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### Giving Proper Credit

#### Ethics violations by a chemist in Sweden highlight science's unpreparedness to deal with misconduct

William G. Schulz

**After a months-long** investigation in Sweden, Stockholm University has sanctioned an associate professor of chemistry, Armando Córdova, for research misconduct. In a number of cases, the investigation found that Córdova violated scientific ethics in his quest to publish research results in the emerging field of organocatalysis.



Linda Wang/C&EN

Sneak Preview Scientists often share research results at symposia prior to publishing them.

The matter might have stopped there except that some of Córdova's colleagues in organocatalysis say his unethical behavior—often a failure to cite or cite properly the work of other scientists and thereby taking credit for new discoveries that are not his own—continues. And they claim that by not taking tougher action against him, Stockholm University is protecting Córdova and further damaging the scientific community.

Córdova's case reveals that the scientific community is often unprepared to deal with misconduct, particularly when the violations fall short of scientific fraud. Although ethical guidelines themselves seem clear, what to do about ethics violations is another matter. Most people familiar with the Córdova case who talked to C&EN could not specify what they think should happen to him as a result of his actions.

Researchers who have been directly affected by Córdova's actions say his misdeeds are, in any case, very serious and go beyond simply failing to cite properly. They say Córdova steals research ideas at conferences and then presents the ideas as his own by publishing the results of hasty and often poorly executed parallel experiments.

Donna G. Blackmond, a professor of chemistry at Imperial College, London, says Córdova stole her scientific ideas at a lecture, published them, and continues to present her development of a new model explaining nonlinear effects in organocatalysis as if it were his own. The investigation, which included detailed analysis of Córdova's lab notebooks, backs up her accusations, and she has been relentless in her effort to stop Córdova. She does not think the university's sanctions match the severity of his violations.

Stockholm University counters that the consequences for Córdova are appropriately tough, pointing out

that his violations do not include scientific fraud. Córdova must attend an ethics course, and he must present papers to his dean for review before he submits them to journals for publication—a detrimental delay for a young investigator in a fast-moving field of science.

"The most important thing is to correct his behavior," says Stefan Nordlund, dean of the Faculty of Science at Stockholm. "I don't expect everyone to be satisfied. I am very unhappy with, and do not support, the behavior of Córdova."

**The easy way** to deal with this, Nordlund continues, "would be to sack him from the university. It's very easy to choose what your critics want you to do, and that's not fair. This is not the worst ethical behavior reported in science."

Córdova himself says he didn't know he was doing anything wrong. He says he was following the practices of his former advisers and mentors in science.

That statement angers one of Córdova's former advisers, Carlos F. Barbas III, a professor of chemistry and molecular biology at Scripps Research Institute. "I guess he's going to want to throw stones," Barbas says, "but that's something he would need to back up."

"I have to cite better in the future," Córdova concedes. "It wasn't on purpose—any of the cases. I thought I was doing the right thing. I was looking at what others in the field are doing. But you learn something, and then you move on. It's a competitive field, and a lot of people get touchy. People want to be first."

C&EN spoke with several mentors and colleagues who have worked with or had other significant dealings with Córdova. Those interviews reveal that he has a history of rocky relationships. He has infuriated or alienated some people, and others refuse to comment at all about his behavior or their relationship with him. Colleagues in Sweden who once thought highly of Córdova now distance themselves from him.



Scripps Research Institute

Córdova

On the other hand, some colleagues say that Córdova is exceptionally ambitious and hardworking and that he has an impressive publication record. He has won major research grants in Sweden and in 2006 was the recipient of the Tage Erlander Prize of the Royal Swedish Academy of Sciences.

Whatever one's view of Córdova, his case has presented an opportunity for discussing scientific ethics in the chemistry community. But "talking about ethics is like talking about what happens in people's bedrooms—no one does it," says chemist Janet D. Stemwedel, an assistant professor of philosophy at San Jose State University, in California. She is an expert in scientific ethics and maintains her own blog, "Adventures in Ethics and Science" ([doctorfreeride.blogspot.com](http://doctorfreeride.blogspot.com)).

Stemwedel says that even when scientists are explicitly taught ethics, the courses are often not in the science department but in places like the philosophy department. And many doctoral candidates in science never receive formal training in ethics; instead, they learn by watching their thesis adviser. She says funders of science, however, are starting to demand some formal ethics course work, partly in response to several high-profile scandals in recent years.

