Scientific Values

Scientists and engineers generally adhere to an informal set of values that serve as the basis of ethical conduct in the disciplines. Budding scientists and engineers are also expected to adhere to these rules of conduct. Unless these rules of conduct are expressly stated, students in an introductory lab course might never know them. What follows are one science educator author's interpretation of expected personal behaviors.

Cooperative attributes (and how students can demonstrate them in lab):

- *Be well informed* – Come to lab well prepared. This means not only to complete the required PreLab, but to have reviewed carefully the purpose of the indicated lab and given some thought to the required inquiry practices to be utilized in achieving stated goals. Read pertinent sections of the *Student Laboratory Handbook.*
- *Stay focused* – When in the laboratory setting, the emphasis should be on the first part of the word laboratory (labor) and not on the second (oratory). Work diligently on the task at hand, and see it through to completion with dispatch. Everyone should contribute to the best of his or her ability.
- *Evaluate alternatives* – Listen to others in your group; perhaps someone with an alternative approach might, in fact, be pointing out the best approach. Consider all arguments carefully before making a decision.
- *Take supportable positions* – Positions in lab should be based on evidence and critical thinking. If you hold a position contrary to that of you colleagues, justify it.
- *Being sensitive to others' positions* – Not everyone will agree in lab. If you disagree with another person in your group, then find a solution using reason and evidence. Criticize the idea, not the person.
- *Seek precision* – Don't be satisfied with "good enough." Try your best to minimize experimental error and improve your results. Strive for accuracy in word and action.
- *Proceed in a logical and orderly manner* – For many of you, this will be the first time you have been asked to design and conduct experiments. Think the process through carefully before collecting data.

Individual attributes (and how students can demonstrate them in lab):

- *Be well informed* – Come to lab prepared with an understanding of what it is you intend to accomplish and ideas for how you will accomplish it. This generally means completing the PreLab work, and reading through the lab guidelines in their entirety while attempting to understand. Also, don't forget to read the articles in the *Student Laboratory Handbook;* it has many good articles dealing with practical lab matters.
- *Stay focused* – While working in lab, it is important to stay focused on the task at hand. Avoid wayward discussions. The focus in *labor*atory should be on *labor* and not on oratory.
- *Be willing to evaluate alternatives* – While you will arrive in lab with your own ideas about how a task should be accomplished, carefully weigh ideas and comments by your lab partner(s) dealing with alternative approaches before coming to a firm decision.
- *Maintain only supportable positions* – You should always be sensitive to the positions of other. If, however, there is a justifiable reason for taking one approach over another, then stand your ground. Supportable positions are tenable. Ask for outside commentary from your lab instructor if you have reached an intractable disagreement about how to proceed.
- *Seek precision* – Always strive to be as accurate as would reasonably be expected of a scientist. There is no excuse for sloppy lab work. It would never be accepted by the

scientific community in professional research, and won't be accepted in the introductory lab setting as well.

- *Proceed in a logical and orderly manner* – Plan your work before executing it. Failure to do so is like using a calculator to "solve a problem." Calculators don't solve problems; people do. The calculator literally calculates a solution, and can only do so after a human has reasoned out the approach to a solution. Merely using scientific hardware and software won't solve problems; nothing can replace good intellectual thought.
- *Be sensitive to others*– When working with your colleague(s), be considerate of his or her needs and concerns. Show proper respect; listen to others; think before you act.
- *Think critically* – There are many definitions of critical thinking, and any of the following would apply: "reasonable reflective thinking that is focused on deciding what to do and what to believe" OR "interpreting, analyzing or evaluating information, arguments or experiences with a set of reflective attitudes, skills, and abilities to guide our thoughts, beliefs and actions" OR "examining the thinking of others to improve our own." Strive to apply critical thinking to your tasks.
- *Be intellectually honest* – Evaluate all pertinent evidence carefully and systematically. Avoid prejudicial decision-making.
- *Avoid unwarranted closure* – Avoid leaping to conclusions if data don't support a particular position.
- *Demonstrate personal integrity* – Never "fudge" data to make it fit the expected outcomes. Never eliminate data unless there is a clear and defensible reason.