

INSTITUTE OF CURRENT WORLD AFFAIRS

DRP-12

4284 Hemlock Road
Branchport, NY 14418
June, 1987

99.9999% Truthful

Peter Martin
INSTITUTE OF CURRENT WORLD AFFAIRS
4 West Wheelock Street
Hanover, NH. 03755

Dear Peter,

After reading an editorial written by Daniel E. Koshland, Jr. in *SCIENCE* (235:141), I was compelled to devote another report to cheating in biology. His article opens with "Fraud in scientific research is unacceptable and inevitable," and ends with "we must recognize that 99.9999 percent of reports [scientific papers] are accurate and truthful." This means that only one in a million research papers are untruthful.

A conservative estimate of research papers suspected to be fraudulent and written in the sciences within the last decade would number in the high hundreds. In 1986 alone, for example, a single researcher published sixty-eight papers in medical science that are thought to be fraudulent. If Koshland's estimate was correct, we could calculate that hundreds of millions of research papers have been written in the last decade, which is not true. It is probable that only a small portion of the fraudulent work in science has been revealed to the public, thus "99.9999% truthful" stands as the greatest "statistical" underestimate of scientific fraud in history.

Newsweek (Feb. 2, 1987) has a much clearer and unbiased perspective on cheating in science. Their article, entitled "Tempests in a Test Tube," states that "... fraud is more common in biology than in ... physics, where exact laws of nature serve as a template against which results are measured." Alexander Kohn upholds this opinion in his excellent book False Prophets: Fraud and error in science and medicine, Basil Blackwell, New York. One cannot read Kohn's book without feeling that our science establishment is in the grip of a malignant morality that holds high scientific status above meaningful research.

Probably the greatest source of fraud in science results from tolerance of poor experimental design. It is a tenet of scientific research to eliminate all possible sources of bias. Incredibly, if one were to examine any number of scientific papers, the majority of conclusions contained in these papers would have to be invalidated due to design errors.

The most frequent and serious errors are experimental designs that allow the investigator to make non-random judgments that can change the results of an experiment. Eliminating this

Donald Perry is an Institute Fellow who is developing a new system of access for conducting research in the tops of jungle trees.

source of error is possible by using procedures for "blind" experiments. But this is considered too expensive for most studies because it necessitates hiring technicians who are competent to collect observations or to run experiments while remaining oblivious to experimental or observational goals. It is known that technicians will try to please investigators, so studies that do not guard against this type of bias cannot be considered valid. Unfortunately this means that a large fraction of studies conducted in the world today must be held in suspicion of the simplest and most inconspicuous form of fraud.

A passage from Alexander Kohn's book shows that scientists are aware of the serious flaws in most published research. "Dr. Richard Roberts of the National Bureau of Standards...estimated that at least half of all published scientific papers were unusable or unreliable....Leroy Wolins of Iowa State University...authorized one of his students to write to 37 authors of psychological papers and ask them for the raw data on which they based their research results. Of the 32 who replied, 21 stated that their data had been either accidentally destroyed, lost, or misplaced. Only nine researchers sent their raw data. [Raw data is sacred and professional scientists ensure that this information is safely stored for posterity.] Dr. Wolins, an expert in statistics, analyzed these data and found that only seven sets of results could be statistically analyzed. Of these seven, three contained errors that invalidated what had been published as fact." The number of papers with validated results was only four out of thirty seven! This is a dismal record.

Anyone reading Kohn's book will see that no area of research escapes the specter of fraud; no science is immune from the pervasive human desire to advance in the social system. It has been reported to me that some prominent tropical biologists will not show the raw data of published papers to colleagues. This is demoralizing for the profession; often the papers in question have carried those individuals to "high places."

The frustrating aspect of a jungle full of biological wealth is that tropical nature does not easily give up her secrets. I have seen researchers follow a rigorous line of study for many years and never uncover one remarkable biological discovery. In fact, this is the more common experience.

