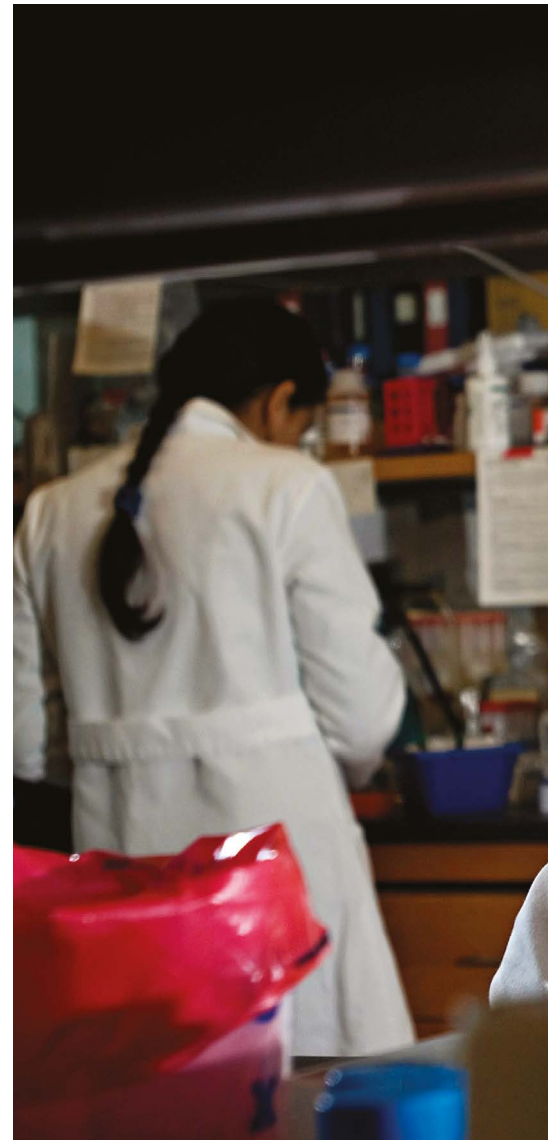


SCIENTIFIC MISCONDUCT FOUND IN WORK FROM PROMINENT CANCER LAB

Ohio State University investigations fault two scientists in lab of high-profile cancer researcher Carlo Croce. The university has cleared Croce of misconduct, but disciplined him over management problems. **By Richard Van Noorden**



Over the past decade, questions have swirled around the work coming out of a prominent US cancer-research laboratory run by Carlo Croce at the Ohio State University (OSU). Croce, a member of the US National Academy of Sciences, made his name with his work on the role of genes in cancer. But for years, he has faced allegations of plagiarism and falsified images in studies from his group. All told, 11 papers he has co-authored have been retracted, and 21 have required corrections.

Five years ago, OSU, in Columbus, opened inquiries into papers from Croce's lab. Although the university has not announced the results, *Nature* has learnt that these proceeded to formal investigations, two of which found multiple instances of research misconduct – including data falsification and plagiarism – by scientists Michela Garofalo and Flavia Pichiorri, in papers they'd authored while in Croce's laboratory. The findings, made in 2020 and 2021, are the first determinations

of research misconduct relating to work done in Croce's lab. OSU released them to *Nature* under a public-records request.

A third formal investigation concluded last year that Croce himself was not guilty of research misconduct, as *Nature* has also learnt from legal proceedings that Croce launched after the findings. But investigators criticized how he managed his laboratory, and OSU told him to retract or correct more than a dozen papers with problems including plagiarized text or falsified images. Last September, OSU stripped Croce of an endowed chair, the John W. Wolfe Chair in Human Cancer Genetics. He remains employed at the university, on a salary of more than US\$820,000, and holds an \$843,904 grant from the US National Institutes of Health, looking at genetic alterations that might lead to cancers.

In statements to *Nature*, Garofalo and Pichiorri challenged their respective OSU investigations. Garofalo called hers "false and discriminatory"; Pichiorri said hers was "biased and discriminatory". Both added that "legal action will be taken".

Croce, meanwhile, is now suing the university's board of trustees to try to regain the chair, and is claiming more than \$1 million in damages over its actions. He told *Nature* that although he accepts that there are errors in some of his lab's papers, which he says will be corrected, the overall incidence of error in his lab's output is low. "My lab has always done great work," he says.

