LETTERS

edited by Etta Kavanagh

Reactions to the Hwang Scandal

Chung Myung-Hee, head of the Seoul National University panel that investigated Woo Suk Hwang's work, announces the panel's findings at a press conference on 10 January.

IT CAME AS QUITE A SHOCK TO KOREAN ACADEMICS TO LEARN THAT Woo Suk Hwang's papers on patient-specific stem cells were fabricated. Members of the Korean Society of Molecular and Cellular Biology, the largest life science academic society in Korea, seriously regret that such a fraud could occur. Since the ethical debate over human ovum supply and somatic cell cloning began, our society members have felt very uneasy and frustrated.

Indeed, we decided to establish a charter for scientific conduct with a strong emphasis on the ethical implications of biological research. The life science researcher's charter has been unanimously acknowledged by our members and was declared officially in October 2005 at the annual congress.

The main points of the charter are as follows. First, we have to consider the impact that research may have upon humans, society, and the ecosystem before inititating that research. Second, we have to ensure and respect the dignity of life within the research objectives, from cells to living organisms. Third, we should not fabricate any experimental results and should be righteous in the distribution of materials and results. Finally, we should be fair in acknowledging authorship and intellectual property of research outcomes.

As the president of the Korean Society of Molecular and Cellular Biology, I sincerely regret that such a fraud occurred. A strong policy to prevent any further similar disgraceful incidents will be established. I believe in the ethical sincerity and academic integrity of our scientists, as suggested in the Charter of Ethics for Life Science Researchers, and that we will continue on in our efforts toward bettering society and human life.

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RECENT REVELATIONS REGARDING THE RESEARCH by Woo Suk Hwang and his colleagues on patient-specific embryonic stem cells created by somatic cell nuclear transfer ("Editorial retraction," D. Kennedy, 20 Jan., p. 335) in South Korea undermine the credibility of the nascent, and fragile, stem cell field. These unfortunate circumstances may embolden opponents of embryonic stem cell research who have argued against such research based on moral objections and on mistrust of scientists to monitor their own activities and ambition.

Excesses in high-profile biomedical research are regrettably not new. The history of the gene therapy field provides one perspective. Soon after cloning of mammalian genes first became possible, expectations were raised that gene therapy might be used to treat serious genetic disorders, such as hemoglobin diseases, cystic fibrosis, and cancer among others. After a flurry of initial clinical experiments in gene therapy that led to unsubstantiated claims or lack of objective findings, a panel was convened by the NIH Director Harold Varmus in 1995 to assess the state of the field (*1*). This group described a field in which research findings were oversold, expectations were raised beyond what was reasonable at the time, and scientific rigor was relaxed in the enthusiasm to rush ahead.

If gene therapy and stem cell fields have elements in common, what does recent history suggest for the future? Since 1995, progress in gene therapy has been episodic, yet clearly on a positive trajectory. In an elegant study reported in 2000, Fischer and his colleagues provided evidence for successful gene therapy of X-linked combined immunodeficiency (*2*). Reconstitution of the immune system was sustained. However, a significant setback was encountered by 2003. Several patients developed leukemia due to insertion of the gene therapy vector in an oncogenic locus, a complication that was anticipated as a rare "side effect" but may be addressable with improved vectors. Fortunately, chemotherapy induced remission in these patients. So, while there are potential serious adverse events associated with gene therapy, they need to be weighed against the lethality of the original condition and the capacity to manage the side effects of therapy. Although progress in the clinical arena hasn't matched what was hoped for in the early 1990s, conclusive evidence of efficacy and success has emerged 10 years later.

Except for the use of bone marrow transplantation for the treatment of primary hematological conditions, the stem cell field (as related to treatment of human disease) is in its infancy, perhaps similar to the status of gene therapy nearly 20 years ago. Although we may despair of the recent events unfolding in South Korea, we should take solace from the confidence that strict adherence to scientific rigor and reason will ultimately prevail and permit realization of the potential of stem cells to ameliorate the suffering of patients with life-threatening diseases.

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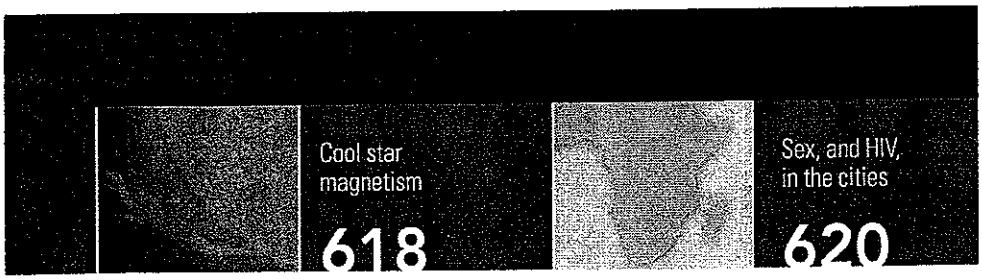

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1. See www.nih.gov/news/panelrep.html.
2. M. Cavazzana-Calvo *et al.*, *Science* 288, 669 (2000).

IT IS APPROPRIATE THAT *SCIENCE* SHOULD LEAD the way in recounting exposure of the fraudulent claims of W. S. Hwang *et al.* that they developed 11 patient-specific cell lines by somatic cell nuclear transfer (SCNT) (D. Kennedy, "Editorial retraction," Letters, 20 Jan., p. 335).

