

naturenews

Published online 2 September 2009 | *Nature* **461**, 27-32 (2009) | doi:10.1038/461027a

News Feature

GM crops: Battlefield

Papers suggesting that biotech crops might harm the environment attract a hail of abuse from other scientists. Emily Waltz asks if the critics fight fair.

Emily Waltz



[Download a PDF of this story](#)

Emma Rosi-Marshall's trouble started on 9 October 2007, the day her paper was published in *Proceedings of the National Academy of Sciences* (*PNAS*). Rosi-Marshall, a stream ecologist at Loyola University Chicago in Illinois, had spent much of the previous two years studying 12 streams in northern Indiana, where rows of maize (corn), most of it genetically engineered to express insecticidal toxins from the bacterium *Bacillus thuringiensis* (*Bt*), stretch to the horizon in every direction.

Working with colleagues including her former adviser Jennifer Tank at the University of Notre Dame, Indiana, Rosi-Marshall had found that the streams also contain *Bt* maize, in the form of leaves, stalks, cobs and pollen. In laboratory studies, the researchers saw that caddisfly larvae — herbivorous stream insects in the order trichoptera — fed only on *Bt* maize debris grew half as fast as those that ate debris from conventional maize. And caddis flies fed high concentrations of *Bt* maize pollen died at more than twice the rate of caddis flies fed non-*Bt* pollen. *The transgenic maize "may have negative effects on the biota of streams in agricultural areas" the group wrote in its paper, stating in the abstract that "widespread planting of Bt _ crops has unexpected ecosystem-scale consequences"*¹.

The backlash started almost immediately. Within two weeks, researchers with vehement objections to the experimental design and conclusions had written to the authors, *PNAS* and the US National Science Foundation (NSF), Rosi-Marshall's funder. By the end of the month, complaints about the paper had rippled through the research community. By the time Rosi-Marshall attended a National Academy of Sciences (NAS) meeting on genetically modified organisms (GMOs) and wildlife on 5 November 2007, "She looked hammered", says Brian Federici, an insect pathologist at the University of California, Riverside, one of those who commented on her work. "I felt really sorry for her. I don't think she realized what she was getting into."

"The response we got — it went through the jugular."

Emma Rosi-Marshall

No one gets into research on genetically modified (GM) crops looking for a quiet life. Those who develop such crops face the wrath of anti-biotech activists who vandalize field trials and send hate mail. But those who, like Rosi-Marshall and her colleagues, suggest that biotech crops might have harmful environmental effects are learning to expect attacks of a different kind. These strikes are launched from within the scientific community and can sometimes be emotional and personal; heated rhetoric that dismisses papers and can even, as in Rosi-Marshall's case, accuse scientists of misconduct. "The response we got — it went through your jugular," says Rosi-Marshall.

Problem papers

Behind the attacks are scientists who are determined to prevent papers they deem to have scientific flaws from influencing policy-makers. When a paper comes out in which they see problems, they react quickly, criticize the work in public forums, write rebuttal letters, and send

them to policy-makers, funding agencies and journal editors. When it comes to topical science that can have an impact on public opinion, "bad science deserves more criticism than your typical peer-reviewed paper", Federici says.

But some scientists say that this activity may be going beyond what is acceptable in scientific discussions, trampling important research questions and stifling debate. "It makes public discussion very difficult," says David Schubert, a cell biologist at the Salk Institute in La Jolla, California, who found himself at the sharp end of an attack after publishing a commentary on GM food² (see '[Seeds of discontent](#)'). "People who look into safety issues and pollination and contamination issues get seriously harassed."

To see the effect that biotech crop research can have on policy — and why some researchers feel that they need to weigh in against such studies as quickly and forcefully as possible — it is instructive to look back to a study³ published in *Nature* in 1999. In it, John Losey, an entomologist at Cornell University in Ithaca, New York, and his colleagues reported that nearly half of the monarch butterfly caterpillars eating leaves dusted with *Bt* maize pollen died after four days, compared with none exposed to untransformed pollen. The media and the anti-GMO community erupted. "Gene Spliced Corn Imperils Butterflies" headlined the 20 May 1999 *San Francisco Chronicle*. Greenpeace activists demonstrated in front of the US Capitol dressed as monarch butterflies, collapsing from 'killer' GM maize.

