Preface to the Reader

You might well ask, does the world really need another introductory chemistry textbook? The answer is, of course not—not if that book is just a variation on those currently available. Chemistry, and particularly introductory general chemistry, is simply not changing that much and people learn pretty much the same way they always did, at least if we restrict ourselves to the last few thousand years.[1] On the other hand, there is compelling evidence that the way chemistry is commonly presented, both to the public and in college, is both off-putting and ineffective–a potent combination that leads to the widespread public misunderstanding of chemical principles. How many times do we hear about “natural remedies, without drugs or chemicals,” despite the fact that everything is composed of chemicals and the most toxic chemicals known are natural products.[2]

A growing body of research results on student understanding of chemistry indicates, pretty emphatically, that we need better ways to teach and assess students’ understanding of the fundamental ideas upon which chemistry is based. These are important ideas that students need to learn, and learn in a robust way that enables them to transfer their understanding to new situations rather than just remember what they were told. It would be even better if we could cultivate an appreciation for how science works and, in our most ambitious moments, light a spark of enthusiasm for the beauty, unity, and bizarre processes that make up the natural world. Our problem is how to approach the Socratic ideal in a practical and economically feasible manner.

In this light, we should ‘fess up to where we stand on a number of important issues—we unambiguously accept the liberal ideals of the Enlightenment, namely that intellectual honesty and rigor, rational and logical discourse, and free and dispassionate analyses, together with compassion and empathy, something all too often forgotten by revolutionaries, are critical, both in the context of the scientific enterprise and more generally in making the world a better place for all of its inhabitants. Unfortunately, the ideals of the Enlightenment appear to have fallen somewhat out of favor, at least in some circles. While there is an apparent excess of passion, few appear to be willing to examine objectively or even consider both the positive and negative implications of their positions. Passionate advocacy devoid of rational analysis and the recognition that our understanding of the world is tentative and incomplete, and likely to remain that way for some time into the future, seems to encourage various forms of irrational, and often cruel and violent beliefs, many of which should be dismissed out of hand.

So, back to the project at hand—how do we build a better chemistry book and course? We freely admit our inspirations. Books like Bill Bryson’s “*A Short History of Nearly Everything*” and Einstein and Infeld’s “*The Evolution of Physics*” present science in a logical and engaging manner; they are both interesting and stimulating to read. Unfortunately, this is quite different from the style found in most textbooks. So what is missing from the Bryson and Einstein and Infeld books that make them inappropriate for use as a college textbook? Most obviously, they do not concern themselves with determining whether their readers really–that is, accurately–understand and can apply the ideas presented. Therein lies the logic and impetus behind our book and its associated web-based and in-class materials. Our goal is to merge the inherently engaging aspects of chemistry with the active experiences and metacognitive reflections needed to rewire the student’s (that is, your) brain to really understand and accurately use chemical knowledge.

While there have been many educational experiments over the last 100 years, we take our inspiration from Socrates (470–399 bce). Basically, our goal is to present concepts and skills in various ways, ask students to talk about and work with their understanding, and then ask questions about what students actually mean when they use specific words and ideas. Critical to the success of this approach is time: the time required to understand what students think before, during, and after reading the text and working with the applets and activities; the time required for students to recognize and talk about their assumptions; the time required to listen to them, to ask them what, exactly, they mean, and for them to explain, analyze, and where appropriate reconsider, their ideas. Because of the critical link between time and learning, we will not consider some of the topics often presented in standard textbooks and instead will concentrate on more foundational ideas. Does this mean that using this book and its associated materials will leave students unprepared in critical areas of chemistry? No, and we can demonstrate that is not the case. Rather, it leaves students able to work through many of these topics on their own and we will provide web resources to make this possible.

We developed much of the material in this new curriculum using research on how people learn and our own work on how to improve understanding and problem solving in college-level science classes. In previous studies we have found that our methods, which include dramatic reorganization and reduction of materials covered, increase student interactions and activity and lead to equal or better performance on standardized exams, greater conceptual understanding, and improved problem-solving skills. By focusing the time and effort on the foundational ideas we expect that you will achieve a more robust and confident understanding of chemical principles, an understanding that should serve you well in subsequent chemistry and other science courses, not to mention “real life”!

1. Take a look at Pauling’s General Chemistry and tell us we are wrong. ↩
2. http://www.the-scientist.com/?articl...rbal-Remedies/ ↩