The profoundly negative effect of this episode is all the greater because of the way in which the matter was handled from the outset. When the 2005 paper was received in the *Science* editorial office, it was regarded as a showstopper, something that would make big headlines, with important implications for the treatment of a number of diseases. That much was noted in the News of the Week article "... And how the problems eluded peer reviewers and editors" (J. Couzin, 6 Jan., p. 23), e.g., "[i]mmediately, the journal's editors recognized a submission of potentially explosive importance." The paper was published in due course and hailed in several quarters as important science. But was its science in any way special?

Even if Hwang *et al.* had achieved what they described, all they had done was to repeat with human material what had been done with several other species. At best, it had required skill, persistence, and some technical twists, but nowhere was there evidence of any significant contribution of cell or molecular biology or of concept. Success with other species made it relatively easy to fake, and one cannot blame the journal's referees for failing to recognize that.

If the *Science* editorial staff had paid more attention to the science and less to the sensation, and if others had not leapt onto the bandwagon, the impact of this sorry affair might have been much less.

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THE ROLE OF YOUNG KOREAN RESEARCHERS IN the Hwang controversy ("How young Korean researchers helped unearth a scandal," S. Chong and D. Normile, News of the Week, 6 Jan., p. 22) raises important aspects of research misconduct that are long overdue for international action.

It took the actions of an anonymous whistleblower to unmask the deception and dishonesty of Woo Suk Hwang. It is noteworthy that the whistleblower chose to make his allegations anonymously—even though he was no longer working in the laboratory—and to a TV program and not to the university involved or to regulatory authorities.

The central role of whistleblowers in the Hwang scandal affirms the urgent need for (i) whistleblowing of fraudulent activity to be accepted and encouraged as a legitimate duty that is integral to the responsible conduct of research; (ii) institutional policies that protect the rights of all parties, especially junior researchers, to due process and protection from retribution, intimidation, and harassment; and (iii) an international standard of responsible research and definition of research misconduct.

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Questions About Forensic Science

IN THEIR REVIEW "THE COMING PARADIGM SHIFT in forensic identification science" (5 Aug. 2005, p. 892), M. J. Saks and J. J. Koehler confuse the roles of adversaries in the criminal justice system with those of objective scientists. The "assumption of discernible uniqueness" may seem to be a tenet of forensic science; however, it is not found anywhere in the literature. They claim that "Traditional forensic scientists seek to link crime scene evidence to a single person or object 'to the exclusion of all others in the world.'" Some analyses can never obtain such resolution, and the practitioners of those disciplines would not claim to be able to do so. Those disciplines that do seek to individualize evidence do not adhere to their invented proposition "when a pair of markings is not observably different, criminalists conclude that the marks were made by the same person or object." The references they cite [see their (*7*, *8*)] for this proposition contain no such language. Source attribution rarely, if ever, relies on a single marking.

We take exception with the implication that "all" experts have a propensity to fabricate and lie about evidentiary results. In fact, all comparative forensic science fields have a reasonably high frequency of exclusions. This is in conflict with the notion of data manipulation to achieve unique identification. There is as much incentive in obtaining a true result when it is an exclusion as there is in achieving a match. Fudging a match has dire consequences that the overwhelming majority of forensic scientists well appreciate; the true perpetrator is still free preying on innocent victims and the forensic scientist risks having a contrary (legitimate) scientific opinion presented in court.

Errors do occur in any endeavor involving humans. However, Saks and Koehler do not define the types of error that can occur and describe which ones are of consequence and which are not. Instead, they focus on diminishing the weight of evidence based on a hypothetical error rate that does not apply to the case at hand. Saks and Koehler declare that "the practical value of any particular technology is limited by the extent to which potentially important errors arise" as if this potential necessarily decreases the value of the evidence. A known error rate is not a direct measure of the reliability of the specific result(s) in question. The most direct way to measure the truth of the purported results is to have another expert conduct his/her own review (*1*), as is advocated by the National Research Council for DNA analyses (*2*).

Saks and Koehler misstate many of the false-positive error rates. For example, microscopic hair comparison is estimated at 12%. The Houck and Budowle (*3*) study contains no data on false-positive errors. It is a comparative study of the different resolving capacities of the methods.

When an error of consequence occurs, corrective action is taken. Subsequently, the forensic scientist is better educated and less likely to err. The calculation of a current error rate should take this into consideration. The error should never be ignored, and if the defense believes it useful, it should make use of such information during a cross-examination.

Saks and Koehler did not point to one example of the foundations of the disciplines being baseless; they merely focused on errors having been committed by scientists. Forensic science is evaluating itself and is improving its practices (*4*). Enhancing the forensic disciplines should continue and must be advocated.

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3. M. M. Houck, B. Budowle, *J. Forens. Sci.* 47, 964 (2002).
4. B. Budowle, J. Buscaglia, R. Schwartz Perlman, *Forens. Sci. Commun.* 8 (no. 1) (2006) (available at www.fbi.gov/hq/lab/fsc/current/index.htm).

IN THEIR REVIEW "THE COMING PARADIGM SHIFT in forensic identification science" (5 Aug. 2005, p. 892), M. J. Saks and J. J. Koehler assert that error rates in forensic science can be calculated for comparisons performed by human examiners, and that these error rates can then be used to predict the probability that