"Before you become too entranced with gorgeous gadgets and mesmerizing video displays, let me remind you that information is not knowledge, knowledge is not wisdom, and wisdom is not foresight. Each grows out of the other, and we need them all."
- Arthur C. Clarke

Nurturing an interest in science, particularly at the High School level, is about helping students understand the power of the scientific process and the tools at their disposal. Middle School students may benefit from slick 'gee-whiz' science entertainment. I contend that High School students do not benefit from being entertained, they benefit from being challenged. This requires a teacher with the depth and breadth of knowledge to design the lessons that will allow students to discover their scientist within.

High School science students have much in common with beginning violin students. The teacher of violin, or any other unfretted stringed instrument, must be patient and kind with students, but must persevere until middle C sounds like middle C. The students must be willing to sharpen their sense of pitch, and the teacher must already have some mastery of the skill. By empowering students with the ability to create correct notes, they can go on to scales and eventually to extraordinary heights. Their foundations are solid.

How is a solid foundation in science achieved? First, it is based on concepts, not terminology. Vocabulary without understanding is like the violinist who believes C is somewhere between B sharp and D flat. Conceptual teaching of science has been brilliantly demonstrated by Robert M. Hazen of George Mason in a series of books on science education.

Traditionally, students are taught that Protons and Neutrons are in the nucleus of an atom and Electrons are in some type of shell or orbit. This information stays with the student until the final exam, because the students only memorized isolated facts. I contend there is a better way. One can present the same information as a journey of discovery.

Experiments by Ernest Rutherford in the early 20th Century can be readily demonstrated that show the basis of atomic structure. Further work from Nils Bohr a quarter century later further refined the structure, particularly electron structure. By viewing the unveiling of atomic structure as a process of research, that is, careful experimentation punctuated with intuitive leaps, students can experience the dawning of the understanding of the building blocks of our universe. This leads to fundamental understanding and not simple memorization. The same learning process is true for Chemistry, Physics, and the Biological Sciences. As Albert Einstein said, "It should be possible to explain the laws of physics to a barmaid"

Springboarding from pioneering works from the great scientists of the past, students can then learn to appreciate the simple elegance of the scientific method. Students see how hypotheses were either supported or destroyed in the past, and can apply the same logic to designing their own experiments. Traditionally, science laboratories consisted of following a 'cookbook' to achieve a very predictable and uninteresting result. These exercises did little to teach science students how to think. Empowering groups of students to design their own experiments is a superior way to facilitate learning.

Once the basic concepts are understood, and the scientific method has been internalized, then it is time to teach critical thinking. Students with solid foundations in

scientific inquiry soon discover that they have the capacity to separate the wheat from the chaff in scientific reporting. I consider this the demystification of science. Teaching how to look at all science with a critical eye will give these High School students a great advantage when they enter college.

In summary, whether I teach Biology, Chemistry, or Physics, I will be teaching a process. This process allows students to understand, not memorize, why the world is the way it is. Then they will learn how to expand their knowledge through observation and experimentation. When this is achieved, my students will develop a critical eye so that they can filter out the noise that permeates scientific reporting today. That is when foresight starts to develop.