustainable. To address these concerns we plan the following:

1. The BIOS staff will continue to track student progress. Studies have shown that "one-shot" assessments to gauge student success in college become problematic (Astin and

Lee, 2003). We plan to track 2005 BIOS participants, as well as those in subsequent years, as to overall GPAs and retention rates among science majors, to offer areas for continued improvement of the program and to offer input for institutional change at LSU.

2. There are arguments for two different mechanisms of funding: institutional support versus student payment (Upcraft *et al.*, 2005). Miller (2003) stresses that funding should impose as little financial burden on students and their families as possible, but research suggests that large public institutions tend toward funding by registration fees (Strumpf and Wawrynski, 2000). In the future, the LSU BIOS Program will operate on a combination of funding sources. Although most students will still be charged the registration fee, support for students exhibiting "financial need," as identified by the LSU Office of Student Aid and Scholarships, will be awarded \$250 scholarships to participate in BIOS through funding from a grant to LSU from the Howard Hughes Medical Institute (HHMI) through the Undergraduate Biological Sciences Education Program.
3. Due to the apparent success of the BIOS program, LSU and College of Basic Sciences administrators have encouraged us to expand the program (e.g., the 2006 BIOS Program had an enrollment cap of 120 students instead of 60), and they plan to continue to support the program in the future in several ways, including adding the scholarships mentioned in 2 above to the HHMI grant proposal, support for ongoing assessment, and expanding the concept to other departments and colleges across the campus. The College of Engineering has recently received a National Science Foundation-Science, Technology, Engineering, and Math grant that includes an engineering counterpart to the biology program. These two boot camps will share programmatic components where appropriate in the Fall 2007 semester. Other departments, such as Chemistry, Geology, and Geophysics and Mathematics, are closely observing the BIOS Program to modify the model to help their incoming majors.

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Appendix 1

BIOS 2005 Schedule

Sunday (7 August)

- 4:00-6:00 pm Check-in for students needing housing
- 6:00-7:00 pm Program check-in
- 7:00-9:00 pm Orientation (LSB A101) (with time for focus groups)

Monday (8 August)

Morning

- 8:00-10:00 Introduction, Content Lecture 1, Basic Chemistry (atomic structure, valence, bonds)
- 10:00-10:30 Break
- 10:30-12:00 Study Skills Discussion 1, Note taking skills, Listening skills and Metacognition

Afternoon

- 12:00-1:30 Buffet Lunch
- 2:00-3:30 Content Lecture 2, Basic Chemistry II (properties of water, pH, hydrogen bonding)
- 3:30-3:45 Break
- 3:45-5:00 Study Skills Discussion 2, Learning Styles
- 5:00-6:30 Buffet Dinner
- 6:30-7:00 Research Presentation
- 7:00-9:00 Study Hall

Tuesday (9 August)

Morning

- 8:00-9:00 Exam 1
- 9:00-9:15 Break
- 9:15-10:30 Content Lecture 3, Biological Molecules
- 10:30-12:00 How to be a Student Session 1, What are your responsibilities as a student? (know the rules, go to class, take notes, be prepared, remember that you are the only one who is concerned about your grade)

Afternoon

- 12:00-1:30 Buffet Lunch
- 2:00-3:30 Discussion of Exam Results
- 3:30-3:45 Break
- 3:45-5:00 How to be a Student Session 2, What is Center for the Freshman Year? (Paul Ivey and/or counselor from UCFY)
- 5:00-6:30 Buffet Dinner
- 6:30-7:00 Research Presentation
- 7:00-9:00 Study Hall

Wednesday (10 August)

Morning

- 8:00-10:00 Content Lecture 4, Biological Molecules II
- 10:00-10:30 Break
- 10:30-12:00 How to be a Student Session 3, What is the College of Basic Sciences?

