



Environmental Chemistry

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From students in class to people in real world
From known to unknown, taught to un-taught
From study to research

Two Worlds:

Textbook World:

Unquestioned Answers

Real World:

Unanswered Questions

From students in class to people in real world



Ebbing, General Chemistry, 4th ed.

Under student (study for known) in schools:
Know it, Understand it (get it), Do it,
Do it Right.

...**Unquestioned Answers**

People in real world:

Don't know it, but you can learn it by
yourself.

Never do it before, but you can learn
to do it, and do it right.

...**Unanswered Questions**

Research (exploration for unknown):
A bridge to real world

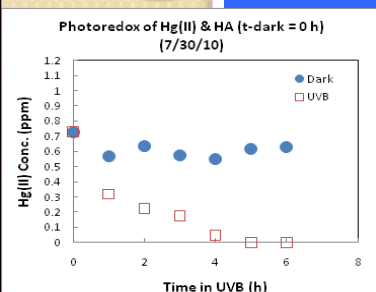
No one knows it or understands it,
but you find a way and get to know it,
understand it, and do it.

My Research

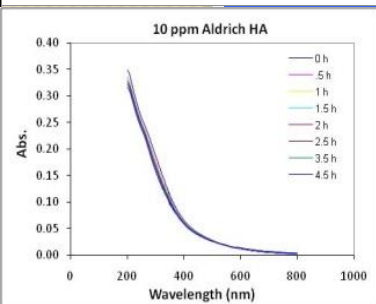
- In my research group, we are doing both
 .lab experiments
 ..field work
- Depending on funding, resource, and research topic, and each individual student's interest, I will work with students to come up with fun, interesting research project.

Research:

- Kinetics and mechanisms of photochemical redox transformation of Hg in aqueous systems*



This is a continuation of a previous project collaborating with ORNL funded by US DOE. DOE's new Science Focus Area (SFA)



We do lab experiments to learn kinetics and rates of Hg dark and photo redox and try to understand the mechanisms and processes behind.

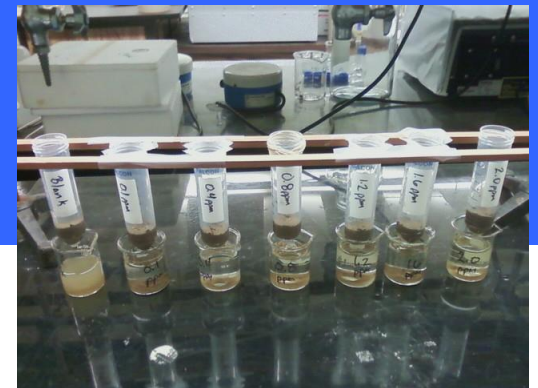
Students: Tao, Stephen, and Zach (graduated)

Research: *Hg(II)* Transport in Soil Column

- Adsorption of atmospheric Hg(II) by soil through leaching of rain waters: A laboratory simulation study

We try to learn the fate of atmospheric Hg(II) deposited to soils, where it goes?

Student: Carrie (graduated)



Research: *Environmental Chemistry and Photochemistry of Fe(III)*

Photochemical redox of Fe(III)-Organic Ligands (OL), such as organic acids and humic acids/fulvic acids

This has important implications to many environmental chemical reactions and processes

Basic principle:



Note: Organic radicals are strong reducing agents

Student: Carson (graduated)

Research:

*Environmental Chemistry of **Humic** Matter*

- Humic matter: humic acid (HA), fulvic acid (FA)
 - very important chemicals in the environment
 - affecting transport, transformation, and fate of pollutants
 - controlling natural environmental systems

Students: Carrie, Zach (graduated)

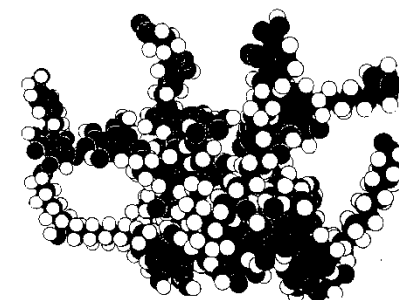
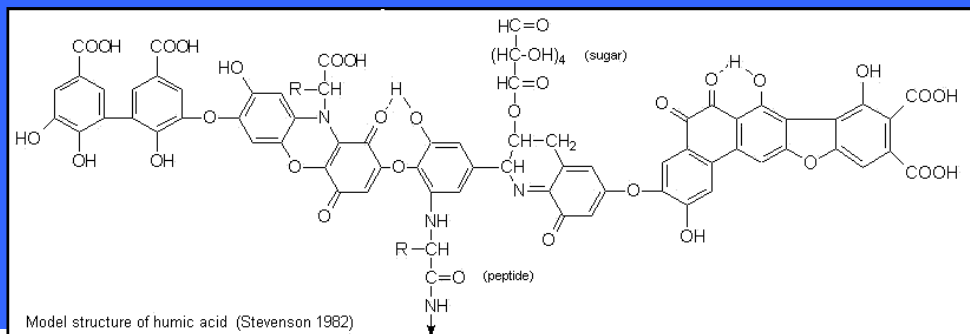


Figure 7 Geometry-optimized and energy-minimized three-dimensional structure of soil HA. (From Schulten, H.-R., The three-dimensional structure of humic substances and soil organic matter studied by computational analytical chemistry, *Presentes J. Anal. Chem.*, 351, 62, 1995. With permission.)

Doing Science

- ***A note/tip for student research:***

The topic of research is not too critical.

The most important is to gain experience and learn how to do research and have one discovery or two.

The topic is just a vehicle to take you there.

- ***A note/tip:***

The stages of undergraduate research:

Stage 1. undergraduate research ***Experience***

Stage 2. undergraduate research ***Result***

Stage 3. undergraduate research ***Discovery***

Note: Discovery means something new, new product, new property, new phenomenon, or new method, etc.

Doing Science is Fun

.Doing research is like chatting with nature.

..It's fun chatting with nature.

...You can make one discovery or contribution or two.

....Give it a try, then you'll know it for yourself.

Sun, Lake, Tree, Beach, and Dream...