The outcomes of OSU's inquiries have been keenly anticipated by scientists who investigate misconduct, errors and other problems with research papers, says Elisabeth Bik, a research-integrity consultant in California. "This appears to be a lab where there has been a tremendous amount of pressure on lab members to produce certain results, with little mentorship and checkpoints for the integrity of the data. Croce should take responsibility for all the results published under his name," she says.

OSU's actions in response to the findings are unusual. It's rare for a university to take these kinds of disciplinary steps concerning work from the lab of such a prominent and highly



Carlo Croce is a cancer researcher at the Ohio State University.

which she joined in 2016. She currently holds federal grants of more than \$2 million to study treatments for the bone marrow cancer myeloma. (*Nature* contacted City of Hope, which declined to comment; Pichiorri emphasized that her own comment was a personal statement.)

Misconduct findings

OSU's inquiries proceeded to formal investigations by a committee. By April 2020, it had found Pichiorri responsible for nine cases of research misconduct in three papers – all involving falsifying research data when generating figures, according to the committee's final report. One of the studies was published when Pichiorri was a postdoc in Croce's lab (she later became a principal investigator at OSU). Regarding that paper, Pichiorri told the initial OSU inquiry that she had made mistakes in reusing some images, had been overwhelmed with work and was pressured by Croce to get the paper done. She admitted that she was disorganized and had limited skills with imaging software. During the final investigation, however, she said that she wasn't responsible for the figures in the misconduct allegations. She also said she had not received training on how to generate figures, and that she had worked under Croce's direction. In her statement to *Nature*, she reiterated that she wasn't responsible for alleged errors in the studies at issue and that their scientific results remained valid.

In Garofalo's case, a committee found 11 cases of research misconduct – 7 concerning plagiarism and 4 image falsification – in 8 papers published while she was in Croce's laboratory (of which 7 were co-authored with Croce). The final report, dated October 2021, states that Garofalo told the committee she had not understood the meaning of plagiarism until allegations were raised in 2015 – at which time she had already joined the University of Manchester – and didn't realize that sentences shouldn't be copied without appropriate quotation marks and citations. She added that there was a lack of oversight in the Croce lab. The report also states that Croce, who was interviewed for the investigation, said he had made researchers aware of the importance of plagiarism and that there was adequate training in the lab. OSU investigators recommended that both Garofalo and Pichiorri be banned from rehire at the university.

Garofalo told *Nature* that in some cases, OSU had "intentionally ignored" evidence that showed she wasn't responsible for some of the instances of plagiarism they attributed to her, so that it could "make up a case of misconduct". She added that some of the plagiarism was minor and should not rise to the level of

decorated researcher; Croce has received more than \$100 million in US federal grants as a principal investigator in the course of his career, as well as scores of awards.

And although OSU concluded its investigations last year, many of the papers in which investigators found problems have not yet been either retracted or corrected.

First allegations

Concerns about work from Croce's laboratory first came to widespread attention in 2017, when *The New York Times* reported on allegations of research misconduct against Croce – including e-mails sent to journals about some papers as early as 2013 – and reported that multiple OSU inquiries had cleared him of wrongdoing. Croce subsequently sued the *Times* for defamation. He also sued David Sanders, a biologist at Purdue University in West Lafayette, Indiana, who had been quoted in the newspaper's story and had raised questions about the research. Croce ultimately lost both cases.

After the *Times* story, Sanders, who had previously been contacting journals to raise his

IT'S RARE FOR A UNIVERSITY TO TAKE THESE KINDS OF STEPS CONCERNING THE LAB OF SUCH A PROMINENT RESEARCHER.

concerns, sent some allegations direct to OSU. Other complainants also raised concerns, and the university opened new inquiries into work from Croce's lab.

Garofalo and Pichiorri had left the university by that time. Garofalo joined the Cancer Research UK Manchester Institute at the University of Manchester in 2014, but the institute says she left in 2020; she declined to tell *Nature* her current whereabouts. Pichiorri is at City of Hope medical centre in Duarte, California,



OSU has investigated the work of Carlo Croce, Michela Garofalo and Flavia Pichiorri.

misconduct, and that image flaws in papers didn't affect the research.

OSU declined to comment on Garofalo's statement, and had not commented on Pichiorri's by the time *Nature* went to press.