In response, the US Environmental Protection Agency (EPA) told seed companies to submit data about the toxicity of *Bt* maize pollen in monarch butterflies or lose the right to sell the maize. Scientists dived into the research, using industry and government funding. The effort produced six *PNAS* papers in 2001 that concluded that the most common types of *Bt* maize pollen are not toxic to monarch larvae in concentrations the insects would encounter in the fields⁴. (Losey had used higher concentrations in his lab studies.) "The Losey paper resulted in a lot of good work and brought to a close that particular question," says Alison Power, who studies ecology and evolutionary biology at Cornell University. Yet some scientists were dismayed that a single paper with preliminary data gave so much ammunition to anti-GMO activists and caused an expensive diversion of resources to calm the scare. They did not want it to happen again.

The caddis-fly study was Tank and Rosi-Marshall's debut in GM research. The idea stemmed from a 2002 talk that Tank gave at Michigan State University in East Lansing about nitrogen dynamics in streams. A researcher in the audience asked whether organic debris from fields of transgenic maize drains into streams, and whether it has any effect on stream life. "We've never thought about that," Tank told the questioner. And once the paper was complete, Tank, Rosi-Marshall and their collaborators had little idea of the storm it was about to kick up. "I thought the response would be 'So what? We're going to lose a few trichopteran'," says co-author Todd Royer, an assistant professor at Indiana University in Bloomington.

On a Friday after the paper was published, Federici and plant biotechnologist Alan McHughen, also at the University of California, Riverside, met at a campus bar for a beer after work. "[McHughen] was really annoyed," says Federici. "I don't think there's been another case where I've seen him so really ticked off." Federici says he too was annoyed — Rosi-Marshall's study was "bad science", he says, and they feared that activists would use it to forward an anti-GMO agenda. McHughen and Federici wanted to neutralize any effects that Rosi-Marshall's paper might have on policy.

The two discussed the key points of a rebuttal letter. McHughen wrote the critique and "circulated it around to people who might be sympathetic", says Federici. The letter listed six grievances with the "sloppy experimental design", and said the publication of the paper had "seriously jeopardized the credibility of *PNAS*". "How many busy scientists and how much scarce money will we need to divert to calm this new scare?" the researchers wrote. McHughen got ten other scientists' signatures, including Federici's. On 22 October, they sent the letter to the journal and to the NSF. Days later, Klaus Ammann, a retired botanist and professor emeritus at the University of Bern in Switzerland who had signed the McHughen letter, posted it on an online discussion forum⁵.

Critical mass

Wayne Parrott, a crop geneticist at the University of Georgia in Athens, also began working on a rebuttal to Rosi-Marshall's paper as soon as he saw it. He said recently that in his opinion: "The work is so bad that an undergrad would have done a better job. I'm convinced the authors knew it had flaws." He e-mailed the authors, the NSF and *PNAS* two bulleted lists of flaws that he said invalidated the paper. He wrote: "It is risky to extrapolate from lab results to field results, particularly when key factors were not monitored, measured or controlled appropriately." In January 2008, *PNAS* published a slimmed-down version of this letter⁶ and the one from McHughen⁷.

Tank and Rosi-Marshall were dismayed by Parrott's e-mail. A few days after receiving it, Tank called James Raich, her contact at the NSF, to talk it over. "I told her to ignore it," says Raich, an ecosystem ecologist at Iowa State University in Ames who worked for the NSF for two years reviewing grant proposals. He told her that letters like these were unusual. But the critiques kept on coming. On 30 November, Monsanto, a maker of *Bt* maize based in St Louis, Missouri, sent the EPA a six-page critical response⁸ to the paper, and posted it online. Eric



Protesters can brandish science suggesting that genetically modified crops are harmful.

P. PAVANI/AFP/GETTY



Jennifer Tank (left) and Emma Rosi-Marshall study stream ecology.

G. LAMBERTI

Sachs, director of global scientific affairs at Monsanto, says that regulators ask seed companies to notify them of papers that relate to crop safety, so Monsanto often includes with its notification evaluations of these papers.

