Overall teaching philosophy.

The ultimate goal of teaching is to teach students to teach themselves. This is especially relevant in rapidly progressing fields such as biochemistry. Even if an instructor is able to keep course content 'current', students will be left behind if they are not able to update their knowledge as new discoveries are made. Also, the sheer volume of knowledge in such rapidly growing fields makes it difficult if not impossible to directly communicate all of this information to students. Arming students with the ability to teach themselves is a potential solution to these problems. But how might an instructor accomplish this? My teaching philosophy is based on the pursuit of this goal through these three guidelines:

1. A teacher should identify the key fundamental concepts that students need in order to acquire further knowledge in the field. These fundamentals should be reduced to a minimum in order to allow students to gain a solid understanding of these concepts.
2. Selected topics should be used as a means to demonstrate how to acquire further knowledge in the field. Aside from showing students how to learn new material, this has the significant benefit of adding interest and excitement to the subject.
3. Inquiry and problem solving based teaching methods should be used as much as possible. These methods emphasize the learning process and promote true understanding of the material as opposed to memorization.

Thoughts on teaching and learning biochemistry.

Biochemistry can be divided into three basic parts:

1. Structure and function of biomolecules (amino acids, proteins, carbohydrates, nucleic acids, lipds, etc.). I feel we should approach the study of biomolecules from a foundation of organic and physical chemistry. I can remember being somewhat disappointed at the lack of detailed structure and mechanism information covered in my undergraduate biochemistry courses.
2. Metabolic pathways. This is a much more interesting area today with the skyrocketing field of metabolic engineering.
3. Genetic biochemistry (expression, control, transmission of genetic information). This is also an area where discoveries are being made at a rapid pace.

Ideally each part would be taught in a separate course. But convincing students to take three semesters of biochemistry on top of all of the other classes they need to take would likely be a difficult task. By focusing on the fundamentals, a satisfactory treatment of the subject could be done in two semesters. This sequence would be appropriate for students majoring in biochemistry or a closely related field.

There will likely always be a need for a 'survey' (one semester) course in biochemistry. I think this would be one of the most challenging courses to teach due to the vast amount of material to address in the short amount of time. An instructor teaching such a course must take care to reduce the fundamental concepts to the barest minimum and avoid falling into the trap of glossing over details in order to cover more material. Perhaps the only way to provide adequate coverage in a one semester biochemistry course is to choose an excellent textbook (Voet and Voet is the best I've seen) and require the students to read it (…and there was great wailing and gnashing of teeth). Class time could then be spent going over the key concepts for part of the time, and spending the rest of the time exposing the students to interesting and exciting areas in biochemistry and problem solving. Done properly, the survey course could persuade more students to pursue a career in biochemistry.

A laboratory course in biochemistry should have the goal of showing the students what it is like to do experimental biochemistry. It should convey the excitement we feel about our work and display the powerful tools that have been developed over the past 15-20 years that have created the boom in biochemistry. I feel this means that we can't rely on traditional experimental biochemistry programs. I am interested in designing an inquiry-based lab course to meet these needs. Also, I believe it is possible to incorporate original research into laboratory courses. I was a student in such a course and found it to be by far the most rewarding laboratory course I've experienced. Another possibility is to allow students to conduct original research in a professor's laboratory as a substitute for a traditional lab course. In addition to giving the student an exceptional opportunity, this is also a chance to augment a professor's research program and perhaps get some novel publishable material.

Thoughts on a biochemistry program.

Scientists calling themselves biochemists can very roughly be divided into two major categories: the molecular biologists (gene-jockey types) and the bio-chemists. There is of course a good deal of overlap between the two. In my opinion, a chemistry department should focus on developing bio-chemists and allow the biology and microbiology departments to educate the molecular biologists. A program designed for the bio-chemist should include mathematics, physics, and of course a chemistry curriculum as core courses. Putting the biochemistry classes on top of all of this makes for a very packed program (which is perhaps one of the reasons for the abundance of molecular biologists today … molecular biology programs often omit math and chemistry courses to make room for more biology based courses). However, if a student is given a strong foundation, I believe that they are able to pick up much of the molecular biology on their own. For majors I think a number of electives could be offered (molecular (protein) modeling, protein folding, theoretical biochemistry, biophysics, *in-silico* biochemistry etc.) which would give students a detailed look at particular areas in modern biochemistry and reinforce the methods of acquiring further knowledge in the field.

Thoughts on the future of biochemistry.

It has been said that we are in the 'Golden Age' of biochemistry. The rapid evolution of techniques for manipulating and studying biomolecules has lead to a data explosion. For the past 15 to 20 years the focus has been on the techniques of biochemistry. This has lead to a high demand for scientists proficient in these tools and methods. However, now and increasingly in the future, I believe there will be a need for biochemists who are able to understand and analyze this mountain of data. While there will doubtless be still more data to be generated and hence the technique based biochemist will still be in demand, the availability of large amounts of data provides a giant playground for scientists who calculate and theorize about various problems in biochemistry. In the future ‘Theoretical Biochemistry’ , ‘Computational Biochemistry’ and ‘Biomathematics’ may become commonplace. My philosophy on the development of tomorrow’s biochemists is centered on this belief.