

## First-Year Chemistry (Arguably)

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**Abstract:** The first chemistry courses that students take in college go by many names, including *general chemistry*, *first-year chemistry* and *introductory chemistry*. These may be evocative and powerful identifiers; they also may be problematic (arguably). In this paper, we consider “names” as a way of introducing key questions about what we teach, what our students learn, and what interests, prejudices, and passions both we and our students bring to the teaching and learning processes. We also lay the groundwork for a series of commentaries on first-year chemistry, in which we introduce an organization, the International Center for First-Year Undergraduate Chemistry Education (ICUC), formed to address the issues we face and to support those who teach these courses.

*What's in a name? That which we call a rose  
By any other word would smell as sweet*

*Shakespeare, Romeo and Juliet (II, ii, 1-2)*

In truth, a name is a highly evocative identifier, sometimes a powerful one. In 1994, a civil war in Rwanda involved people who were identified as Hutu and Tutsi. In the U.S. Civil War, the names North and South gave a sense of purpose to people on both sides. Names also may evoke a sense of hope or of pleasure: UNICEF, International Red Cross, Earth Day, Mothers Day, arguably, of course.

Similarly, a chemical name can be a powerful identifier. The name napalm grabbed people's attention and brought a new level of reality to a distant war. The name caffeine may dictate the first actions one takes each morning. Ice can be fearsome to a flight crew (not to mention to any passengers). And again, a chemical name can evoke a sense of hope or of pleasure: penicillin, taxol, codeine, or Viagra, again arguably.

Because names carry the power to shape the thoughts of those who invoke them, they are worthy of both our reflection and further consideration. With this in mind, let us examine the names of the courses we teach. Of particular interest here is the chemistry course (or sequence of courses) that college students first take. We have selected three names commonly in use: *general chemistry*, *first-year chemistry*, and *introductory chemistry*. Names such as these may suggest answers to questions that now trouble us as educators; they may also offer new questions to guide our thinking.

The “chemistry” part in the names general chemistry, first-year chemistry, and introductory chemistry is vital. College chemistry courses do teach chemistry, that is, a systematic study of the interactions of matter, but even a definition (this and others) can provoke further discussion. How do we approach knowing these interactions of matter? Does the systematic study reflect what chemists actually do? And to what extent does the “chemistry” of this first course include

the varied practices, hopes, issues, fears, and realities of those engaged in its study?

Let us also examine the merits of modifying the word chemistry with the adjectives general, introductory, and first-year. The first pairing, *general chemistry*, has merit: a general chemistry course, just like a general store, truly is not limited to one class of things. Beyond this, though, the adjective falls short. Courses that are general should involve only the main features—not the details—if we are to believe the name; however, anybody who ever has taught (or taken) a general chemistry course surely knows otherwise. A seemingly infinite number of details are part and parcel of class meetings, examinations, and laboratory experiments.

The second pairing, *first-year chemistry*, also falls short of the mark. All students do not take this course in their first year in college, and such a course is not “first” in the sense that many students have had at least one high school chemistry course. In actuality, “last-year” chemistry might be a more accurate term in the sense that for many, this is the last time that they ever will open a chemistry text. Furthermore, the term first-year (or any other year!) says nothing about the course content. In this regard, the mathematicians may be a step ahead of the chemists. Course names such as algebra, trigonometry, and calculus are far more descriptive. The term “first-year mathematics” does not exist.

Unlike the first two pairings, *introductory chemistry* makes no claims of what year or how much breadth. Nonetheless, the term *introductory* brings issues of its own. Because so many of our students have already been introduced to chemistry via courses in high school, a college-level course is hardly an introduction. Some college and university “100-level” chemistry courses truly do begin at the beginning (though what we define as “the beginning” may well be different for each instructor). Most, however, assume a good bit of prior knowledge and begin somewhere in the middle.

Again, what is in a name? Our point here is not simply semantics. To the extent that we as chemical educators find difficulty in appropriately naming our course, we also may encounter difficulties in recognizing the goals, topics, and intellectual processes that accompany this name. Surely this course, by whatever name, continues to present us with its own unique intellectual challenges.

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In reality, few instructors have the time or inclination to give serious thought to names such as general chemistry, introductory chemistry, or first-year chemistry. Such titles, most likely, were approved long ago by curriculum committees (if not formulated by historical design or accident), but herein may lie the very problem: The lack of precision in a name may reflect a similar lack of precision in our vision, arguably, of course!

With all the questions that can be raised about something as seemingly straightforward as a name, we should look more closely at the entire curriculum—the broad term that we use to define all aspects of the course—that accompanies this name. We believe this curriculum to be sufficiently challenging as to require its own field of study. We who teach this first chemistry course recognize the special questions and answers, frustrations and pleasures, as well as the relationships that we have to others who teach this course; hence, we see a value in promoting a professional camaraderie that can help us learn and can give us support as we tackle issues relating to the first-year curriculum, name and all.

From this desire to learn, to support, and to advocate for chemical education, a group of 25 faculty and professional staff met in October 2003 at the invitation of one of us (PK) at the University of Illinois at Urbana-Champaign. Those assembled agreed to form an international organization dedicated to our common interests in entry-level undergraduate chemistry. Together, we named this organization *The International Center for First-Year Undergraduate Chemistry Education*, or ICUC (admittedly not being able to resist the acronym “I see, you see”). We have accomplished many things in less than a year, including a commitment to publish regularly in *The Chemical Educator*. In a subsequent essay, we will further explain the ICUC and invite your participation, but for now we wish to keep the focus on the names of the courses that we first teach at the college level and what these names can teach us. The ICUC tackled this issue, arguably.

As you might suspect from our earlier comments, identifying a single name for the group of courses that we all teach was problematic for 25 instructors who had 25 sets of experiences for, in several cases, more than 25 years! Worldwide, many names are in use, and we listed others than the three discussed above. These included:

- preparatory chemistry
- chemistry for X, where X is chemistry majors, non-science majors, biology majors or engineers, etc.
- general, organic, and biochemistry (GOB)

- honors-level chemistry, accelerated chemistry
- environmental chemistry
- chemistry in our world

In terms of what we teach, we recognize the individual flavors among the tens of thousands of postsecondary institutions around the world (including 3500-plus in the U.S. alone.); however, to one degree or another, we agree that each of these courses considers many areas of chemistry so that *a student leaving any of these courses should (arguably!) be able to intelligently discuss certain fundamental ideas of chemistry and how they apply to each of the traditional areas of our subject, if not to wider issues of importance to that student and/or to our society.*

As professionals who focus on what we will henceforth call “First-Year Chemistry,” we have common interests in the key areas of the curriculum that apply to this field. Here are some of the questions to which we seek answers as we design first-year chemistry curricula:

1. How do we balance the multiple purposes of the first-year chemistry course?
2. To what extent do we connect to topics and issues beyond our discipline?
3. How do we determine which students are prepared for our courses?
4. In what ways should we use the classroom time allotted to us and, more broadly, what research supports the choices we make?
5. How do we evaluate what students know during the class period, during office hours, and outside of class via assignments, examinations, presentations and other tools?
6. How might we work with students who are having difficulty in learning?
7. What should be our role in promoting success for traditionally under-represented students?
8. What norms exist for assigning grades to first-year students?
9. How can we help each other improve our teaching?

In this column, we will discuss questions such as these in the coming months. And as part of the essential mission of the ICUC, we will advocate with and for teachers of first-year chemistry so that this name—“first-year chemistry”—remains associated with questions, with answers, and most of all, with the greatest sense of dignity for practitioners of one of the most vital jobs in chemistry, unarguably!