Afternoon

- 12:00-1:30 Buffet Lunch
- 2:00-3:30 Content Lecture 5, Chemical Reactions/Enzymes
- 3:30-3:45 Break
- 3:45-5:00 How to be a Student Session 4, How to get help (assistance programs, Dean of Students etc.)
- 5:00-6:30 Buffet Dinner
- 6:30-7:00 Research Presentation
- 7:00-9:00 Study Hall

Thursday (11 August)

Morning

- 8:00-9:00 Exam 2
- 9:00-9:15 Break
- 9:15-10:30 Content Lecture 6, Cell Structures
- 10:30-12:00 How to be a Student Session 5, How do I survive as a student? (Student Health Center)

Afternoon

- 12:00-1:30 Buffet Lunch
- 2:00-3:30 Discussion of Exam Results
- 3:30-3:45 Break
- 3:45-5:00 Content Lecture 7, Cell Membrane Structure and Function
- 5:00-6:30 Buffet Dinner
- 6:30-7:00 Research Presentation
- 7:00-9:00 Study Hall

Friday (12 August)

Morning

- 8:00-9:00 Exam 3
- 9:00-9:15 Break
- 9:15-11:00 How to be a Student Session 6, What comes after you graduate?
- 11:00-12:00 Discussion Results Exam 3

Afternoon

- 12:00-1:00 Checkout of dormitory rooms

Appendix 2

Student Anecdotal Feedback

Question: *Please send me back any feedback you think would be useful for next year's freshmen, what did we do right, what could we have done better, was BIOS worth a week of your summer in hindsight?*

1. Hi! It is funny to get your email today because I was telling my friend about the class and how much it helped. We just had our first exam on chapters one through six and I made a 98 on it. I could not have done that with out attending the Bios program. I used my notes to help study and I could focus more on the details because I already had a general idea of what was going on. I could even help other people in the class. It helped to get a feel for college before it really counted and to see what the exams were like. I would recommend continuing the program next year. I feel that it was really worth my time. Thanks for the opportunity.
2. BIOS was well worth a week of my summer. Not only did I feel confident on the first exam, but was much less stressed my first few weeks in school because I already had the notes and understood the material for one of my classes. I realize that BIOS put me ahead of many of the students who did not attend the program; this allowed me to help them, which in turn helped me grasp the material even further. Most important, was that I made some really great friends at BIOS. Actually a good majority of my friends I either met at BIOS or met through someone from BIOS. It's a great opportunity to learn and meet people who are as serious about learning as you are. I really feel that if I had not attended your program I would not love LSU as much as I do.
3. In hindsight, I really enjoyed BIOS. I liked the way you put us in groups with people in our Bio lectures and labs. BIOS really helped to prepare me for my biology course.
4. I have to say that it helped me out a lot. Knowing people in my Biology class was great, and I actually have most of my science classes with other students from BIOS. I have 'aced' all of my first exams, which I give BIOS credit for, because I used the study and learning strategies provided by the Center for Academic Success. Learning the beginning chapters in Biology helped me significantly! Being comfortable with LSU's campus also helped me to know where I was! BIOS is a great program that should be continued! Thanks again,
5. After the first Intro Bio exam, I am positive that BIOS was worthwhile. I have felt prepared and comfortable with the material in 1201 since the first day and have your program to thank. The study tips, orientation, and early exposure to college biology have truly proved to be extremely helpful and I appreciate all of your efforts over the summer! Thanks again,
6. I definitely think that Bios was worth my time, especially after receiving A's on all of my first exams, not just Biology. I find just knowing a little bit about the information before hand helps out a lot even though I have a Biology teacher with a completely

different style of teaching. I also found the study skills area of the program helpful because I hate to say it, but they really do work. They take a lot of the pressure off of studying so much information. The only parts of Bios I may have to complain about are: a) the group study sessions until 9:00, b) the lack of variety in our lunchtime menu, c) order size small t-shirts. Good Luck with next year!

7. I think that BIOS has really helped me so far. Not only did it help me with Biology, but it also has helped with other classes. I am taking notes better than in high school. I also use the studying strategies I learned in the program. The only thing that could have been better were some of the speakers said the same thing. Other than that, BIOS was a really good experience, and I am really glad I participated in it.

8. The bios program was amazing. It made the first test a lot easier and kind of broke the ice between the transfer from high school to college. I feel like the course is almost a must for biology majors and I am sure it also helps the other majors as well. Thank you so much for the experience and helping me get a 98 on my first college test.