How might an intelligent botanist or zoologist react when after a year of labor an idea that looked very promising led to pedestrian results? What if the project lasted four or five years and would determine whether a Ph.D. was received? With rare discoveries being a goal of research, the pressure for fraud can be extreme, especially when role-models -- the "fathers of disciplines" -- are often involved in unscrupulous behavior. Fraud exists because it is an accepted and regularly practiced route to attaining dominance within the hierarchy.

A partial list of scientific leaders that have been condemned for fraudulent data, imagined events, and other infractions is enlightening. Robert Millikan, who won a Nobel Prize in physics, received that prize largely for ideas conceived and conducted by his student, Harvey Fletcher. Harvey died a

disillusioned man. Newton is thought to have doctored data, as was Mendel. Claudius Ptolemy faked astronomical observations. William Herschel reported the approach of a comet that in fact was Uranus. Uranus does not act in the reported manner. George Hale, an astronomer at the turn of the century, in an apparent stroke of brightness, fabricated an influential paper on the sun's magnetic field that proved impossible with his own data. Margeret Mead's standards of accuracy were also claimed to have been low.

Science routinely elevates biased ideas into "law" and once this is done it is difficult to have the ideas dismissed. Matters become more difficult when the author is influential. Influence opens the door to a diversity of minor and major ways for an author to exert pressure to keep his (her) ideas circulating. The history of science shows that influential scientists protect their own theories by standing in the way of excellent ideas for decades, if necessary. By far the most interesting aspect of science society is that dominant scientists wield a disproportionate share of influence, far more than their opinions warrant.

According to Kohn, the frequency of fraud is high. He has found that a large fraction of scientists know of several or more instances of dishonest and/or fraudulent behavior. Scientific fraud ranges from out-and-out fabrication of data to the widespread habit of throwing away "bad" data from a data set. The latter, known as "cooking" or "massaging" a data set, is one of the fastest ways to become (and to remain) a prominent scientist. Cooking, combined with subtle and persistent politicking and socializing, is the most direct approach for individuals to quickly climb the hierarchical ladder.

I have often heard scientists, some of them prominent, make a curious statement pertaining to fraud. It goes something like this: scientific fraud is of little significance. They reason that if an area was important (this raises the sticky question of which fields are important), then fraud would soon be discovered by the many scientists who are certain to repeat experiments. This claim is nothing but a smoke-screen. Ironically, erroneous "research" can easily survive through dozens of repeat experiments simply because scientists "want" their experiments to confirm the results of the erroneous study.

Repeat experimentation has almost no meaning in tropical biology because studies are almost never repeated. When studies are repeated, they often do not agree. In this atmosphere one need not be shy about publishing fraudulent papers. The process of uncovering fraud is so protracted that it may take from one and a half years to several decades to accomplish, even a life time -- or never, which is common. The bonus is that the fraudulent theory could still be accepted by the scientific community and the scientist would retain his position. Much questionable work will not be openly brought under suspicion because the author is still living and scientists are afraid of repercussions.

Leading scientists will not come forward and admit that fraud is a problem because they feel it is essential to protect the image of science. They believe that if the possibility of invalid studies was known, there would be less interest in

funding research. Also those who have used fraud to get to the top will defend the purity of scientists because it would become risky if fraud attracted too much publicity. This deception is easily perpetrated because scientists, like doctors in malpractice suits, protect colleagues even when there is ample damning evidence. Alliance has a higher value than morality, and the hierarchical order is more important than truth.

The comical side to the demise of morality in science is that a hidden "honor among thieves" code exists. This code is now evident in research on superconducting materials that is being revolutionized by a new class of compounds. These substances superconduct (zero resistance) at much higher temperatures than were previously thought attainable.

The above refers to the publication of a study concerning the discovery of one of these new superconductors by Paul Chu and others. It must be emphasized that this is potentially a highly commercial product. Chu's manuscript, of course, underwent the infamous process of peer-review. One thing that is decided in peer-review is whether an idea is worthy of theft. Thus, there has been some speculation that Chu, in his pre-publication manuscript, purposefully mislabeled one of the elements to his unique compound specifically to protect his discovery while applying for a patent. Chu modestly claims that it was a typographical error.

