James W. Brown
Department of Microbiology

Portfolio for Outstanding Teacher Award

Teaching Philosophy

I came to NCSU in 1994 with little teaching experience: substitute-teaching a lecture now and again for my research advisor, filling in for a short summer course, being a graduate TA, that sort of thing. My training was in research, not teaching. On the other hand, I'd had a lucky string of excellent mentors for both research and teaching, from Dr. Guinn in High School to Prof. Norm Pace, my postdoctoral advisor.

All of these mentors shared one trait – they were *excited* about the science they did and taught. This excitement, and the contagious perception that it was OK to get excited about some scientific fact, result, implication, approach, or especially question, just because it was *cool*, is in my mind the single most important trait to be passed on, by example, to students at all levels of experience.

The second guiding principle in my teaching is that every student is bright, in his or her own way, and that the difference between instructor and student is nothing more than experience. Students are to be treated as adults and equals, with the rights and responsibilities this implies. My job as an educator is to guide their learning, it is the students responsibility to take charge of their learning.

A third important aspect of my teaching is to use a variety of learning approaches: digested information and scientific papers, concepts and theory, facts (lots of them!) and uncertainty (this is often a new and difficult concept for students), lecture, reading and hands-on lab work. The trick is to weave these together, so that these different approaches not only help students with all types of learning styles, but also complement each other to build a coherent whole that is more than the sum of its parts.

I have modeled my teaching style after the "the exception proves the rule" approach used by both Charles Darwin in his various papers on geological and biological theory, and by Steven J. Gould in his popular essays and scientific work on evolutionary biology. It is a great complement, and immensely gratifying, that an occasional student will recognize this approach and its sources.

Course sections taught during the last five semesters.

MB 409/451 is the focus of my traditional teaching efforts, and the data for this class is listed in tabular form as requested. Undergraduate research and various forms of graduate teaching that fall outside the realm of traditional lecture/lab teaching are listed in brief narrative form.

MB 409 (now MB 451) – Microbial Diversity
Microbial Diversity is a required "core" course in the Microbiology undergraduate curriculum. The data included here is for the past 5 years, since the class is only taught in the spring semester. No comparisons are made with other instructors, as I am the only one who teaches it.

Semester	Enrollment	Course rating	Instructor rating
Spring 2000	44	4.4	4.6
Spring 2001	38	4.2	4.7
Spring 2002	56	4.0	4.6
Spring 2003	56	4.5	4.7
Spring 2004	72	4.3	4.7

MB/BCH/BS 493 – Undergraduate Research
Students get credit under a variety of course designations, or simply volunteer, for performing research in my lab. A total of 22 undergraduates have worked in my lab since 1994, recently averaging 2 at any one time. Required for Biochemistry majors, elective for Microbiology majors. No course evaluations or comparisons available.

MB 601/801 – Microbiology seminar
Required course credit for all graduate students, for participation in the Department of Microbiology seminar series. Typically 5-6 students are enrolled each semester. I have been responsible for this course for 3 years (1994/1995, 1999/2000, and 2003/2004) since 1994. No course evaluations or comparisons available.

MB/BCH 610R/810R – Microbiology Journal Club or RNA Biology Journal Club
This elective course is for graduate students to get credit for participation in journal club. Taught each semester for the past 2 years, with 1-3 students enrolled for credit per semester, although ca. 20 students (and a number of faculty, postdocs, etc) participate each semester without credit. No course evaluations or comparisons available.

MB 621/821 - Instrumentation
Required for all graduate students in their first semester, typically 5-12 each year. Organized and administrated by Prof. Paul Bishop, I teach a single lecture on DNA sequence analysis. No course evaluations or comparisons available.

MB 670/870 – Laboratory Rotations
This required course is for graduate students to get credit for time spent doing laboratory rotations in their first semester. Taught most fall semesters. A total of 21 graduate

students have rotated in my lab since 1994, 1 or 2 each fall semester recently. No course evaluations or comparisons available.

MB 686/886 – Graduate Teaching Experience
These are students (2 each Spring semester) getting required credit for being teaching assistants for me in MB 409/451. No course evaluations or comparisons available.

MB 695/895 – Graduate Microbiology Research
These are graduate students being mentored in my lab, recently 2 or 3 at any one time. Required credit. No course evaluations or comparisons available. 4 Ph.D. and 6 M.S. students have completed their degrees in my lab since 1994.

BCH 751 – Macromolecular Structure
Organized and administrated by Prof. Paul Agris, I taught a two-week module in this elective course in spring semester of 2002 on the prediction of RNA structure for 12 students, and I am scheduled to teach this again in Fall semester of this year. No course evaluations or comparisons available.

Involvement in course and/or curriculum development and improvement, etc.

MB 451 (ex-MB 409) – Microbial Diversity

In the early 1990's, the Department of Microbiology recognized the need to create a senior-level course on Microbial Diversity for inclusion in the undergraduate Microbiology core curriculum. The task of creating this course was included as part of the faculty position I was hired to fill in 1994.

