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ETHICS IN SCIENCE AND SOCIETY: AN OVERVIEW

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ABSTRACT—The impact of scientific activities on society is discussed in light of the way scientists do things. The three most common facets of unethical behavior of which scientists may be found quilty are given with a discussion of each and, finally, how this behavior impacts society. Ethics, science, and society are defined, and an overview of the importance of ethical behavior in general is given.

Today, more than any earlier times, there is heightened awareness of ethics and its importance in all facets of life. This includes the workplace, the home, the school, hospitals, the church, and society in general. Life is a stage upon which one acts out his or her role until the act is over and the curtain is drawn. The lessons acted out are learned at home and carried forward into society for expansion and fine-tuning.

Within this context, society may be defined as "a community, nation, or broad grouping of people having common traditions, institutions, and collective activities and interests." For the purpose of this article, the appropriate definition for "science" may be given as knowledge covering general truths or the operation of general laws, especially as obtained and tested through the "scientific method". An appropriate definition for scientific method may be stated as a systematic pursuit of knowledge that proceeds as follows: 1) recognizing and formulating a problem; 2) collecting data through observation; 3) formulating hypotheses based on observation; 4) testing hypotheses through experiment.

Science and the activities of science, by their very nature, impact society either directly or indirectly. The activities of science are based on uncovering truths resulting from the observation of nature or naturally occurring phenomena.

What does society expect of scientists? Strangely enough, society looks to science and scientists as the main source of innovative ideas and the driving force for technological advances and technology transfer. Society looks to science for miraculous "breakthroughs" in medical research, basic research, and the improvement of the quality of life in general. Even today, there are many mixed reports on the advantage (or disadvantage) of antioxidants as supplements in the diet. All of the results are supposedly based on research. However, who is to say one theory is right and the other is wrong? Who is to say that one result is based on excellent research while the other result is based on "sloppy" research? In each case, the individual scientist must have the intellectual honesty to observe, interpret, and report data accurately. In retrospect, one must recall discoveries that brought into existence the "wash and wear" fabrics, cooking utensils with "no-stick" lining, polymers in general and biodegradable polymers, improvements in the cosmetic industry by producing products that allow all types of hair to be given permanents, and numerous other new or improved products. This is a tremendous responsibility placed on scientists by society. Such responsibilities present terrific challenges, and true scientists must meet the challenge.

After following the scientific method as described, the data resulting from hypothesis testing by experiment must be analyzed and interpreted. Also, the experimental design must have been carefully laid out in a manner that will achieve the goal of the experiment. Another aspect of grave importance with which the scientist must reckon is accepting what is observed even though it may differ from what was predicted by the hypothesis. Of course, what is obtained at this point is, in large measure, the result of experimnetal design and technique of the experimenter.

Definitions have been given for society and science in terms of the scientific method, but the key term "ethics" has not been defined. For the purpose of this document, ethics may be defined as the principle of conduct governing an individual or group; hence, this whole business of ethics and ethical behavior becomes an individual activity. However, an individual leading a group could persuade the group he or she is leading to conform to his or her mode of conduct, whether it be ethical or unethical. Believe it or not, almost anything that gets into the printed page will be believed by someone, truth or untruth. This is most unfortunate and really highlights the fact that true scientists must be self-disciplined and sworn to being truthful and, above all, fair. Scientists must operate with an "open mind," and this open-mindedness must spill over into all facets of activity whether it concerns dealing with humans or with inanimate objects.

As the 21st century slowly comes into focus and the 20th century slowly fades, there is cause for reflection and projection. The terms or phrases that are heard and read all too frequently among scientists today include all facets of unethical behavior which are plagiarism, conflict of interest, scientific misconduct, and lack of basic integrity. Maddox (1991:13) feels that plagiarism is the worst offense that attacks or is against scholarship. The main characteristic that sets one apart or contributes to uniqueness in an individual is his or her creativity or originality. When plagiarism is the culprit, no one knows who the real author is. Even though the one doing the plagiarizing rewords the thought a little differently, this individual would not have had the thought to work with except by taking it from someone else. Yes, plagiarism is very "ugly" business.

Koshland (1990:109) presents some interesting aspects on conflict of interest, pointing out just how easy it can be to observe conflict of interest in the activities of others, but how difficult it is to recognize the same in our own activities. Marshall (1994:747) brings out the extent to which some individuals will go to convince themselves of the presence

(or absence) of conflict of interest in the peer review system that is practiced in scientific circles. They will bring lawsuits against agencies and individuals in an effort to prove the presence of conflict of interest. This form of unethical behavior is somewhat difficult to "nail" down unless it is reflected in the reviewer comments. Even then, the reviewer's name will not be revealed. There may be laws in the making that will bring federal funding agencies to submitting open discussion between applicant and reviewer when there is controversy over proposals being rejected.

Anderson (1994:747) speaks out on mixed signals being sent by the federal government via reporting on activities of the National Academy of Sciences and other similar entities concerning scientific misconduct. This aspect of ethics (or unethical behavior) is one that many scientists find difficult to recognize, and, if recognized, they find it difficult to say it is wrong. A Commission on Research Integrity was mandated by the National Institutes of Health Revitalization Act of 1993 and subsequently chartered. The members represent science, academic administration, law, and ethics. The Commission has been charged with making recommendations to Health and Human Services and Congress on how the Public Health Service should deal with scientific misconduct in federally-funded research. Zurer (1994:20-21) reported that Kenneth J. Ryan, a Harvard Medical School Professor and Chairman of the Commission on Research Integrity, is very concerned about the manner in which the scientific community responds to the problems involved in scientific misconduct. It appears that the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine are joining forces to take the lead in creating an environment that will promote responsible leadership in research and other scientific activities.

There are many instances where scientists violate ethical behavior without realizing their actions are not ethical. All three facets of unethical behavior mentioned can be conducted or displayed in the peer-review process and overlooked or considered ethical. Over the years, there has been speculation that ideas have been taken from proposals read and put into action. Also, it appears that reviewers have allowed their personal biases to intervene in the rating of proposals. Occasionally, this bias is reflected in the reviewer's comments. Of the three facets of unethical behavior, the most difficult to pinpoint is plagiarism. Who is to say that two scientists did not have a "flash of genius" at about the same time? Many such cases can be cited in the archives of scientific history.

How do all these unfavorable activities or unethical behavior in science impact on society? The ultimate effect is the lack of trust coupled with a poor image. It is the responsibility of scientists in leadership roles to set the tone through precept and example for emphasizing ethical behavior in all facets of science.

Basic integrity underlies the principles of ethics. Scientists in leadership roles must possess and demonstrate unwavering basic integrity if unethical behavior is not to be tolerated in those being trained and many of those practicing science. Many laws are being created as well as being reactivated and implemented in an effort to bring unethical behavior in science and society under control.

It must be remembered that ethics and ethical behavior rest on basic integrity, and basic integrity is an individual possession. It cannot be legislated.

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