Now Chu is branded a liar by the peer-review thieves who had been duped. Thieves do not like discovering that they spent precious time stealing costume jewelry. I take my hat off to Chu who stung his colleagues with the pure reflection of their own morality.

"Publish or perish" and the peer-review system operate much like the social structure in Lord of the Flies, elevating greed, social status, and conformity as motivating forces in publication. In this system scientists are coerced into running a sordid treadmill where biological truth is weighed in positive citations given to senior scientists. Citation is considered so important that it determines who the leaders of science are as well as who will remain the leaders. Those with the most power can demand the most citations; research funds are allotted only to subordinates who demonstrate a "flexibility" in citing leaders. A common result of this system is that subordinate scientists are not allowed to determine what they will study or write.

In an article entitled "Bad, bad, bad, bad, citations," (New Scientist, May 1, 1986) Richard Wilson writes that citation counts are often used "as the single most reliable measure of the excellence or otherwise of scientific output." Wilson finds a sinister element in this convention because citations for articles and proposals are not selected for their intrinsic merit.

Today statistics are nearly an absolute requirement to publish field biology research. For statistics to be successful, all bias must be removed from experimental design, yet this is seldom accomplished. The result is that statistics often make fraudulent research appear correct. Statistics offer the quintessential alibi for fraud; not only are the figures

difficult to validate, they are the scapegoats when fraud is discovered. Statistics not only hide fraud, they increase the incidence of fraud.

Another myth often referred to by dominant scientists is that the science community operates on the "honor system." What does honorable mean? Honor is part of the human hierarchical system, a code of behavior that helps to organize society. In science, honor's less-recognized but major function is to keep subordinates working at time-consuming tasks while allowing cheaters to advance to dominant positions. If a researcher, out of a sense of honor, publicly reveals that another researcher has been cheating, the informer is considered dishonorable. If loss of honor in the eyes of one's peers does not dissuade squealers, being "black listed" on the job market does. Few want a squealer working with them, especially if numerous forms of cheating are standard operating procedures. Honor and loyalty serve only to perpetuate a fraudulent-based science society.

In science, dominance is routinely confused with scholarship. The dominance system is the major disease of science because un scholarly people often gain control of other intelligent, professional scientists who find the hierarchical game distasteful. Often dominant, senior scientists, out of great insecurity, will use their power to try to divert intelligent subordinates, often young scientists, into tasks that perpetuate the dominant researcher's career. If these subordinate scientists refuse to operate as "slaves," financial support ends. Most scientists find themselves in a social atmosphere that is little different than slavery.

Given uncontested monopolies, unsupervised research, bias of passion, a loose mathematical framework, the frequent use of statistics for cheating, desire to climb the academic ladder, the institutional pressure to publish frequently, a legacy of cheating by "fathers" in the field of science, a desire to uncover biological laws with a minimum of effort, simple access to ideas of peers through secret peer-review, simple access to students' ideas by professors, senior scientists dominating scientists, and a Pandora's box full of petty ways of cheating -- I would make a purely speculative guess that the number of at least partially fraudulent research papers in biology is higher than fifty percent of those published annually.

I find it incredible that scientists, a group composed primarily of subordinates, would submit to a social system that gives them absolutely no say over the structure of their society. The old-boys determine everything. They are the crown-wearers of a social system that has drifted down unchanged through forgotten corridors of time to haunt life in our increasingly complex world. Science society, because it has direct access to knowledge of human behavior, should be at the forefront of perfecting a equitable social system. Inexplicably, however, science society retains basic social problems that have been handed down to us from our ape heritage.

One might claim that scientists are not interested in social problems, inside or outside of science society, and that they are just concerned with research. Dominant scientists, however, are particularly interested in the outside world and its ills.