Microbial Diversity was taught on a pilot basis, as MB 495, for 5 students in Spring semester of 1995, and for 12 students in Fall semester of 1995. The Course Action Form for conversion to permanent status as MB 409 was approved November of 1995, and the Curriculum Action Form adding Microbial Diversity to the required 'core' Microbiology curriculum was approved in March of 1996. The course was taught for the first time as a regular course for 25 students in Fall semester of 1996. In Fall semester of 1997, the enrollment of 34 students required the expansion of the lab to 2 sections, and the 56 students in Spring semester of 1999 required further expansion to 3 lab sections. Also in 1997, an on-line lecture section was added, as part of "Project 25" (see below). The course was restricted to Microbiology majors (or by permission) starting in 2000 to manage student numbers. In August of 2004 the Course Action Form was approved to change the course number to MB 451, to add a weekly discussion session, to change the course from 3 to 4 credit hours, and to make some scheduling and prerequisite adjustments. The course is taught every spring semester to a maximum of 72 students (more would require the addition of a 4th lab section).

MB 451, Microbial Diversity, is intended to immerse students in the relatively new "phylogenetic perspective" in microbiology. Students are exposed to the principles of microbial diversity and the phylogenetic perspective in a variety of ways: traditional instructor-driven lectures, student-directed free-ranging discussion sessions, hands-on project-oriented labs, and a capstone computational and writing-intensive term project.

The lecture sessions are relatively traditional in format. Each lecture is divided into three components. The first part of the lecture is the description of some phylogenetic group of microbes. The second part of the lecture deals with some concept or issue raised by the members of this group. The last segment of each lecture is a discussion of a journal article about these organisms, allowing us to explore the process of scientific discovery, and usually contains some broad lesson or unusual twist to hold the students interest.

An on-line lecture section was developed in the Fall of 1997 as part of "Project 25". All students, whether taking the lectures on-line (section 002) or traditionally (001), participate fully in the lab. Many students participate both in the traditional and on-line lecture approaches; students attending lecture generally bring with them printouts from the web pages for that day.

An addition to the class this year is a weekly "discussion session". This new component of the course originated from comments in student evaluation and feedback questionnaires, which I take very seriously. Our Friday discussion sessions are being used to review background material, go over problem sets or graded exams, hash over difficult concepts from different angles, chat about microbiologically-oriented things in the news, recent exceptional scientific papers, etc. The format of these discussion sessions is student-driven on a daily basis.

The format of the Microbial Diversity lab is unusual; instead of the traditional series of discrete laboratory exercises, the students carry a series of experiments in parallel throughout the semester. This long-term project-oriented lab format allows the students to perform more involved and integrated lab work, and has served as a model for the renovation of the lab component of General Microbiology for majors and honors students (MB352H/M). Data collected in lab serves as the starting point for a computationally- and writing-intensive term project. This project serves to integrate the lecture and lab portions of the course; it is the "capstone" of the course.

MB/BCH/BIO 493 - Undergraduate Research
Undergraduate students in my lab work on projects individually tailored to their interests, needs, and future directions. Many of these are microbiological projects that emerge from their work in the classroom laboratories. Other students work on some facet of RNase P, the focus of research in my lab, but these can take a variety of forms: computational (e.g. Jessica Anderson, 2003), molecular (e.g. Jennifer Cockerham and Maggie Titus, 2004), biochemical (e.g. James Wilde, 2004), microbiological (e.g. Beatrice Criveanu, 2004) or some combination of these (e.g. Danielle McLauren, 2004). For some students, developing materials for educational purposes better suits their goals (e.g. Robert Freeze, 2004). Most of these students are microbiology majors, but many are from Biochemistry or Biological Sciences.

My intent in undergraduate research is to strengthen in the students minds the connection between what they learn in class and scientific laboratory investigation. This direct connection between teaching and research is a fundamental aspect of my activities here at NCSU.

Grants for teaching
- NSF *RNC: RNA Ontogeny Consortium* (**pending**, Co-PI with Prof. Neocles Lenotis, *et al*, multi-institutional)
- NIH-NIGMS *Biotechnology Training Program at NC State University* (2000-2005, Co-PI with Prof. Robert Kelly, *et al*.) $852,000 (2005-2010 $1,200,000 **renewal pending**)
- NCSU Project 25 (1997) $1500
- NCSU Instructional Computing Grant (1995) $3000
- NCSU Undergraduate Studies Initiative Award (1994) $7000

Curriculum development
I have been an active participant in the Microbiology Undergraduate Curriculum Committee during my entire time here at NCSU.

Advisor for PBS station KCTS
Although not traditional teaching, I served in 2003 as scientific advisor for PBS Station KCTS (Seattle, WA) for their educational production of "Space Millenium".

Summary endorsement statements from two former students.

