



THIS STORY HAS BEEN FORMATTED FOR EASY PRINTING

Oak Ridge researchers admit errors

The Boston Globe

By Eugenie Samuel Reich, Globe Correspondent | November 27, 2006

Thirteen years after the fact, scientists at a top US Department of Energy laboratory have admitted misrepresenting key data in a landmark paper on the use of electron microscopes to analyze materials at the atomic scale.

Publication of the correction earlier this month in the science journal *Nature* was more than a historical footnote. It followed an allegation that scientists in the same lab had manipulated data in a new paper submitted to a sister journal. The allegation, made by a reviewer for *Nature Physics*, was confidential.

Word of it circulated unofficially among scientists, however, and several have now raised broader concerns about the reliability of the work of the team at Oak Ridge National Laboratory in Tennessee, which is led by Stephen Pennycook and gets about \$2 million a year from taxpayers.

Pennycook said the data problems were mistakes that didn't undermine the papers' conclusions. But John Spence, a physics professor at Arizona State University with a joint appointment at the Energy Department's Lawrence Berkeley National Laboratory, said they are "very troubling. . . . This is a field that involves the use of very expensive, highly centralized facilities, and Pennycook's group is the best funded."

In recent years, a number of high-profile instances of scientific fraud -- most famously a Korean team's claim that it cloned human embryonic stem cells -- have made clear the limits of peer review by outside scientists to flag problematic papers before they are published. But the Oak Ridge case highlights the fact that even when peer reviewers suspect that authors are manipulating or fabricating data, there is no certainty other scientists will be alerted to their concerns.

In some cases, reviewers may be hesitant to get involved in a messy situation and simply recommend rejection of the paper. If they do inform editors, the editors are barred from speaking publicly, though they can notify the authors' institution.

This can leave authors free to revise the paper and shop it around to other journals with a less rigorous review process.

Karl Ziemelis, *Nature's* physical sciences editor, said the journal is unable to publicly discuss submitted manuscripts, even ones with serious problems, because they are confidential. "In general, there is nothing sinister about this -- one of the key purposes of peer review is to identify honest mistakes, which may subsequently be corrected," he said. "But, of course, peer review confidentiality could be exploited."

This possibility was envisioned by the reviewer for *Nature Physics* in April. "I find that there is direct, incontrovertible evidence for systemic data manipulation and scientific misconduct in this manuscript," the reviewer wrote about a paper whose lead author was Maria Varela, a staff scientist in Pennycook's group. The comments were provided to the *Globe* on the condition the reviewer not be identified.

One example the reviewer cited was a figure that showed the number of electrons detected by the Oak Ridge electron microscope as it scanned across a three-layer sandwich, with one material in the middle flanked on each side by a second material. The data points for the outside layers were exact mirror images, something that would be implausible. In addition, the data points for the middle layer were an inverted version of data for a different sample of the material.

The reviewer went on to raise the concern that the comments might "effectively 'aid and abet' improper behavior," enabling the authors to quietly correct or remove the evidence of misconduct from their manuscript and resubmit it.

The reviewer also pointed out that similar problems were evident in other papers published by Varela and urged the editors to notify the authors' institutions.

James Roberto, deputy director for science and technology at Oak Ridge, said he convened a panel of three outside scientists to examine allegations received from Nature in May, and they cleared Pennycook's group of misconduct in July. "This is not a case of research misconduct," he said, only a case of errors in the group's work.

Pennycook and Varela acknowledged in an interview that in the "sandwich" figure cited by the reviewer, measurements had not been taken for one of the outside layers and data from the opposite layer were used instead for illustrative purposes. "I think this was in a sense schematic," said Pennycook. The data shown for the middle layer were measured on a different sample and switched in by mistake, they said. Varela said other results in the manuscript were taken from a 2003 paper she published and mislabeled.

Several scientists questioned the use of mirrored data, because the figure was labeled as actual measured data. "That is an inventive step the rest of us wouldn't have made. The point in science is to be accurate and not about presentation," said Neil Mathur, a materials scientist at Cambridge University in England.

Misrepresented data also were at issue in the 1993 paper.

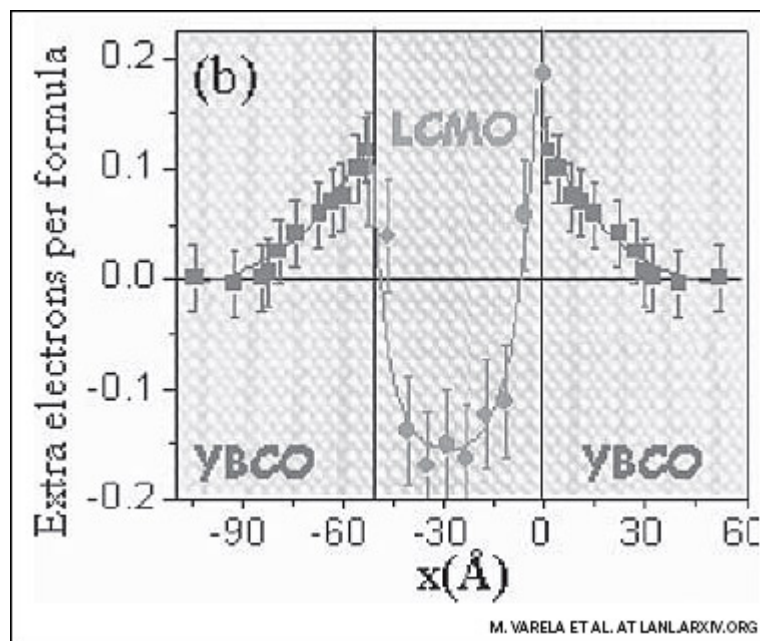
"Key data were misrepresented by the authors, both during the review process and in the final published version of the paper," Nature said in an editorial that accompanied the correction published Nov. 9. "Without doubt, there has been . . . a severe breach of the trust on which the publication of science is based." Pennycook was a co-author of that paper, but not Varela.

Since the correction was published, scientists have questioned four additional papers by Pennycook and Varela, noting that figures supposedly showing the same results have data points in different places. Pennycook told the Globe he will correct a figure in one of the papers but said the other discrepancies resulted from reanalysis of the data.

"All the mistakes uncovered in our publications are editorial in nature, regrettable, and without impact on the scientific conclusions," he wrote in an e-mail. ■

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This figure, posted on a website scientists use to share unpublished manuscripts, is similar to one in the paper submitted to Nature Physics by Oak Ridge National Laboratory researchers. It shows electron microscope measurements of a three-layer “sandwich” of materials, but the data points for the layer on the left are not actual measurements; they are a mirror image of the data points on the right. In addition, the data points for the middle layer are an inverted version of data for a different sample of the material. The researchers have posted a revised version of this figure.

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