**In fairness** to Córdova, many sources for this story point out that organocatalysis—the catalysis of chemical reactions using a purely organic compound—is a fast-paced and fiercely competitive field. One researcher tells C&EN that organocatalysis "is full of piranhas"—researchers with big egos who are racing

furiously to get the most papers off to the best journals. Because reactions can be completed in hours or days, the field generates a blizzard of submissions, often overwhelming journal editors. Researchers are often working in parallel areas, and it can be difficult to determine with certainty the priority of published work.

A graduate student in the Córdova lab, Ismail Ibrahim, claims that other, larger groups envy their productivity. "People don't reference our work, but they use our methods," he claims. He says he enjoys working with his mentor and that the Córdova lab is a productive and happy environment. He points out that many papers in organocatalysis "appear at the same time with the same chemistry. There's a lot of competition."

But several of the researchers C&EN spoke with for this story say they are particularly concerned about Ibrahim and other students in the Córdova lab. They say the students might be happy but that they are learning the wrong lessons from Córdova about scientific ethics. "The students in his lab will pay the price if they emulate his behavior," Barbas says.

At the request of Nordlund, the investigation of Córdova was conducted by chemistry professors [Olov Sterner](#) and [Torbjörn Frejd](#) of Lund University, in Sweden. The Sterner-Frejd report details two cases in which they found scientific misconduct by Córdova and two cases that they describe as borderline. The four cases were those the investigators could document. They say that many other allegations and rumors of scientific misconduct by Córdova could not be fully substantiated.

"It's fair to say that Córdova has a pretty bad reputation in the community, and it seems he is resubmitting things he has heard about in lectures," says [Benjamin List](#), a professor of chemistry at Max Planck Institute for Coal Research, Mülheim, Germany, and a leading organocatalysis researcher. List says that after he spoke at a conference in Italy, Córdova submitted similar work that was published in *Tetrahedron Letters*. He says he blames himself for talking about the work, but he adds, "People know what's going on."

Looking at Córdova's record, Sterner says, one gets the impression that "this is a very hardworking guy who gets a lot of work done—a lot of important work published in important journals. But when you study his publications in detail, all are not as important as you might believe. Journals have failed to thoroughly examine his work."

More thorough examination of Córdova's work by journal editors and reviewers, Sterner continues, might have turned up similar work that Córdova failed to cite. At the same time, he says, one must be an expert in organocatalysis to know the citations. Given the activity in the field, he says, "it's not difficult to hide citations. You have a fair chance to get away with it."

Frejd says it's difficult to grade the seriousness of Córdova's ethics violations. "It's not that he manufactured data. It's not in that degree at all, but it's serious enough for him to be criticized. To take others' results and present them as your own is pretty serious and it is wrong. Córdova has done similar things a number of times."

The first case of misconduct by Córdova that Sterner and Frejd examined involved Barbas, whose research group has pursued organocatalysis. In 2001, Córdova became a senior postdoc in the [Barbas lab](#). While there, he submitted a research paper to the *Journal of the American Chemical Society* and later to *Tetrahedron Letters* without Barbas' consent. The paper was rejected by JACS, and Barbas was able to retract it after he learned that it had been submitted and accepted for publication in *Tetrahedron Letters*. Córdova had by then been fired from the Barbas lab for reasons that Barbas won't specify. In April 2003, Barbas wrote to Stockholm University, saying he feared Córdova would attempt to submit the paper again.

"Indeed, Córdova submitted the manuscript to *Synlett* on May 21, 2003, and it was published in Córdova's name (as sole author) in 2003," Sterner and Frejd write in their report of the investigation. "We regard this as a clear case of unethical behavior. Work done in the Barbas laboratories must have his approval as supervisor and [as the person] responsible for the research group before publication. There is no doubt about this in the scientific community as far as we are aware."

"His reputation internationally is extremely poor," says Barbas of Córdoba today. Barbas says he is working to retract the *Synlett* paper but has otherwise moved on in terms of dealing with his former postdoc.

Barbas says that when he first hired Córdoba, he thought he was an ambitious fellow who wanted to do ambitious science. But he says the relationship quickly unraveled, and he learned that Córdoba had a reputation for being difficult at other labs he had worked in. Barbas says if other people did what Córdoba has done "at other institutions, they would have lost their jobs."



Jian Wang

Blackmond



Joe Claus

Stemwedel

The other case of misconduct documented by Sterner and Frejd was Blackmond's. It is a complex case that has taken more than a year to resolve.