Examples are everywhere in literature.

I cannot resist bringing to you ideas on how some economists would try to improve the outside society. It is my contention that the same basic changes that James Buchanan, the Nobel Laureate for Economics of 1986, thinks must be done in governmental economics are also desperately needed within science society. The first quote is quoted by Buchanan in his recent article in Science (12 June 1987, p. 1433).

"The science of public finance should always keep ... political conditions clearly in mind. Instead of expecting guidance from a doctrine of taxation that is based on the political philosophy of by-gone ages..."

(Knut Wicksell, 1896)

"The vision of politics that informed the thinking of James Madison was not dissimilar, in its essentials, from that which informed Knut Wicksell's less comprehensive, but more focused, analysis of taxation and spending. Both rejected any organic conception of the state as superior in wisdom to the individuals who are its members. Both sought to bring all available scientific analysis to bear in helping to resolve the continuing question of social order. How can we live together in peace, prosperity, and harmony, while retaining our liberties as autonomous individuals who can, and must, create our own values?"

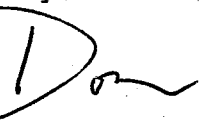
(J.M. Buchanan, 1986)

One must wonder why it is that scientists on the one hand are quick to recommend improvements to governments yet do nothing to improve their own social environment. I seriously doubt that dominate scientists would want subordinate scientists creating their own values and exercising their liberty.

I agree with the thinking of Madison, Wicksell, and Buchanan. It is time for scientists to retain their liberties, and moth-ball a social system that totally excludes scientists from participating in and formulating crucial values of the social and political environment within which they live. Scientists need a social constitution and I can think of no better time to begin than now as we celebrate the bicentennial of the American Constitution.

Interestingly, it is among the young and subordinate scientists that many major advances of scientific thought are made. All of humanity would benefit from a system that helped these scientists determine their own scientific futures.

Sincerely,



P.S. This report has been peer-reviewed and the reviewers for obvious reasons must remain anonymous. I have appended a short list of minor suggestions and inequities that need correction. I leave the major considerations to those who are more familiar with social dynamics.

APPENDIX

These are some of the problems that must be addressed in any movement to reorganize the faltering scientific society.

1) First and foremost "publish or perish" must be abolished. Significant research does not come from exhausted and biased number shuffling. My view, and it is shared by a growing number of biologists, is that the "publish or perish" game is responsible for, dare I say it, 99.9999 percent of the fraud.

2) End secret peer-review (merit-review). Actually it would even be better to end all peer-review. Papers should be reviewed by panels of paid experts who do not stand to benefit from the publication process. According to Alexander Kohn (p. 146) "out of a series of 1309 academic scientists in the exact sciences, 25 percent complained of having their ideas 'stolen' by others, or at best, their ideas not having been acknowledged...It demands great integrity [integrity that does not exist] on the part of the reviewer not to make use of information gleaned from a grant application or from an as yet unpublished article."

Given figures like these scientists are lunatics if they allow peers to look at their proposals and manuscripts. No wonder scientists often seek grant support for work that has already been done. Peers will have a difficult time stealing ideas that are ready for publication and the funds that arrive can be used for a secret studies. This is the way it should be.

As long as peer-review exists smart scientists will be forced to devise deceitful methods of suckering their cheating peers.

3) Grants should be awarded for innovative ideas and productive avenues of research, not for testing fad theories promulgated by dominate researchers.

4) Fifty percent (actually a 75% would be better) of all NSF funds should be set aside for a raffle. Minimal criteria would guarantee that all scientists could get a ticket to the raffle. 50% could be awarded in the old-fashion way.

5) The tax on research grants, called overhead, must be stopped.

The whole biological social system, an archaic hand-me-down from the time when only the privileged class dabbled in science, is standing at the brink of change. An attractive new democratic based landscape is on the other side of a chasm. But slow Darwinian change will not take us there, what is needed is a "Gouldishly" quick, evolutionary leap.

Received in Hanover 6/22/87