

# **csid** Center for the Study of **Interdisciplinarity**

## **Ethics of Science in Society**

a discussion of *On Being a Scientist*

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with

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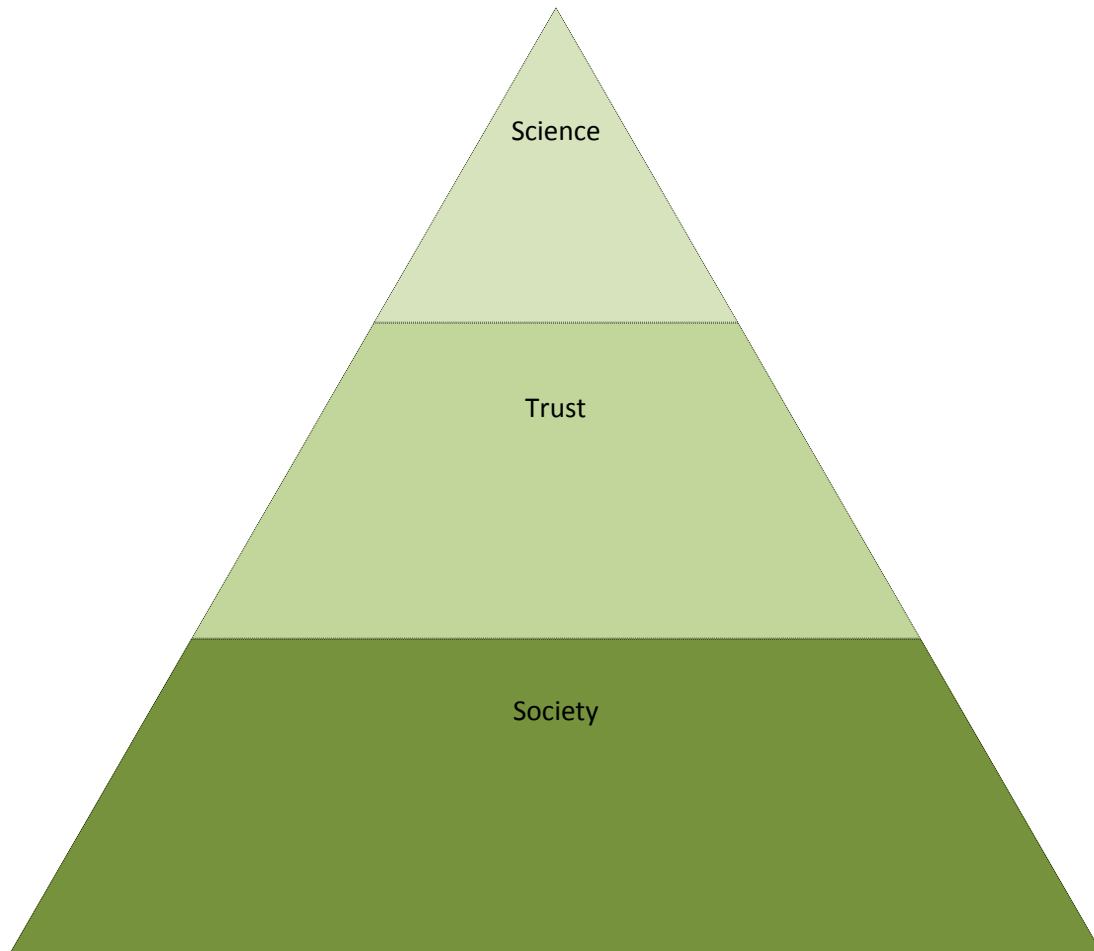
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**Introductory Observations/Questions**

- *Informal education* in ethics in science should be **supplemented** with *formal instruction*.
- *Discussion* serves to uncover “largely tacit knowledge” of ethics in science.
- Science and ethics are ways of knowing or encountering the world ...
- Science is “the body of knowledge held in common by all scientists” (1).
- “Scientific knowledge is defined collectively through discussion and debate” (VII).

*Question: Are these claims consistent? How?*

- “Research ethics is not a complete and finalized body of knowledge” (VII)

*Question: Is science a complete and finalized body of knowledge?*

*Question: What is the relation between ethics and science?*

*Question: What is the relation between science and society?*

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“Researchers often have considerable **freedom** both in choosing what to investigate and in deciding how to organize their professional and personal lives. They are part of a **community based on ideals of trust and freedom**, where hard work and achievement are recognized as deserving the highest rewards. And their work can have a direct and immediate **impact on society**, which ensures that **the public will have an interest** in the findings and **implications of research**” (1 – emphasis added).

“As the influence of scientific knowledge has grown throughout society, nonscientists have acquired a greater interest in assessing the validity of the claims of science. With science becoming an increasingly important social institution, **scientists have become more accountable to the broader society that expects to benefit from their work**” (2 – emphasis added).