This is from Andy Andrews, B.S. Microbiology 1998, M.S. Microbiology 2000.
I am writing to inform you of the excellent teaching and scientific ability of Dr. Jim Brown. His class provides opportunities not often found in the education system; it is the best class I have ever taken. I cannot think of another class that allows the self-exploration of microbial life via isolation of a pure microbial culture from environmental samples brought in by the students. In addition, while his lab allowed me to see how microbial ecology is done, his lecture opened my eyes to wide range of biochemistry and the difficulties in forcing parameters on life itself. After only a few weeks in his class, I could not imagine doing anything else with my life. I started working in his lab later that semester and absolutely loved the work, which ultimately turned into my Master's degree. While I am currently finishing my PhD at the University of Michigan in Biological Chemistry, I hope to use what I have learned in enzyme kinetics and mechanism to study some of the less understood biochemistry presented in Dr. Jim Brown's class. I will be forever thankful for the positive impact Jim has had on my career as a scientist and thinker. Dr. Jim Brown is an exceptional educator, scientist and mentor.

This is from Eric Kaufman, B.S. Microbiology 2003.
I never thought I would ever see someone get so excited talking about pink filamentous bacteria that grew in some hot spring in Yellowstone National Park. Come to think of it, I never thought *I would* ever get so excited about someone talking about pink filamentous bacteria that grew in some hot spring in Yellowstone! Go through the records of former microbiology majors at NCSU and ask them which thing they enjoyed most. I'll bet you Dr. Brown's Yellowstone lecture and the 409 lab are in the top 5, and number one and two on numerous people's list. It's because the things we can learn, and he still learns, from Yellowstone are so important. And the 409 lab begins with a scavenger hunt for mud and rotten fruit! I asked myself, "What is this guy thinking?" Well, it all made sense, A LOT of sense in the end. But the lab and lecture are not the only place Dr. Brown excels in. I am privileged to have had Dr. Brown as an advisor. To be as well respected in the scientific community as the man is, it is a testament to his character that he still finds time for his students on an individual basis -something far too many professors in academia forget. I haven't always been the academic success I see myself as today. Public school had been a joke to me when it came to success. This resulted in a nonexistent work ethic and when coupled to the demands of the busy university academic (and social) setting… well, lets not discuss my GPA after two years. My wake up call came when I failed 351, Intro to Micro, the first class you take as a micro major. I think most professors would have written me off right then. Still not knowing Dr. Brown very well, I called him and asked what I had to do to fix this and get back on track. He helped me. That summer I retook 351, and got an A. Today, I'm a PhD candidate with the Chem. Dept. here at NCSU. And after all the face to face talks about microdiversity, Dr. Brown as even found a way to forgive this "chemistry infidelity" and sit on my committee. I thank Dr. Brown.

Summary endorsement statements from two faculty colleagues.

This is from Gerry Luginbuhl, Interin Head of the Department of Microbiology
Dr. Brown teaches Microbial Diversity, a senior level lecture and laboratory course that all of our microbiology majors are required to take. He recently reassessed the learning challenges faced by the students in his course, and proposed several revisions. Chief among these revisions was the addition of a credit hour for a weekly problem/discussion session. He also proposed renumbering the course from MB 409 to MB 451 to better reflect the advanced nature of the material. These proposed revisions were approved by the college and university committees early in the fall semester of 2004, and will go into effect spring semester 2005. Dr. Brown's course is a rigorous treatment of microbial genetics, physiology, ecology and evolution. His course builds on the students' prior learning in biochemistry, microbiology and genetics. He relates this material both to fundamental research problems and to applied areas such as drug discovery and nutrient cycling in the environment. He makes himself available to the students through office hours, review sessions, and e-mail and most notably through his constant presence in the laboratory component of the course. Students report that the laboratory and class projects are challenging and ultimately great confidence builders. In many years, at least one of his students isolates a previously uncharacterized microorganism. This leads to a further independent research experience in Dr. Brown's research laboratory to attempt to further determine the nature of the microbe. The students report that his exams are challenging but very fair. The students often report in senior exit interviews that Dr. Brown's course was one of the most valuable courses they had while at NC State. What is particularly valuable is not so much the specific content, although of course that is valuable too, but the critical thinking skills that the students practice throughout the course. Most of the students in Dr. Brown's course, which is offered in the spring, are graduating seniors, so it is sometimes difficult to collect student nominations for him. Last spring semester the students' evaluation of his teaching (overall instructor rating on the college evaluation instrument) was 4.69 on a 5 point scale, with 5.0 being the best.

Dr. Brown has participated in many summer research initiatives that bring high school and early college students into the research laboratory. He can be counted on to work with these students and provide them with a positive experience. In summary, Dr. Brown makes a valuable contribution to undergraduate education at NC State, and is deserving of the honor of being named to the Academy of Outstanding Teachers.

This is from a 2001 peer review by Dr. Stephen Libby (then Associate Professor).
The material presented in class (MB 409) is very complex and raises more questions than it answers. However, this is exactly what is needed, for the students to learn how to critically analyze the literature and come to their own conclusions. Dr. Brown clearly illustrates this point. Speaking to (the students) gives me the impression that the message is received. The students are attentive and genuinely seemed to enjoy the lecture.
(Note that Dr. Libby scored my class "Outstanding" {5 out of 5} in all of 8 categories).