Chemistry is a different science! Reprinted from page 1, May 1994 and an update from Geoff.

A student comes to your office and says "I am interested in science – tell me why I should study chemistry rather than biology, geology, or physics." What do you say? How do you describe what chemistry is about? Where does chemistry fit in the great scheme of scientific knowledge? This is an interesting philosophical problem, for in my view, chemistry is a very different creature from the other natural sciences. The other three sciences are concerned with studying our natural world, while chemistry is largely concerned with changing our world.

This uniqueness becomes apparent when one looks at the two great themes of science: the astronomy-physics direction, focussing upon the origins of the universe and the fundamental particles of matter; and the geology-biology direction, looking at the evolution of life on earth. In fact, contemporary works on the philosophy of science often focus on the controversies in these two areas: how did the universe start; and how did life originate?

So where is chemistry? In this scheme of things, it is doing the mundane tasks such as explaining how rocks form as a result of ionic and covalent bonding, and how DNA functions by means of hydrogen bonding. This is very important, but it does not, I believe, reveal the beauty nor the excitement of chemistry. Neither is it at all controversial, for the existence of ionic and covalent bonding and inter-molecular forces have been widely accepted for decades.

When we look at what scientists do, then the difference becomes clear. Astronomers do not "make" new stars; biologists do not "make" new life forms; geologists do not "make" new strata; but chemists do make new chemical compounds. Chemists make compounds that have never before existed in the history of this planet (and even the universe). Most of the excitement in chemistry comes from creation, not observation, hence it is a very different sort of science. So, chemistry does not really fit in the natural sciences as it is really a synthetic science.

To discover this excitement in print we have to look in an entirely different direction, to such books as Taking Things Apart & Putting Things Together, Molecules, Chemistry in Context, Chemistry in the Marketplace, and The Cambridge Guide to the Material World. It is the "molecular engineering" aspect of chemistry that provides most of the real wonder of the subject. Chemists are at the forefront of the design and synthesis of new and exotic materials that will change our lives — superconductors, novel polymers, designer drugs, species-specific insecticides, and so on.

Chemistry is a pure and an applied science, for what chemists synthesize in the laboratory may become a multi-million dollar product. There is no "industrial biology" as such, but industrial chemistry is a major contributor to both the Canadian and American economies. At the present time, the Canadian chemical industry employs about 84,000 people and of added importance, chemistry has been identified as one of the engines of the New Economy.

So when you explain what chemistry is, don't try to fit it into a box along with the other sciences; focus on chemistry as THE CREATIVE SCIENCE.

References

An update from Geoff Rayner-Canham

So have things changed since the original article was written? There have been some very good resources written in recent years, including: Napoleon’s Buttons, by Penny LeCouteur and J. Burreson, together with a useful series of books by Joe Schwarcz. In addition, Simon Cotton has been producing a
wonderful series of web pages on chemical compounds in the news. But is the message getting through to our students and to the general public? I fear not. We still hear people say about a product: “But does it contain any chemicals?” I have come to the conclusion that our teaching of chemistry is at fault. We have become calculation-obsessed. Instead of convincing our students that chemistry is about mole calculations, we should be focussing more on real chemistry, such as important chemical compounds and how we can explain their physical properties in terms of bonding and inter-molecular forces. This is the real chemistry that affects people’s lives. And it can be done. I take an outreach Chemistry program to schools in remote (often aboriginal) communities during which students get ‘turned on’ to chemistry not through ‘magic’ demos but through the chemistry of new materials, of hydrophobic and hydrophilic substances, and of polymers.

References


[Editor’s Note: Geoff and Marlene Rayner-Canham have a new book called “Chemistry was their Life, Pioneer British Women Chemists, 1880-1949” due out this month. Go to www.worldscientific.com for more information. Chem 13 News plans to have a review in 2009.]

Bruce Mattson’s Ad

Nick Kim, New Zealand

Do I contradict myself?
Very well then I contradict myself,
(I am large, I contain multitudes.)
Walt Whitman, “Song of Myself”, US poet (1819 - 1892)

Nick has a new website, http://www.lab-initio.com/, where he posts his creative cartoons. Mugs, t-shirts, etc. with Nick’s cartoons are available online.