Four other signatories of the McHughen letter went on to publish scathing opinion articles over the next few months. In a March 2008 article⁹ criticizing four papers on biotech crops, Ammann joined forces with Henry Miller, a research fellow at the Hoover Institution in Stanford, California, to ask "Is biotechnology a victim of anti-science bias in scientific journals?". They called Rosi-Marshall's conclusions "dubious", and said their use of evidence "arguably amounts to investigator misconduct". And in a July 2008 commentary in *Current Science*¹⁰, Shanthu Shantharam, a visiting research scholar at Princeton University in New Jersey said Rosi-Marshall's "offending" paper "carried a wrong message to farmers and environmentalists", and that anti-biotech crop activists would use the paper to "hamper the progress of science".

Rosi-Marshall took the hits hard. "I experienced it in person and in writing," she says. "These are not the kind of tactics we're used to in science." She was a few years out from her PhD, she did not have tenure at Loyola and her first paper in a prominent journal was getting trashed, along with her reputation. "She's young and was getting picked on," says Michelle Marvier, a biologist at Santa Clara University in California who attended the NAS November 2007 meeting.

It was at least some comfort to Rosi-Marshall and Tank that e-mails and phone calls of encouragement came pouring in from other scientists. Some of their supporters had observed similar attacks on other biotech crop papers. "The most reassuring thing we learned was that it had happened before and by the exact same people," says Tank.

What was it about Rosi-Marshall's paper that prompted such a strong reaction? The wording of the abstract — "widespread planting of *Bt* crops has unexpected ecosystem-scale consequences" — was a particular point of contention. Her critics say that the data do not support such a definitive conclusion. "They absolutely went too far," says Randy Schekman, editor-in-chief of *PNAS*. Of the half-a-dozen letters received by the journal, most of them protested at this wording, he says. "Why this would have escaped the attention of the referees beats me."

The authors agree that the wording was unfortunate and in retrospect say that the sentence should have articulated the potential for ecosystem-scale consequences within streams, rather than suggesting that such consequences were observed. "This was an oversight," says Rosi-Marshall. "But we did not expect that this sentence would, in light of all of the other statements in our paper, elicit the response it did. We thought the paper would be taken as a whole."

The study's methods also came under fire. It is unclear, for example, whether it was the *Bt* toxin itself affecting the caddis flies, or some other difference between *Bt* and non-*Bt* plants. To test this possibility, critics say the caddis flies should have been fed isogenic lines: strains of maize that are genetically identical except for *Bt* genes. The authors say they chose not to use such lines because their nutritional quality would have differed — *Bt* maize has higher concentrations of lignin than non-*Bt* maize, and so is less nutritious. So the authors matched the *Bt* samples with non-*Bt* samples that had similar levels of lignin and other nutrients. "To do otherwise would have resulted in a confounded experiment. Pairing the treatment on the basis of isolines might be standard for agronomic studies, but was inappropriate for an ecological feeding study," the authors told *Nature* in an e-mail. Rosi-Marshall and her colleagues made this point and other responses to their critics in a correspondence¹¹ published online in *PNAS* the week after McHughen's and Parrott's critiques.

It is also unclear how much *Bt* toxin the caddis flies ate. The authors let the insects eat as much as they wanted, as they would in the wild. Critics argue that the authors should have fed the insects known amounts of the toxin in a method called a dose-response study that is routine in toxicity assessments. "The Rosi-Marshall *et al.* paper would have benefited from additional toxicological data," says Doug Gurian-Sherman, a senior scientist at the Union of Concerned Scientists in Cambridge, Massachusetts, and a former reviewer for the EPA. But the method the authors used "is a widely accepted method, and is generally adequate for a preliminary study of possible toxicity", he says.

Omitted study

The paper was also accused of omitting contrary findings. In June 2007, four months before Rosi-Marshall's *PNAS* paper was published, Jillian Pokelsek, a master's student at Loyola University Chicago working with Rosi-Marshall, presented results from a preliminary field experiment at the annual meeting of the North American Benthological Society in Columbia, South Carolina. The work showed that *Bt* maize pollen did not influence the growth or mortality of filter-feeding caddis flies. The society posted an abstract¹² of the presentation on its website attributing the work to Pokelsek, Rosi-Marshall, Tank, Royer and four other scientists who also authored the *PNAS* paper. It was not mentioning this study that prompted Miller and Ammann's accusation of misconduct⁹.