9. Sorry about the delay, but here it is, better late than never I guess. I want to start by saying that by far the best thing I got out of BIOS initially was something y'all didn't even advertise: I met people before I started college. The first week was enormously stressful and it helped immensely already having friends from BIOS, as well as a friend from home, to fall back on. To this day, over half way through the semester, some of my best friends are the ones I made at BIOS. Just as a quick example, I ate lunch with two of them today, my old roommate and a group-mate. I guess there's something about 3 of Dr. Wischusen's test in a week that tends to bring people together. My grades have also been much higher than they would have been without. The jump on the biology work gave me that much less to worry about while transitioning to college life, and is currently my highest grade at a 97.7. The skills learned at BIOS have also transferred well to other classes, even if only at times it tells me I'm not doing well in a class.

10. I can't think of much in the way of improvement, although perhaps losing one of the later 'being a student' sessions in place of a little downtime, not so much for a break, but for a bit of socialization/study time. Plus, the sessions towards the end seemed to get a bit repetitive and got harder and harder to pay attention to. The initial ones were great, though, giving useful information that I still use (or forget to and soon regret it). All in all, I'd say it was definitely worth my week of summer. I must admit, I went to BIOS mostly on my father's suggestion and was not looking forward to giving up one of my final weeks of summer before college life began, but all in all, I'm glad I did.

11. BIOS did me very well. With Bio II AP and BIOS I felt very comfortable, perhaps too comfortable, with the material presented. Everyone I talked to aced it because of BIOS and I found it easy as well. I really wouldn't change much of anything, other than the minor detail that entropy and all are covered in the Unit 2 test part and perhaps you could substitute that information with more information for unit 1 test so they do even better? No complaints, thank you.

12. I definitely think BIOS was worth a week of my summer. I aced my first exam. The material on the exam was basically review of what BIOS had covered during that one week. I just feel a bit uneasy about my upcoming exam; I don't feel as if I know the material as well as I did for the first exam. I know that the reason is because this is new material in much more detail. The point I'm trying to make is that most BIOS participants may feel as if they may have some room to slack off a bit because he or she may have performed well on the first exam. However, I don't want students to feel as if they won't have to study for the upcoming exams. Who knows...grades may drop as a result of this "overconfidence"? But, as long as students adhere to the intense study sessions like Dr. McGuire suggested; I don't think they'll have this problem. BIOS was extremely helpful to me, and I am very satisfied with the results based on my performance of my first exam. I will wait and see how this second exam goes in order to see if BIOS study tips have helped as well.

13. BIOS was well worth the time. Since classes have started, work has been piling up, but because I went to BIOS and learned so much there, I was able to spend more time studying and doing work for other classes. I was still studying for Biology but not as long as I had to for other classes. The tips for studying really helped and it seems to be working really well for all my classes. The schedule was organized very well. The thing that I noticed being the least beneficial were the group study sessions. If the point was to demonstrate the benefit of group study sessions, then that did not come across that great. Many people left to study on their own leaving only a few people in the study session. Besides that, everything else was well worth it and I am glad that I went.

14. I was very pleased with the program and am so glad that I attended. Just being able to recognize and recall the information we were learning in class was a big help. The study tips have also helped and I have been trying to stick to what we were taught. Also some of the sessions we had gave very useful information that I sometimes forget we had the advantage of learning until a friend says that they are clueless about where to go if they need help or something like that. I can't think of anything right now to improve the program, but if I do I will be sure to email you my thoughts. I am so appreciative you all did this program and I know others will find it useful in the future.

15. I thought the BIOS program was a great opportunity to learn the material that is taught in BIOL 1201. I learned a lot of material in that short of time which most of it ended up being on my first test. I thought the BIOS program was well worth the time and effort. Even though I knew the material for the first test, and studied a whole lot, I made a 66 on it. I knew the information really good, but the questions confused me on what they were asking. Some of the material on the test I had never seen before. It was not in the lectures notes, so I guess he got them from the book. Next time I will study my

lectures notes and the book. On a bright note, I made a 93 on my first chemistry test and a 100 on my second chemistry test. I also have an "A" in BIOL 1208.