

University Core Development Committee

December 2, 2002

Gasson 105, 1:30 p.m.

Members in attendance were Chair Richard Cobb-Stevens, Patrick Byrne, Clare Dunsford, Margaret Kearney, Ourida Mostefai, Dennis Sardella, Tim Duket, And Sandra Waddock

The meeting was devoted entirely to the discussion and approval of the document below.

Submitted by Richard Cobb-Stevens

Report on the Status of Core Courses in the Physical Sciences

Prologue

During the 2001-2002 academic year, the University Core Development Committee (UCDC) devoted considerable attention to the question of Boston College's Core course offering in the natural sciences. Boston College can be justifiably proud of the growth in excellence in the natural sciences over the past decade. The rapidly increasing research reputations of these departments, the numbers of graduates receiving prestigious post-graduate honors and fellowships, and the placement of top students majoring in the natural sciences in prestigious graduate programs all testify to the high quality of the faculty in these departments. Our recommendations are intended to add to these developments in line with our responsibility for monitoring and recommending resources for excellence in undergraduate instruction at the Core level.

While our recommendations are derived in part from focus-group interviews with undergraduate students, they are largely derived from comments of the faculty from the natural science departments themselves. During 2001-2002 we met with undergraduate directors and faculty responsible for teaching Core science courses in Biology, Chemistry, Geology/Geophysics, and Physics. Following their lead, we make the following recommendations aimed at what Sheila Tobias has called "reaching the second tier" – undergraduate students intellectually well capable of learning college-level science material,

but not falling into the mold of the stereotypical "science major."

Biology

The Biology Department currently teaches approximately 1100 students in its core offerings BI100-102: Survey of Biology (304, 304 & 90), and BI200-202: Introductory Biology (169 & 101; parenthetical numbers based on S02 enrollments, total fall enrollments in the five sections being about 120 higher). The Introductory Biology course primarily serves those intending to major biology and those pursuing the pre-medical/pre-dental program. However, since many students withdraw from the premedical program after their first year at Boston College, this course also functions as the *de facto* Core science instruction for large numbers of our students.

At present, in our judgement, all levels of Biology core instruction are severely lacking in resources. Introductory Biology has only one TA per 150-200 students, and Survey of Biology only one TA per 200-300 students. Even if each TA were to run four (4) recitation sessions per week, this would mean teacher/student ratios ranging anywhere from 37:1 to 75:1, rather than an ideal average of 25:1.

Representatives of the Biology department estimate that there would need to be a total of 32 discussion/recitations sections to meet the need of Survey alone (a total of 8 TAs @ 4 sessions/week). In addition to running the recitations, the TAs would be expected to attend the class lectures (3 hrs/week), attend course staff meetings for supervision and advice (2hrs/week). These additional resources would enable the faculty teaching the course to add more writing assignments (TAs would grade these), bringing the biology Core courses closer to the objectives of the Core curriculum, which emphasize writing as one of the six essential features of any Core course.

The recommended total of 8 TAs would also bring the Survey course into conformity with the way support is offered for large core classes in, for instance, Economics and History. As in those courses, student attendance at recitation would be

required and participation would count toward the final grade. Given the demands on Boston College Biology graduate students for laboratory assistance, it is unlikely that this increase in instructional support could be met from that graduate student population. Boston College would have to hire additional, part-time assistants. Prof. Eric Strauss suggested that some of this additional need could be met by hiring advanced Boston College undergraduates, and expressed his willingness to develop and conduct a weekly teaching-staff supervision program for those assisting his Core course. These students would not receive academic credit in return for their services, but rather would be paid. He also suggested that the undergraduate TAs could assist in grading. However, the UCDC does not view this as appropriate, and does not endorse this part of the recommendation. However, we do endorse a one-year pilot project to determine whether advanced undergraduates could satisfactorily conduct the recitation portion of the sessions, answering questions and going over issues with the Survey students who are at a far less advanced stage.

The Biology Department's representatives were emphatic that such increased resources would greatly improve the quality of instruction for Survey of Biology, and was their highest priority. Yet they were reluctant to ask for too much. However, since the UCDC itself is charged with responsibility for Core overseeing the quality of instruction for all undergraduate students, we therefore further recommend that equivalent support also be provided for Introductory Biology. This would mean recitation sessions for that course at ratios of 25:1 (and therefore approximately 12 sessions and 3 TAs @ 4 sessions/TA.) In addition, these paid TAs would attend the lectures and comparable supervisory meetings conducted by the faculty, and would grade written assignments.