On Nov. 29, 2005, Blackmond delivered the Holger Erdtman Lecture at KTH, the Royal Institute of Technology in Stockholm. She presented her findings concerning nonlinear effects in amino acid catalysis, work that she had just submitted to *Nature* (**2006**, 441, 621). Córdoba was in the audience.

As the Lund report relates, during the week after the lecture, the Córdoba group studied nonlinear effects in acyclic amino acid catalysis of an aldol reaction as a function of the catalyst concentration. The results were included in a manuscript that Córdoba submitted to *Chemistry-A European Journal* (CEJ) on Dec. 30, 2005. The paper was accepted and published online on April 25, 2006 (*Chem. Eur. J.* **2006**, 12, 5383).

According to the Lund report, after reading Córdoba's paper, Blackmond on April 28, 2006, wrote to the editor of CEJ and Jan-Erling Bäckvall, head of organic chemistry research at Stockholm and chairman of the CEJ editorial board, to raise the question of scientific misconduct on the part of Córdoba, as she recognized that concepts presented during her Erdtman lecture are used in Córdoba's paper without referring to her work. Blackmond pointed out several weaknesses with the Córdoba paper: that the results reported on nonlinear effects lack backup of scientific data, are poorly interpreted, and in some parts are confusing or even wrong. She suggested that Córdoba be required to publish a correction in the journal.

"Córdoba has been extremely foolish," Blackmond tells C&EN. "He didn't do a good job of being fraudulent. He tried to steal something he doesn't understand. With less than a week of simple experiments, he tried to take credit for a model that required months of experimental work. He carried out experiments showing the effect we observed, but examination of the lab notebooks showed that he did no experiments to uncover the cause, which was the basis of our model. To state that you have measured a quantity that you have not measured is scientific fraud, in my opinion, not simply lack of citation."

Initially, Córdoba balked at the idea of publishing a correction, known as a corrigendum, in CEJ. Instead,

he charged that Blackmond borrowed "speculations, scientific thoughts, and writings" from a paper he had submitted to *Nature*, which had been reviewed by Blackmond in advance of her paper. What's more, Córdova claimed Blackmond was biased in reviewing his work, which was ultimately rejected by *Nature*, and that she, too, failed to cite prior work—his. Córdova later withdrew these allegations and apologized to Blackmond; *Nature* has supported her integrity as a reviewer.



Antonio Vilaseca

Sterner

After one month of discussions, including several letters to Bäckvall, Blackmond on May 29 raised with Nordlund the issue of scientific misconduct by Córdova and "the possibility of tacit internal support" for him, according to the Lund investigators. Within short order, they continued, Córdova agreed to the wording of the corrigendum in CEJ and an official investigation of his conduct was launched. The corrigendum appears in the same printed issue of CEJ as the Córdova paper.

Córdova, however, continues to maintain his innocence: "I do not steal any other people's ideas from their lectures. They are my own."

In the Blackmond case, the investigation found otherwise. According to the report: "Córdova could not present evidence that he made any observations of a link between nonlinear effects and amino acid concentrations and phase behavior or that he had any knowledge or understanding of such a link" prior to Blackmond's lecture at KTH.

"Córdova has a confused and incorrect concept of phase behavior. This supports us in our conclusion that the eutectic model could not have been developed independently by him. It is clear that Professor Córdova behaved unethically" by publishing ideas that Blackmond first made public in the KTH lecture and claiming they were his own, the report states.

However, this was not the end of the story. It turns out that, while the matter of the CEJ corrigendum was being resolved, Córdova again submitted some of the same data and similar claims to *Tetrahedron Letters*. This paper presented a model similar to that first proposed by Blackmond in her *Nature* paper—but without citing her work properly. Córdova's paper was accepted and published (*Tetrahedron Lett.* **2006**, *47*, 6657.)

"Cordova does indeed refer to Blackmond's work in this paper but does it in a more or less covert form," Frejd says. "Instead of admitting that Blackmond was the one who first reported the eutectic behavior, Cordova puts her references much too far in the back."

Blackmond stepped up the pressure she had been putting on Córdova and Stockholm University. Finally, Córdova agreed to a second corrigendum (*Tetrahedron Lett.* **2007**, *48*, 1875).

"My main mistake was walking into KTH and giving a seminar," Blackmond says. "I was aware that Córdova would be in the audience."