The authors defend the omission on the grounds that the data in the meeting presentation were not published or peer-reviewed, and were less reliable than those in the *PNAS* paper. "Field experiments are inherently difficult to control and have lower statistical power to detect significant differences compared with controlled laboratory experiments, thus we included the more controlled and statistically rigorous lab experiments in our paper," Tank and Rosi-Marshall told *Nature*. Also, the caddis flies in the student presentation belonged to a different family, with different feeding mechanisms to those in the *PNAS* study. Miller's response: "I don't want to split hairs," he says. "If you don't do appropriate controls or if you draw conclusions that are erroneous, I think that's misconduct." But Ammann says he has a "bad feeling" about the accusation. "Maybe we should have been more careful with the wording."

Scientists who were not involved in the debate over Rosi-Marshall's paper say the results were preliminary and left some questions unanswered, but that overall the data are valuable. "The science is fine as far as I'm concerned," says Arthur Benke, an aquatic ecologist at the University of Alabama in Tuscaloosa, who called the strong language in some of the criticisms "inappropriate".

"When bad science is used to justify bad policies, we all lose."

Alan McHughen

What drives the critics? Financial or professional ties to the biotech industry don't seem to be the impetus. Such ties do exist — like many people researching biotech crops, some have received research grants from industry or have other interactions with it — but in interviews they say that these are not the major driving force. Rather, many of them feel strongly that transgenic crops are safe and beneficial to the environment and society, and that the image and regulation of these crops has been too harsh. Many of the critics have been studying biotech crops since they were developed commercially in the late 1980s, and some were involved with the first regulatory approvals. They have specific ideas about how the risks of these crops should be scientifically assessed. And they worry that papers that fall short of high standards will give anti-GMO activists ammunition to influence policy,

just as the monarch-butterfly study did. "When bad science is used to justify bad public policies, we all lose," says McHughen, who says he is on a "campaign to make academic scientists a little less politically naive and a bit more careful in their scientific work". Miller adds that "agricultural biotech has been so horrendously, unscientifically regulated and so over-regulated and so inhibited over the past 30 years that to have these pseudo-controversies stirred up unnecessarily does a disservice to everyone and everything".

Ammann points to the example of golden rice, a variety engineered in the late 1990s to contain more vitamin A. Regulations have delayed the rice's development, he says, although more than 250,000 children a year go blind from vitamin-A deficiency. "We have to get emotional," says Ammann. "I can't agree with the cool scientists' perspective — only dealing with the facts. We live in the real world." In 2006, Ammann formed a rebuttal team called ASK-FORCE to challenge reports about biosafety of GM crops. On one online site, Ammann criticizes 20 reports — none of them positive toward biotech crops — that he considers biased or bad science. In July, he was revising a critique of a paper that appeared in *The Lancet* ten years ago. "I'm working nearly day and night on these things," says Ammann.

The emotional and sometimes harsh quality of some of the attacks strikes some scientists as strange and unlike the constructive criticism to which they are accustomed. Benke points out that none of the criticisms on the caddis-fly paper, for example, called for further study on the insects. "What papers like this do is alert us to possible reasons to look into this more carefully," he says. "No one mentioned this." To try to dismiss the research out of hand ignores how science is supposed to work, adds Power — you make a hypothesis, test it, refine it, test it and refine it again. "You keep doing that until you have an answer that is as close as you're going to get," she says. "I don't understand the resistance to that notion."

Arbiters of the truth

Some scientists say they are galled by the certainty with which some of the critics state their opinion. "Part of what exasperates me is that they have declared themselves to be the experts in this field, and forcefully present themselves as the ultimate arbiters of truth," says an editor for the Entomological Society of America who asked to remain anonymous. "I personally am in favour of GMOs in general, and think that they are very beneficial for the environment. But I do have problems with the tactics of the large block of scientists who denigrate research by other legitimate scientists in a knee-jerk, partisan, emotional way that is not helpful in advancing knowledge and is outside the ideals of scientific inquiry."

"It is critical to assert the right of scientists to question each other's work."

Wayne Parrott

The critics respond that they are simply pointing out flaws in research, and that this is an important part of the scientific process. "It is neither fair nor accurate to equate pointing out serious deficiencies with experimental design and data interpretation as 'denigration'," Parrott says. "For science to maintain its integrity and move forward, it is critical to assert the right of scientists to question each other's work." McHughen says that he doesn't condone *ad hominem* attacks. "They are invariably unproductive," he says, and points out these tactics are often used against scientists who don't oppose GM crops.