#### Current (FY 09) funding levels:

NSF – ~\$6 Billion + \$3 Billion AARA stimulus funding

NIH – ~\$30.4 Billion + \$10.4 Billion AARA

NASA – ~\$17.8 Billion + \$1 Billion AARA

*Key words for discussion: freedom, trust, accountability ... impact, implications, benefits to society.*

Who knows what ‘epistemological’ means?

## 1. “The Social Foundations of Science” – Science as Social Knowledge

“Science is inherently a social enterprise—in sharp contrast to a popular stereotype of science as a lonely, isolated search for the truth. With few exceptions, scientific research cannot be done without drawing on the work of others or collaborating with others. It inevitably takes place within a broad social and historical context, which gives substance, direction, and ultimately meaning to the work of individual scientists.

The object of research is to extend human knowledge of the physical, biological, or social world beyond what is already known. But an individual's knowledge properly enters the domain of science only after it is presented to others in such a fashion that they can independently judge its validity .... Throughout this continuum of discussion and deliberation the ideas of individuals are collectively judged, sorted, and selectively incorporated into the consensual but ever evolving scientific worldview. In the process, individual knowledge is gradually converted into generally accepted knowledge.

This ongoing process of review and revision is critically important. It minimizes the influence of individual subjectivity by requiring that research results be accepted by other scientists” (3).

*Question: What is the relationship between subjectivity and objectivity in science?*

## 2. Scientific methods

“One goal of methods is to facilitate the independent verification of scientific observations. Thus, many experimental techniques—such as statistical tests of significance, double-blind trials, or proper phrasing of questions on surveys—have been designed to minimize the influence of individual bias in research. By adhering to these techniques, researchers produce results that others can more easily reproduce, which promotes the acceptance of those results into the scientific consensus” (4).

*Question: Is an emphasis on reproducible results necessarily conservative?*

*Question: What is the relation between scientific consensus and scientific discovery?*

### 3. Values in Science

“Scientists bring more than just a toolbox of techniques to their work. Scientist must also make complex decisions about the interpretation of data, about which problems to pursue, and about when to conclude an experiment. They have to decide the best ways to work with others and exchange information. Taken together, these **matters of judgment** contribute greatly to the craft of science, and the character of a person's individual decisions helps determine **that person's scientific style** (as well as, on occasion, the impact of that person's work)” (6).

- *Intra-scientific values – values within science*

“Scientists and philosophers have proposed several criteria by which promising scientific hypotheses can be distinguished from less fruitful ones. Hypotheses should be internally consistent so that they do not generate contradictory conclusions. Their ability to provide accurate experimental predictions, sometimes in areas far removed from the original domain of the hypothesis, is viewed with great favor. With disciplines in which experimentation is less straightforward, such as geology, astronomy, or many of the social sciences, good hypotheses should be able to unify disparate observations. Also highly prized are simplicity and its more refined cousin, elegance” (6).

- *Extra-scientific values – values coming from outside science?*

“Other kinds of values also come into play in science. Historians, sociologists, and other students of science have shown that social and personal beliefs—including philosophical, thematic, religious, cultural, political, and economic beliefs—can shape scientific judgment in fundamental ways” (6-7).

*Question: What are some values that have ‘influenced your judgment’? Must all judgments be made according to explicit or implicit criteria, or could someone simply play a hunch, i.e., a ‘criterionless judgment’?*

“The empirical link between scientific knowledge and the physical, biological, and social world constrains the influence of values in science. Researchers are continually testing their theories about the world against observations. If hypotheses do not accord with observations, they will eventually fall from favor (though scientists may hold on to a hypothesis even in the face of some conflicting evidence since sometimes it is the evidence rather than the hypothesis that is mistaken)” (8).

*Question: Is there a real world independent of our observations? How do we know?*

#### 4. Conflicts of Interests – conflict of values

“Sometimes values conflict. For example, a particular circumstance might compromise—or appear to compromise—professional judgments” (8).

*Question: Is it ever possible to make a disinterested judgment?*

*Question: Can we rely on rules as a substitute for judgment?*

#### 5. Publication and Openness

- *The role of pre-publication peer review*

“Science is not an individual experience. It is shared knowledge based on a common understanding of some aspect of the physical or social world. For that reason, the social conventions of science play an important role in establishing the reliability of scientific knowledge. If these conventions are disrupted, the quality of science can suffer.

Many of the social conventions that have proven so effective in science arose during the birth of modern science in the latter half of the seventeenth century. At that time, many scientists sought to keep their work secret so that others could not claim it as their own. Prominent figures of the time, including Isaac Newton, were loathe to convey news of their discoveries for fear that someone else would claim priority—a fear that was frequently realized.

