

Statement of Biocore's Philosophy on Teaching and Learning

It is learning that matters.

The focus of our attention has to be on what happens in the students' minds, rather than on what happens in the front of the room. Effective teaching consists of something much broader than presenting material; it means setting up the whole environment to facilitate learning. This includes the way we view and treat students, the intellectual tasks we assign them, the social climate of the class, and the methods we use to assess their learning. Furthermore, since different people learn in different ways, we must incorporate a variety of assignments and assessment methods into our courses.

We cannot do it for them.

Teachers can serve as coaches and guides but we cannot do the intellectual work for our students. Students have to interact with ideas in order to integrate them into their own intellectual frameworks, often overcoming previous notions. This is one of the reasons that working in small groups has proved to be such a powerful way to learn. As students discuss their emerging ideas, they begin testing them and making them their own. They also learn through teaching each other. Indeed, a student who has just mastered a difficult concept is often better than the instructor at explaining it to a peer. This is why we make group learning a priority.

Writing is another way for students to interact with the material, to struggle with ideas, and to consolidate their thinking. Writing became a focus in Biocore long ago because we are convinced that writing helps thinking. Students sometimes complain that we require too many papers (many of them involve drawing conclusions from data they have generated), and we struggle with the heavy responsibility (and grading load) of providing feedback on all of that writing, but our experience has been that students get the most out of projects for which they write (and rewrite) papers or prepare posters given quality feedback from instructors and peers.

Teach science as a process.

Science is a powerful method for discovering how the world works. It has allowed us to understand an impressive amount, but science is not the sum of all we know. Indeed, its central tenet is that our models are open to revision as new methods for testing them and new information becomes available. We must focus as much on how we know as on what we know. This means continually making hard decisions about which concepts, vocabulary, and methods are essential, particularly since "what we know" becomes larger every year. It is a constant challenge to keep Biocore up to date without overwhelming students with information.

Laboratory courses are expensive and labor-intensive but absolutely crucial for students to understand how science is done. Labs must be based on inquiry rather than being "cook book" exercises demonstrating something one already knows. Part of the scientific process involves communicating results with other scientists and exposing one's ideas to discussion and review by peers. These, too, should be part of the students' experiences.

Set high standards and expect students to reach them.

Students need to be stretched beyond their comfort level to reach their true potential. This is particularly true for high ability students who have come to expect A's for very little effort. We hold students to high standards from the beginning and have learned to accept their initial unhappiness and anger about early grades as part of the learning process; we also build in opportunities for them to revise their papers. Most (but not all) of them appreciate the high standards in the long run. They achieve a great deal more and are justly proud of their accomplishments.

The world is changing so rapidly that we cannot even picture what students will need to know in the future, let alone teach it. What we can do is to give our students opportunities to develop: (1) a foundation of concepts and principles upon which they will build an increasingly complex intellectual structure, (2) a language and an ability to communicate with other people as they amass and share this structure, (3) a recognition in any particular situation of what they need to know and strategies for acquiring it, (4) an understanding of the process of science that allows us continually to revise our models, and finally, (5) a skeptical mind that constantly asks for evidence for claims.

A Community of Learners and Teachers

Biocore faculty are recruited because of their distinction in a particular area of biology, their excellence in teaching, and their interest in undergraduates. Some Biocore faculty participate in the laboratories as well as the lecture-based courses; this is indeed a commitment because there are up to 6 three-hour laboratory sections per week. Their dedication to teaching and learning is shown by the fact that most of them teach in Biocore on top of their normal departmental responsibilities (with no additional financial compensation). They work in groups of 3-4 to plan and teach each course and do this as a team (not a relay!). They ask for and give constructive criticism to each other. They struggle together over the best ways to present challenging material, to accurately assess student learning, and to address problems that students have. The chairs of the 7 courses meet to reflect on the progression of topics through the sequence and to discuss connections between subjects taught in different courses. Junior faculty find Biocore a particularly welcoming place to begin teaching because they are not simply thrown into a course on their own but are guided and given feedback by the more experienced members of the team. Experienced faculty find Biocore a place where they can bounce ideas off colleagues who share their excitement about teaching. They generally find Biocore to be a place where teaching is a form of scholarship and take their teaching very seriously.

Teaching Assistants are colleagues who share responsibility for carrying out the course goals. Biocore is able to recruit excellent graduate students from across campus for these positions because the program has developed a reputation among graduate students as an excellent place to obtain teaching experience that helps prepare them for their future careers. Biocore provides TAs with information about teaching and learning, examples of effective teaching practices, opportunities to help develop course materials (including exams), and on-going support and feedback as they carry out their responsibilities. The faculty and staff listen to TAs and value their perspectives on students' progress. TAs appreciate and live up to Biocore's high expectations for them. Almost all receive high ratings on the course evaluations and several have been chosen as L&S Teaching Fellows.

Biocore students form friendships and bonds as they work together over 4 semesters. Some students take to Biocore's challenge and high expectations immediately; others require time before they appreciate being held to such high standards. Research on learning has shown that working together in small groups is an effective way for students to learn challenging material and Biocore provides many opportunities for small group work. The program encourages students to form study groups and allows students to work together on the assignments as long as they list the names of their collaborators on their papers. (Exams, quizzes, and most laboratory papers must be completed individually, however.) As a further means to emphasize cooperation rather than competition, Biocore courses are graded using a set grading scale, not a curve. Biocore faculty and staff invite student comments throughout each course and try hard to respond to any concerns that are raised. Each Biocore course provides a mechanism for continuous feedback from students utilizing a student Board of Directors composed of representatives from each of the discussion sections. BOD representatives meet with faculty instructors and TAs each week to provide input and discussion for addressing students' issues.