Federici says he finds it inappropriate to call the reactions 'knee-jerk' ones. "Losey and colleagues, and Rosi-Marshall and colleagues at the time of their studies were newcomers to the field. Most of the people who found their studies flawed and protested had extensive experience with *Bacillus thuringiensis*." He also points out that the critics varied in how strongly they responded to the Rosi-Marshall paper, saying "I don't consider writing a letter to the editor a harsh response."

"Young people are not going into this field because they are discouraged by what they see."

Ignacio Chapela

Ignacio Chapela, a microbial ecologist at the University of California, Berkeley, says that the attacks may be deterring young scientists from pursuing careers in biotech crop research. "I have a very long experience now with young people coming to me to say that they are not going into this field precisely because they are discouraged by what they see," he says. Chapela faced criticism from pro-GMO scientists after publishing a 2001 paper in *Nature*, in which he reported that native maize varieties in Mexico had been contaminated with transgenic genes⁴³. Following the criticism, *Nature* decided that "the evidence available is not sufficient to justify the publication of the original paper".

At its worst, the behaviour could make for a downward spiral of GM research as a whole, says Don Huber, a emeritus professor of plant pathology at Purdue University in West Lafayette, Indiana. "When scientists become afraid to even ask the questions ... that's a serious impediment to our progress," he says. Miller says: "I don't see how criticism of flawed science that verges on misconduct should discourage

anybody." Researchers could be invigorated by entering a field with such lively debate. "For some people it might be exciting because you're doing science that is relevant to society," says Power.

Pervasive spread

Rosi-Marshall's caddis-fly paper did find its way into the anti-GMO rhetoric, although on nowhere near the scale that the monarch butterfly paper did. For example, the London-based Institute of Science in Society, a not-for-profit organization involved in the GM debate, on 30 October 2007 posted its summary of the paper, saying that: "calling a halt to planting *Bt* corn next to streams ... would be in keeping with the evidence [the authors] have provided". Greenpeace included the paper in an April 2008 briefing on *Bt* maize, citing it as evidence of environmental risk.

The impact went further than that. On 9 January 2008, three months after Rosi-Marshall's paper was published, France's watchdog on GM foods ruled that one of Monsanto's types of *Bt* maize, known as MON810, may have an impact on wildlife. The evidence it cited included Rosi-Marshall's paper. Two days later, the French government announced a ban on cultivating the maize. "[The paper] got to every agency and non-governmental organization that doesn't like the technology and gave them a flag to wave," says Parrott. Not that he considers the effort wasted: "I have no doubt the impact on policy-makers would have been much worse had it not been countered."

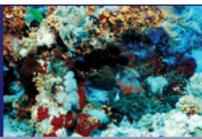
Nearly two years since the paper was published, the critics' comments are still pointed. "It was just an idiotic experiment," Miller said this July. But Rosi-Marshall and her co-authors stand behind their paper. "We believe our study was scientifically sound," they wrote in an e-mail, "although many questions on the topic remain to be answered. The repeated, and apparently orchestrated, *ad hominem* and unfounded attacks by a group of genetic engineering proponents has done little to advance our understanding of the potential ecological impacts of transgenic corn."

And Rosi-Marshall's career seems to have survived the furore. In May 2009 she secured tenure at Loyola University Chicago, and in August she moved to the Cary Institute of Ecosystem Studies in Millbrook, New York. There she will study human-dominated ecosystems and will continue to investigate the influence of maize varieties on stream ecosystems. Since the caddis-fly paper, she has co-authored another study on transgenic crops showing that *Bt* maize debris decomposes in streams at a faster rate than conventional maize¹⁴. She says more data produced with the NSF grant are on the way and that the attacks won't deter her from her studies.

"It toughened me up a lot," she says. "I'm not going to be intimidated."

Emily Waltz is a freelance writer based in New York City. See also Correspondence [Battlefield: hitting the supporters of biotechnology](#) and [Battlefield: useful debate needs caution and civility](#).