Croce investigation

OSU also conducted an investigation into Croce; he e-mailed the final report to *Nature* (after the university said it could not release the findings). According to this report, dated July 2021, the committee determined that the allegations against Croce did not rise to findings of research misconduct, because he had not personally plagiarized text or falsified figures. But investigators noted problems in many papers, including the studies in which it had determined instances of data falsification or plagiarism by Garofalo or Pichiorri. And the committee said it "believes that the inappropriate behaviours of those working in Dr. Croce's laboratory, leading to the occurrence of image falsifications or copying of text, was due in part to Dr. Croce's poor mentorship and lack of oversight".

Croce told investigators that there was adequate training around plagiarism and research ethics in his team, but the committee said many of his laboratory members denied this. He also said that he reviewed raw data from his team, but the committee said that if he had, he would have noticed that some members had managed their data poorly.

According to a September 2021 letter included in Croce's later lawsuit against the OSU board of trustees, Carol Bradford, dean of the university's college of medicine, told Croce that the investigators had been "very troubled by the management of your laboratory" and that after reviewing the investigation report, she had "deep reservations" about Croce's approach to his obligations as a principal investigator.

Bradford wrote that, as recommended

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by investigators, she was removing Croce's endowed chair. (OSU says the chair did not come with any salary.) This was the second chairship removal for Croce: in November 2018, the university had told him that it was removing him as chair of the department of cancer biology and genetics. He contested the grounds for this removal in court, but ultimately lost.

Bradford also required Croce to develop a data-management plan, undergo extra training and have his laboratory's original research data monitored for three years by a committee of three faculty members.

But Croce, noting through his lawyers that he had been "exonerated" of charges of research misconduct, challenged these actions in court, seeking damages and to be reinstated to his endowed chair. He also asked for an order compelling the university to "advertise in national media outlets equivalent to the *New York Times*" that he was exonerated of research-misconduct allegations. In the lawsuit – case number 2022-00187JD in the Ohio Court of Claims – Croce argues that the OSU committee had conflicts of interest and that its investigation took longer than it should have. The university's board denies any allegation of improper conduct on its part, or that of OSU. The case is ongoing.

In his response to *Nature*, Croce says that of the 11 so-far retracted papers that he

co-authored, only one was a primary research paper stemming from his lab.

Very few of the papers in which OSU found plagiarism, data falsification or other errors have been retracted or corrected.

The university's April 2020 final report from Pichiorri's misconduct investigation recommended that two already-corrected papers – one in *Cancer Cell* and one in the *Journal of Experimental Medicine (JEM)* – should be retracted. By July 2022, however, they hadn't been. An OSU spokesperson said the relevant journals had been contacted in January 2021 and again in November 2021, and that "the decision to retract, correct or issue an expression of concern is up to the journal editorial staff and publisher". Editors of *JEM* did not respond to *Nature's* queries; a spokesperson for Cell Press, which publishes *Cancer Cell*, said it could not comment on individual cases.

The OSU investigations that *Nature* has seen found issues in 18 other papers, and recommend that at least 15 of these should be corrected or, in some cases, retracted if figures cannot be verified against research records. (Six of the studies had been corrected before, but investigators said they needed further correction.)

So far, there has been one retraction, two papers have been further corrected and one paper has received an editor's note. Garofalo told *Nature* she had contacted all the journals she'd been asked to.

The retraction appeared in April this year in *PLoS ONE*; it notes that Garofalo and the paper's corresponding author, Gerolama Condorelli – a cancer researcher at the University of Naples Federico II in Italy – "did not agree" with the retraction and that all other authors have not responded directly or could not be reached; it also states that Garofalo and Condorelli had responded to say that the investigation by OSU "is being contested" (*PLoS ONE* Editors. *PLoS ONE* 17, e0267621; 2022). Asked in July whether that were true, an OSU spokesperson responded that "the figures are not being contested at this time".

It's not yet clear whether the US government's Office of Research Integrity (ORI) – which OSU says it informed about its findings of misconduct – will take any further action as a result of the university's investigations. The ORI, which is part of the US Department of Health and Human Services (HHS), can review university investigations and sometimes order them to be redone. It can also make its own findings on misconduct for research conducted with HHS funding. The HHS can then announce sanctions against researchers, including bans on getting federal funding. Asked for comments about the OSU investigations, a spokesperson told *Nature* that the ORI cannot comment on potential cases.

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