Chemistry

The Chemistry Department offers three sections of General Chemistry, which it describes as a "mid level" course. The 100-145 students per section come from widely varying backgrounds (mainly Biology, Chemistry, and Biochemistry majors, along with

pre-medical students drawn from many different nonscience majors). About 20-30% have had only a lower-level high school chemistry course, while another 20-30% arrive highly prepared. The course also requires a laboratory and a discussion section (about 20-40 students meeting once a week for 50 minutes with a graduate student). Homework graders are also provided. The Department does not perceive a need for additional resources in this course.

Chemistry and Society is a course for non-science-majors which typically enrolls approximately 250 students and meets 3 times a week, with no laboratory. The instructor noted the disparate composition of the class, with some students requiring the information she teaches just to be "good citizens," and others possibly requiring information that is more in-depth to prepare them to be "tomorrow's leaders."

The issue of the quality of laboratory instructors was raised by members of the committee who noted that undergrads have complained to them about teaching assistants who cannot speak English adequately enough to explain procedures or answer questions. The Chemistry Department does not conduct a training seminar for teaching assistants. However, each laboratory is supervised by Dr. Lynne O'Connell, the Director, who visits all laboratories twice in the course of each semester. Dr. O'Connell also meets weekly with General Chemistry laboratory TA's to discuss the experiment for the week.

We recommend that Chemistry and Society be split into two sections, each tailored to the different backgrounds and needs of the non-majors. We also recommend that there be at least one teaching assistant per 50 students, and that all teaching assistants participate in a seminar on teaching and laboratory direction. The seminar should be directed by a faculty member.

At present the Department's faculty are already stretched thin covering current courses, so that it is likely that implementation of our recommendation would require additional faculty resources. Although we share the concern of the Chemistry Department about the undesirable long-term effects of a two-tiered faculty, we also recommend that the

department consider the possibility of hiring full-time adjuncts to teach both of these courses. This would give greater continuity to the syllabi of these courses from year to year, make possible long-term improvements, and provide the kind of faculty/student contact requisite for a first-rate Core program.

Geology/Geophysics

All faculty but one teach in the core; core courses include both overviews of the field and surveys of some sub-fields. Cosmos (GE 177) is a broadly based course whose goal, as Chris Hepburn put it, is to "give students the ability to interpret scientific developments throughout their lives." This course typically attracts 100-200 students. A second broad survey course, Introduction to Geology and Geophysics (GE 132-134), co-taught by Chris Hepburn and Kevin Harrison in the first semester, and by Alan Kafka in the second semester, serves as the introductory course for majors. Alan Kafka also offers Geoscience and Public Policy (GE187). The department currently has approximately one teaching assistant per 100 core students. The teaching assistants help with grading essay questions and conducting laboratory research. Kafka suggested that an increase in the number of teaching assistants and some additional computing equipment would make it possible to incorporate computer based research laboratories in the larger classes which currently have no lab requirement.

We are impressed by the efforts of this department to design courses that specifically address the criteria for core courses set forth in the Core Curriculum Task Force document. For example, the courses generally require papers and other forms of written reports, and also incorporate essay questions in examinations. We recommend that the number of teaching assistants be doubled (so as to provide one teaching assistant per 50 students). We also recommend that the department's request for additional computers (and computer projection equipment) be approved.

Physics

The Physics Department currently teaches approximately 350 students in its core offerings PH115-116: Foundations of Physics (39), PH183-184: Structure of the Universe (149) and, PH 211-212: Introduction to Physics (51 & 107; parenthetical numbers based on S02 enrollments). The Introduction to Physics course primarily serves those intending to major in physics, chemistry, biology and those pursuing the pre-medical program. Both the testimony and the class listings indicate that its two sections are well-supplemented by recitation sections that provide opportunities to answer questions and pursue issues in greater depth than in the larger class lectures. Of concern, however, is the size of Structure of the Universe, which does not appear to have any smaller recitation sections to support its students.

Representatives of the Physics Department proclaimed that they have at present adequate resources to provide personalized instruction to those in Introduction to Physics and are not in need of further resources there. They expressed a desire to once again be able to offer additional Core courses to non-science track undergraduates. They explained that while they very much enjoyed teaching such courses in the past, that the new demands of the resurgent graduate program and research dimensions of the department make it impossible to offer such courses at present.

Recommendations: Two part-time stipends each semester (four in total) for two additional core course offerings in physics for non-science majors. These should not be in the stereotypical mode of "science for poets." They should be demanding, and include solid components of mathematics. But should address the learning styles of non-science students (See Sheila Tobias, *They're Not Dumb; They're Different: Stalking the Second Tier*).

While we also would like to see recitation sections for Structure of the Universe that make the student-teacher ratio closer to an ideal norm of 25:1, it is not clear to us that such additional resources are warranted for that course.