ADVERTISEMENT



The Journal of
Antibiotics

Marine Microbial Natural Products:
Special web focus

Access articles free for a limited time.

References

1. Rosi-Marshall, E. J. *et al. Proc. Natl Acad. Sci. USA* **104**, 16204-16208 (2007). | [Article](#) | [PubMed](#)
2. Schubert, D. *Nature Biotechnol.* **20**, 969 (2002). | [Article](#)
3. Losey, J. E., Rayor, L. S. & Carter, M. E. *Nature* **399**, 214 (1999). | [Article](#) | [PubMed](#) | [ISI](#) | [ChemPort](#) |
4. Scriber, J. M. *Proc. Natl Acad. Sci. USA* **98**, 12328-12330 (2001). | [Article](#) | [PubMed](#)
5. http://pubresreg.org/index.php?option=com_content&task=view&id=64
6. Parrott, W. *Proc. Natl Acad. Sci. USA* **105**, E10 (2008). | [Article](#) | [PubMed](#)
7. Beachy, R. N., Federoff, N. V., Goldberg, R. B. & McHughen, A. *Proc. Natl Acad. Sci. USA* **105**, E9 (2008). | [Article](#) | [PubMed](#)
8. *Technical Review: Rosi-Marshall et al. 2007. PNAS 104: 16204-16208* (Monsanto, 2007); available at http://www.monsanto.com/pdf/products/caddisflies_review_810.pdf
9. Miller, H. I., Morandini, P. & Ammann, K. *Trends Biotechnol.* **26**, 122-125 (2008). | [Article](#) | [PubMed](#)
10. Shantharam, S., Sullia, S. B. & Shivakumara Swamy, G. *Curr. Sci.* **95**, 167-168 (2008).
11. Rosi-Marshall, E. J., Tank, J. L., Royer, T. V. & Whiles, M. R. *Proc. Natl Acad. Sci. USA* **105**, E11 (2008). | [Article](#)
12. Pokelsek, J. D. *et al.* Presentation at the North American Benthological Society Annual meeting, Columbia, South Carolina, 2007. Available at <http://www.benthos.org/database/allnabstracts.cfm/db/Columbia2007abstracts/id/370>
13. Quist, D. & Chapela, I. H. *Nature* **414**, 541-543 (2001). | [Article](#) | [PubMed](#) | [ISI](#) | [ChemPort](#) |
14. Griffiths, N. A. *et al. Ecol. Appl.* **19**, 133-142 (2009). | [Article](#) | [PubMed](#)
15. Beachy, R. *et al. Nature Biotechnol.* **20**, 1195-1196 (2002). | [Article](#)
16. Tabashnik, B. E., Gassmann, A. J., Crowder, D. W. & Carrière, Y. *Nature Biotechnol.* **26**, 199-202 (2008). | [Article](#)
17. Moar, W. *et al. Nature Biotechnol.* **26**, 1072-1074 (2008). | [Article](#)

18. övei, G. L., Andow, D. A. & Arpaia, S. *Environ. Entomol.* **38**, 293-306 (2009). | [Article](#) | [PubMed](#)

19. Shelton, A. M. *et al. Transgenic Res.* **18**, 317-322 (2009). | [Article](#) | [PubMed](#)

Comments

Reader comments are usually moderated after posting. If you find something offensive or inappropriate, you can speed this process by clicking 'Report this comment' (or, if that doesn't work for you, email webadmin@nature.com). For more controversial topics, we reserve the right to moderate before comments are published.

I am one of the people who published a critical commentary of the Rosi-Marshall paper (see ref. 9 above). Here are my further comments about the piece above.

i. The main reason for the strong criticism of papers like Rosi-Marshall is exactly about bad science with major policy implications.

If I publish a paper about sex determination in asparagus that has no interest beyond the scientific circles, then it does not damage anybody beyond these circles if it is wrong and the damage is mild. On the contrary, when a paper claiming problems with transgenic plants is published, it may be used by people opposed ideologically to ag-biotech.

We have seen this in the past with Loosey, Chapela and others. These papers have been used or are used to prevent introduction of the technology in several European countries and, as a consequence, in several other countries in the third world. Even if the content of the papers is later dismissed as irrelevant or wrong, the claims are still propagated for years. Papers that could have an influence on policy and regulation for years must be screened by editors and referees with the utmost care first and then by the scientific community at large once they have been published.

