XYY Chromosome Study

The ethical objection of Beckwith *et al.* (Letters, 31 Jan., p. 298) to the Harvard XYY study appears to be based upon a simplistic notion of distinguishing the behavior of people either on the basis of genetics or on the basis of social, economic, and familial conditions. Possible effects of the interaction of genetic and social factors are overlooked.

Beckwith *et al.* assume that the design of the study precludes obtaining information about the effects of informing parents about the XYY chromosome. This assumption is probably incorrect. It is likely that some of the informed parents will believe that the XYY chromosome is related to antisocial conduct and others will not, just as there is disagreement among scientists. And some parents may in the course of the experiment change their opinion about this. Thus, the beliefs and related child-rearing behaviors of the parents in the study will probably range along a continuum, allowing a meaningful assessment to be made of any effects of child-rearing practices and of the XYY chromosome.

Genetic and ethical problems do not go away by ignoring them. They should both be subject to thoughtful investigation which balances the risks of knowledge against the benefits, if any, of ignorance.

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Accountability in Science

The recent disclosure of yet another possible breach in the integrity of scientific research raises some hard questions about the public's right to oversee the conduct of science. Both in the Summerlin affair of last April, in which a Sloan-Kettering cancer researcher was given a psychiatric leave after tampering with skin-graft data, and in the current case at Harvard, in which a student is suspected of forging experimental results, the research in question was supported both directly and indirectly through public funds. Yet, the actions which have been taken to date have involved internal "housecleaning" with little or no public access to the facts or involvement with the issues. Why should research scientists be any less accountable to the public for the consequences of their misconduct than are physicians, lawyers, or politicians?

Some maintain that scientists should be sequestered from malpractice or malfeasance by virtue of the impersonal and indirect nature of their work. Behind such a proposition lies the false assumption that scientific data, in contrast to the surgeon's scalpel, "never hurts anyone. After all," the argument goes, "it's the use that's made of science that deserves our scrutiny, not basic research." But ethical judgment is needed at the basic research level as well. Those who practice it know that the nature of the scientific enterprise itself hinges on the scrupulous integrity of its practitioners. Scientific accountability begins at the research bench. One false lead can cost science (and society) years of potentially constructive work.

It is no accident that the current disturbing events are occurring in transplantation immunology, a field still in its infancy. Transplantation immunology may now be in the same inchoate and explosively expansive stage that genetics was in in the Lysenko era of 25 years ago. When "normal" science, as Thomas Kuhn (*1*) described it, begins to falter, as new data repudiate old hypotheses, then basic research takes on new meanings—and basic researchers, new responsibilities. Immunologists today are struggling for coherent theories to incorporate seemingly divergent data. They are met at every turn by paradoxes and anomalies. The immune system can seemingly be turned to good or evil by a quirk of happenstance. Clinicians do not know how to predict when an immune response to a virus may cause a disease or cure it; or if they generate an immune reaction, whether it will stimulate cancer growth or retard it. Reproductive biologists are met with paradoxical success in the survival of the immunologically discrepant fetus and remain ignorant of the adaptive role of the mother's immune response.

Historians of science would recognize in these perturbing uncertainties a scientific field in flux, an old paradigm collapsing, and tentative new models proliferating. It is at just such a time that a field becomes most vulnerable to chicanery and deceit. Total objectivity becomes difficult for even the most scrupulous practitioner. Often it is impossible for the average scientist to distinguish between a vagary of chance to be noted and placed aside and a potential breakthrough result which could unlock a logjam of inexplicable data. Others, like Newton and Mendel before them, consciously or unconsciously suppress variations in their data which "do not fit" in order to sustain the hypothesis they believe to be the right one. All of these perturbations of conduct and reasoning need not occur in the "perfect" practice of the scientific method, with its insistence on blind observation and reproducibility. But human foible, ambition, and the urgency to straighten things out often suppress the ideal.

A science in revolution fairly *invites* scientific entrepreneurs to ply their new hypotheses. It is these people who are simultaneously the most valuable and the most dangerous among the dramatis personae of the morality play of scientific discovery. One extra bit of egoism, one iota of self-aggrandizement and the play can become a tragedy. The stakes are enormous, the tensions great. Some are keen to take up the challenge; others succumb to what Lawrence Kubie (*2*) described as "the neurotic distortion of the creative process." There are those who have the courage to promulgate seemingly rash hypotheses selflessly, willingly taking responsibility for their actions by setting about to refute their own ideological progeny. This is when science is at its best.

Then there are those for whom the fragility of the times calls forth an opportunism that leads to a contamination of the free marketplace of ideas with forged data or rigged experiments. This happened in the Summerlin affair. These events are so troubling and potentially so damaging to the conduct of science that they call out for action.

It is a disservice to science and society alike to treat such events as isolated and idiosyncratic. My experience as a transplantation immunologist at three major laboratories in this country strongly suggests that Summerlin-like observations are the rule, not the exception. Indeed, as Karl Popper has emphasized, the vitality of a science may depend on the number and richness of falsifiable hypotheses available as grist for the scientific mill. However, the proliferation of false (rather than falsifiable) hypotheses may also be a sinister symptom of the heightened stakes for scientific success in research areas, such as cancer or immunology, in which public expectations have been grossly inflated. Scientists in fast-breaking areas and "normal" science alike ought now to take seriously the implications of misconduct on the part of their colleagues. Some laboratories have already instituted internal checks to verify novel results. But such checks themselves are likely to have a chilling effect on innovative research. The line must be strictly drawn between proffering serious hypotheses, simple speculation, and outright fabrication. Somehow, the recognition must be engendered in scientist and citizen that the scientist who intentionally forges or misrepresents basic research data is no simple miscreant or neurotic. Such persons misuse the public trust as well as public funds and should not be shielded behind a veil of "psychiatric illness" or bureaucratic maneuvering. Scientists must be willing to look at the systems which create these perturbations—both in society and in their own enterprise—and begin to undertake a searching analysis of their roots.

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References

1. T. Kuhn, *The Structure of Scientific Revolutions* (Univ. of Chicago Press, Chicago, ed. 2, 1970).
2. L. Kubie, *The Neurotic Distortion of the Creative Process* (Farrar, Straus & Giroux, New York, 1961).

Laser Fusion Research

The article "Laser fusion: One milepost passed—millions more to go" by William D. Metz (Research News, 27 Dec. 1974, p. 1193) seems to imply that only government and private companies are involved in significant work in this field. Actually, the academic community—specifically, the University of Rochester—has been active in this area from the time that laser fusion was first declassified in the late 1960's. More recently, the University of Rochester has joined with industry and government in a long-range commitment to the development of controlled thermonuclear fusion as a future energy source.

This collaboration has resulted in the only suprakilojoule, subnanosecond laser target irradiation facility presently operating. Data from this facility (thousands of on-target shots with neutron