The solution to the problem of making new discoveries public while assuring their author's credit was worked out by Henry Oldenburg [in 1665], the secretary of the Royal Society of London. He won over scientists by guaranteeing rapid publication in the society's Philosophical Transactions as well as the official support of the society if the author's priority was brought into question. Oldenburg also pioneered the practice of sending submitted manuscripts to experts who could judge their quality. Out of these innovations rose both the modern scientific journal and the practice of peer review” (8-9).

*Question: How do values enter into peer review?*

- *The issue of pre-peer review publication*

*Question: What's the problem with non-peer-reviewed publication of results?*

*Question: Who counts as a peer?*

## 6. Allocation of Credit

“The **principle of fairness** and the **role of personal recognition within the reward system** of science account for the emphasis given to the proper allocation of credit. In the standard scientific paper, credit is explicitly acknowledged in three places: in the list of authors, in the acknowledgments of contributions from others, and in the list of references or citations. Conflicts over proper attribution can arise in any of these places” (12 – emphasis added).

So, both an ethical and an institutional justification are given to account for the importance of proper allocation of credit.

Citations serve many purposes in a scientific paper. They acknowledge the work of other scientists, direct the reader toward additional sources of information, acknowledge conflicts with other results, and provide support for the views expressed in the paper. More broadly, **citations place a paper within its scientific context**, relating it to the present state of scientific knowledge” (12).

*Question: What sort of justification is given here for the allocation of credit?*

“Citations are part of the reward system of science. They are connected to funding decisions and to the future careers of researchers. More generally, the misallocation of credit undermines the incentive system for publication” (12).

*Question: What sort of justification is given here for the allocation of credit?*

## 7. Authorship Practices – and the issue of judgment (!) once again

Standards and practices vary greatly from context to context! This includes disciplinary contexts, as well as hierarchical considerations, e.g.:

“Several considerations must be weighed in determining the proper division of credit between a student or research assistant and a senior scientist, and a range of practices are acceptable” (13).

*Question: How should authorship be decided?*

## 8. Error and Negligence in Science

Error = bad, but forgivable, unless ...

Negligence = bad, less forgivable

## 9. Misconduct in Science

“Beyond honest errors and errors caused through negligence are a third category of errors: those that involve deception. Making up data or results (**fabrication**), changing or misreporting data or results (**falsification**), and using the ideas or words of another person without giving appropriate credit (**plagiarism**)—all strike at the heart of the values on which science is based. **These acts of scientific misconduct not only undermine progress but the entire set of values on which the scientific enterprise rests.** Anyone who engages in any of these practices is putting his or her scientific career at risk. Even infractions that may seem minor at the time can end up being severely punished” (16 – emphasis added).

*Question: What types of justification are offered to support the idea that scientific misconduct is unforgivable?*

“The ethical transgressions discussed in earlier sections—such as misallocation of credit or errors arising from negligence—are matters that generally remain internal to the scientific community. Usually they are dealt with locally through the mechanisms of peer review, administrative action, and the system of appointments and evaluations in the research environment. But misconduct in science is unlikely to remain internal to the scientific community. Its consequences are too extreme: it can harm individuals outside of science (as when falsified results become the basis of a medical treatment), it squanders public funds, and it attracts the attention of those who would seek to criticize science. As a result, federal agencies, Congress, the media, and the courts can all get involved” (16).

*Question: How does scientific misconduct undermine the values on which science is based? Which values?*

## **10. Responding to Violations of Ethical Standards**

“Someone who is confronting a problem involving research ethics usually has more options than are immediately apparent. In most cases the best thing to do is to discuss the situation with a trusted friend or advisor. In universities, faculty advisors, department chairs, and other senior faculty can be invaluable sources of advice in deciding whether to go forward with a complaint” (19).

## **11. The Scientist in Society**

“Even scientists conducting the most fundamental research need to be aware that their work can ultimately have a great impact on society” (20).

Since 1997, NSF has required proposers and reviewers of grant proposals to consider two criteria:

### **What is the intellectual merit of the proposed activity?**

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

### **What are the broader impacts of the proposed activity?**

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

“The occurrence and consequences of discoveries in basic research are virtually impossible to foresee. Nevertheless, the scientific community must recognize the potential for such discoveries and be prepared to address the questions that they raise. If scientists do find that their discoveries have implications for some important aspect of public affairs, they have a responsibility to call attention to the public issues involved” (20).

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“In fulfilling these responsibilities scientists must take the time to relate scientific knowledge to society in such a way that members of the public can make an informed decision about the **relevance of research**. Sometimes researchers reserve this right to themselves, considering nonexperts unqualified to make such judgments. But science offers only one window on human experience. While upholding the honor of their profession, scientists must seek to avoid putting scientific knowledge on a pedestal above knowledge obtained through other means” (21 – emphasis added).

*Question: What is the meaning of ‘relevance’ with regard to research, and who is qualified to judge relevance?*

*Question: What is the relation between ethics and science?*

*Question: What is the relation between science and society?*