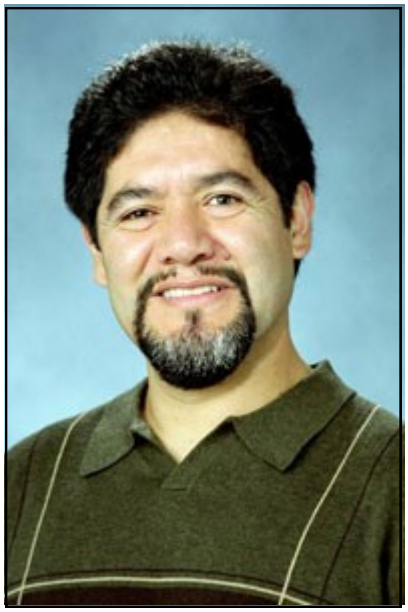
Molecule Mystery

Why does water evaporate? Where does it go? How is it possible that it disappears? These are the types of things Mario Rivera was curious about, even as a child.

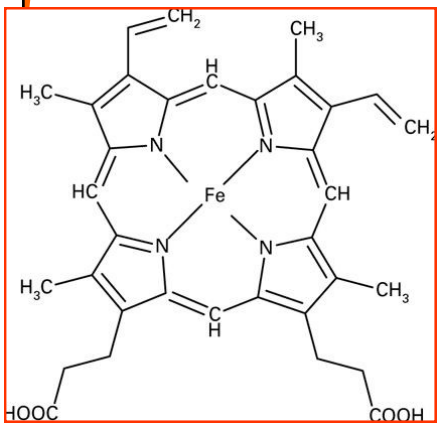


When he was about 12, he read of the discovery of phosphorus, a non-metallic element which sometimes glows in the dark. That's when he decided he wanted to be a chemist. Mario told his parents, and his dad got books on chemistry just to learn about it himself. Then he and Mario could talk about chemistry and he could answer questions his son might have.

"I learned—never question kids' interests. Never hesitate to open the door for them!" says Professor Rivera, who today is a professor of chemistry at the University of Kansas in Lawrence.

Chemistry is a science that deals with the structure, composition and properties of substances and their transformations.

Professor Rivera finds dealing with atoms and molecules amazing. "For instance," he says, "The nuclei of atoms are so small in size and the space between them is so large, that if you took the Statue of Liberty and took out all the space between the nuclei of the atoms in the statue, its size would be reduced to something smaller than the tip of a pencil!"



HEME MOLECULE

Rivera's special research interest is the study of protein molecules that reside in your body. Proteins are thought to be the main ingredients of living cells. Your body has thousand of kinds of proteins which work together to carry out processes that sustain life.

Some proteins have a heme co-factor—which is a flat molecule within your body that carries oxygen. (It is this oxygen being bound to the heme-iron in a protein in your blood called hemoglobin that gives your blood its red color.)

This heme-containing protein also works in partnership with other proteins in your body to carry out reactions where needed. For example, chemical changes made by the heme-containing protein in your liver help detoxify it.

The heme molecule cannot do all this chemistry by itself. "We are trying to understand how proteins and hemes talk to each other so that changes are accomplished," says Rivera. He is interested in the fundamental building blocks of these molecules and how they work, so other scientists can use this information to study things like diseases.

Rivera uses spectroscopy to study the molecules. Spectroscopy is a way in which various kinds of light—like infrared or ultraviolet—interact with molecules. How atoms vibrate, rotate or respond to the different kinds of light tell scientists things about their nature.

As scientists figure out what these spectra mean, they figure out the "rules" to understanding the molecules. "It is a way in which scientists and molecules can talk," says Professor Rivera.

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