KTH chemistry professor Christina Moberg, who hosted Blackmond's visit to KTH, was instrumental in forcing Stockholm University to undertake the external investigation into Córdova's behavior. "As scientists, we need to defend the right to communicate and discuss our results," she says, "Otherwise, we allow unfair behavior to take over, and science will lose."

According to Sterner and Frejd, the *Tetrahedron Letters* paper is important in this case for several

reasons: First, it demonstrates that even while he was agreeing to the wording of the CEJ corrigendum, Córdoba was in the process of submitting a further paper containing some of the same data and focusing specifically on the eutectic model uncovered by the Blackmond group, without giving proper credit to that work.

Surprisingly, they note, "Córdoba continues to attempt to claim some credit for this eutectic model." And he has not altered the behavior that led to the need for the first corrigendum and the official investigation, they add.

The remaining cases examined by Sterner and Frejd concern two papers published by Karl Anker Jørgensen of Aarhus University, in Denmark (*J. Am. Chem. Soc.* **2005**, *127*, 6964 and 18296) and two very similar papers by Córdoba that appeared later (*Tetrahedron Lett.* **2006**, *47*, 99; *Chem. Commun.* **2006**, 1760).

Sterner and Frejd conclude that Córdoba did not properly acknowledge or credit Jørgensen's work. Córdoba's contributions in these two cases are complementary to those of Jørgensen's but are, to a large extent, very similar, the investigators note. They regard these two cases as "borderline unethical" on Córdoba's part and say "he must put more effort" into properly describing and referencing work that was published prior to his own.

Says Jørgensen, "I think the community in the field knows who has done what and at what time."

"If this kind of behavior continues, professional seminars stop serving a scientific function," Stemwedel says. "If [Córdoba] has ripped off other people, then he has done career harm to those people."

Sterner and Frejd write that the ethics rules that govern the way scientists communicate are well understood and they believe that they are well understood by Córdoba. But in later years, "he has found it acceptable to hide or even omit references to relevant work of others, and we cannot see that this was done by accident. It happens too frequently, and we believe that it has been intentional." They add that "such behavior is not acceptable, and it creates serious problems for Swedish chemistry in general and Stockholm University in particular. The problem needs to be solved in a way that is acceptable also for the international scientific community."

Stemwedel says she is surprised that the Córdoba case was pursued in the first place. "People tend to blame themselves" when their work is stolen, she says, and they often do not go to the trouble of correcting the record.

**In fact**, the investigation of Córdoba happened in large part because Blackmond has been diligent in protecting her group's scientific achievements and her professional reputation. But Stemwedel says the responsibility to deal with such serious ethics violations extends beyond the aggrieved party.

"It seems to me that it should not just be up to the person whose ideas were stolen," Stemwedel says. She points out that members of the community at professional meetings where work has been ripped off are "witnesses to a crime" and thus are called upon to take action. She says it must become clear to violators that "individual members of the community think this is bad behavior—that it undermines the venues for scientific communication on which we all depend."

But what should be done about such violations? "I would like to see some serious shunning in the scientific community," Stemwedel says. She believes that reaction to ethics violations like those committed by Córdoba needs to be intense and personal and come from multiple sources. "If people's friends gave them a hard time, it might stop."

Overall, Stemwedel advocates a scaled response to ethics violations in the hope that offenders can correct their behavior and resume productive careers. But "there is a point at which, if moral persuasion is not effective, the offender must be told, 'You no longer get to play with us.' " That is, the offender should be fired and locked out of a scientific career.

Córdoba sticks to his argument that he has not behaved differently, in terms of his publication practices,

than other people in the field. "When more senior people do it, it's okay. I thought I was following the norms of the field. You can make some people upset who are very competitive," he says.

Blackmond disagrees strongly with this assessment. "The idea that 'They do it, so why shouldn't I?' is absurd logic for a scientist. Córdova's initial reason for refusing to write the corrigendum in our case was that we failed to cite his experimental procedures in the Supporting Information section of our *Nature* paper. We cited instead a different experimental procedure, which was in fact what we used."

In the end, the Córdova case backs up Stemwedel's contention that the scientific community mostly does not know how to deal with ethics violators nor how to enforce what's good for the scientific community. But she says a place to start is for scientists to move beyond the notion of the great scientist as a lone individual and recognize that scientific knowledge is built at a community level. "Taking care of the community is taking care of the scientific knowledge that community builds," she says.

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