



Scientist Mentor Idea #1

CONTRIBUTING YOUR TOXICOLOGY EXPERTISE TO K-12 STUDENT CLASSES: IDENTIFYING COMMON GROUND

In recent years, much attention has been focused on bridging the gap between scientists and K-12 science education. One barrier for many career toxicologists willing to volunteer time in K-12 classrooms is uncertainty about what is currently taught in schools, which makes it difficult to know where toxicologists can contribute most effectively. **This collection of ideas was compiled to help toxicologists working with K-12 teachers to integrate toxicology and related environmental health concepts into existing elementary, middle, and high school curricula.**

Now let's get ready for discussions with K-12 teachers about how your expertise relates to subjects they teach! Many of the ideas below that you might suggest to the teachers were offered by K-12 science teachers and SOT scientist mentors participating in the Society of Toxicology's annual "Paracelsus Goes to School" teacher education workshops held in Anaheim, Cincinnati, Seattle, New Orleans, and Philadelphia from 1996-2000. Some suggestions came from teachers in response to the questions: "Do you teach toxicology and environmental health science concepts in your classes?" and "If so, what works particularly well with your students?" Other ideas were offered by SOT members who have had successful K-12 classroom experiences.

Elementary School students can learn to appreciate the importance of responsible use of chemical products and other toxicology principles. Science is not always taught as a separate subject; however, discussions typical of elementary school classes on the following topics provide many opportunities to weave basic toxicology and environmental health science concepts into the conversation and activities appropriate for this age group:

- * personal health, hygiene, and proper eating habits
- * poison awareness and the need for labels on medicines and other household products
- * clean air, clean water, the value of keeping our planet healthy (keeps us healthy!) and how everyone can work toward minimizing pollution (e.g., conservation of resources, recycling and proper disposal of batteries, pesticides, etc.)

Middle School teachers suggest many ways in which toxicologists visiting their classrooms can bring special expertise and stimulate interest and enthusiasm for learning general science, health science, earth science, environmental science and other specialty science areas. At this stage, although students have not had an entire course in chemistry, most have some idea of what a molecule is, and many classes are performing simple chemical tests on soil and water samples (e.g., using pH meters, lead check "sticks", etc.) and working with microscopes and live biological specimens (worms, water fleas). Vocabularies are growing exponentially at this age, and you can help students and teachers by defining technical terms. Be sensitive to use of acronyms and jargon.

- * water and air pollution, both indoors and out, and specific effects on the health of our bodies
- * effects of pollution in our communities and on wildlife species
- * toxicity of household chemical products
- * hazards of drugs, alcohol and cigarettes
- * studying the basic structure and function of all types of cells (can lead to discussion of uptake of chemicals, effects on DNA and other organelles, etc)
- * animals in research

In **High School**, many students continue to study ecology, conservation and environmental sciences. Students also begin more detailed and systematic study of the basic sciences of human biology, physiology/anatomy, chemistry, and physics. Some teachers have even reported integrating toxicology into elective courses in biochemistry, pharmacology, oceanography, and horticulture.

- * impact of activities of modern society on the environment: constituents of toxic wastes; groundwater and surface water pollution; acid rain, how it occurs and what it does

- * in biology/human biology, there are numerous ways to relate to and enhance subjects students are already learning about (e.g., DNA and how chemicals can affect replication; nervous system structure and function: neurotransmitters and enzymes that break them down, such as acetylcholinesterase, can be inhibited by certain pesticides; liver function and what it does to xenobiotics, etc.)

- * in chemistry, awareness of what "toxic" means; how to read an MSDS; chemical hazards in the home; "Chemistry in the Community;" safer alternatives; food additives and their chemical properties and uses; "families" of molecules and how they break down

- * in physics, air pollution and properties and behavior of toxic gases

- * drugs, alcohol, and cigarettes -- health hazards to you and those around you!

Non-Science Subjects in Middle and High School: Some creative K-12 teachers even report using their beginning knowledge of toxicology to illustrate key concepts and liven up math, English, history, social studies, ethics, and other non-science classes:

- * Math: ppm, ppb, etc - placing value in math

- * English: term paper on toxicology; reading big, 'foreign' words on labels; reading news articles on toxicology and environmental health issues

- * History: discussions on "Toxics in the Classics," "Lead and the Roman Empire," "Paracelsus: what was life like in his time?"

- * Social Studies/Civics: What can students do to promote responsible use and disposal of chemicals? Right-to-Know Laws; worker health and safety practices and laws

- * Ethics: benefits vs. risks of chemicals; use of animals in research

After identifying specific subject areas you feel most comfortable with, consider some fundamental objectives that teachers at all K-12 levels are expected to meet following recent reforms in K-12 science education:

- * integration of ideas and information across disciplines

- * relating scientific concepts to real world applications and situations students have experienced

- * age-appropriate inquiry-based learning (encouraging students to ask questions and not accept information as fact without asking why, doing experiments, posing questions that may not have definite answers, etc.). Of course, Toxicology ***is itself*** an interdisciplinary science with ***many*** real world applications.

Therefore, the main challenge that remains for a toxicologist to become a successful K-12 classroom mentor is to think of ways to encourage young students to ask questions and engage in creative problem-solving. See other Scientist Mentor Idea handouts for additional tips.

Most importantly, relax, have fun, and remember that volunteering to work with young students can have a lasting impact on future generations of scientists!

Credits: Scientist Mentor Ideas are a creation of the K-12 Education Subcommittee of the Society of Toxicology's Education Committee. Many of these ideas came from teachers and toxicologists who participated in the annual "Paracelsus Goes to School" K-12 teacher workshops sponsored by the SOT with support from the National Institute of Environmental Health Sciences. Idea Sheet #1 was originally inspired by Neal Biggart, Ph.D., Bonita Vista High School teacher, Chula Vista, California, and a 1996 "Paracelsus" program participant.