The scientific community has the moral obligation of looking more carefully into matters which could impact many more people, both positively or negatively.

ii. A truly constructive criticism in science must have one aim: seek the truth.

The role of peers (referees and later colleagues who read the paper) is to help authors to do this. It is a matter of humility to submit your own research results to the scientific world. If you can't stand this sort of criticism, you are loving your results more than the truth. Sometimes the wording of the criticism may be more or less pleasing (whoever has received referees comments on a manuscript knows it very well). Things lived with passion bring often excesses in feelings. But what matters more is the end result.

iii. These papers do not alert us to possible reasons to look into this more carefully. A research badly designed, for instance with no proper controls or with unreasonable doses completely out of real life range or situation is simply irrelevant and does not advance our understanding and may even be misleading further research. A wonderful example of this is the data accumulated on synthetic substances with test for carcinogens made at high dose in the 70s-80s. They turned out to be deadly wrong and said nothing about the effect at the real doses we are exposed to. Rather than alert about possible reasons to look more into this, they concealed the reality for many years because people did not do the proper control with natural substances (which had the same frequency, 60%, of carcinogens as synthetic substances).

Bad science caused bad regulation and unnecessary spending as well as useless research. Try interview Bruce Ames (professor of Biochemistry at Berkeley) on this or read some of his pieces:

<http://potency.berkeley.edu/pdfs/Paracelsus.pdf>

or a video: <http://www.bruceames.org/bnalect.cancer1.php>

Looking at a transgenic corn causing a reduction on non target organisms without comparing the effect of a conventional corn treated with insecticides is a non real world situation. In Italy this year we are experiencing a strong outbreak of root corn borer. They are treating with insecticides but nobody measures the effect on biodiversity.

iv. I see much more depressing for scientists spending years on developing a new product to see their research fields destroyed or their products not brought to the market because of insane regulatory burden.

These regulations, especially in the EU, are fuelled by bad science and ideological opposition.

Golden rice is a prime example of unjustifiable delay. I know of several other products with real benefits which never made it to the market.

P. Morandini, Dept. of Biology, University of Milan (Italy)

Posted by: **Piero Morandini** | 04 Sep, 2009

It was with surprise that I read Emily Waltz 's article "Battlefield". Waltz used the word "attack" four times in the article yet never once put forward evidence of anything other than challenges to the science methodology, interpretation, incomplete citations, over reaching conclusions etc. Attempting to claim victim status is a very successful method used to avoid the real issue, in this case the BAD Science. I was left wondering if the intent of the article was to quiet the scientific criticisms. As far as I can determine the scientific criticisms were right on the mark. It is too bad Emily Waltz and Nature did not appear to understand this point. When poor quality science goes unchallenged we all lose.

Robert Wager
Vancouver Island University
Nanaimo BC
Canada
robert.wager@viu.ca

Posted by: **Robert wager** | 07 Sep, 2009

The critics' claim that EU regulation on GMOs is "fuelled by bad science and ideological opposition" betrays the critics' own ideological position and scientific hubris. Quite a few peer-reviewed papers have been published in peer-reviewed journals, based on rigorous methodology and long-term field data, which unambiguously show adverse impacts of GM crops on biodiversity (for example, Bohan et al. 2005, *Proc. Royal Soc. B* 272, 463-474). Critics who are so earnest about "good science" are surprisingly silent about such publications. They never write letters to policy makers suggesting immediate ban of herbicide tolerant GM crops in all countries.

Similarly, Saxena's work on the significant larvicidal effect of Bt-root exudates from Bt corn hybrids, representing three transformation events (Bt11, MON810, and 176) and evaluated in both *in vitro* and field studies (Saxena D., S. Flores, and G. Stotzky 2002, *Soil Biology & Biochemistry* 34, 133-137) is neither cited nor noticed by these self-righteous critiques. A number of excellent studies (cited in SÄ©ralini et al. (2009, *Int. J. Biol. Sci.* 5: 438-443) are fated to disappear from the view of policy makers and the public through the "conspiracy of silence".

Contrariwise, when a truly bad paper, reporting absurd findings, was published in a reputed journal like *Science*, the responsibility and righteousness of these same critiques, like the Pharaoh's horses behind Moses, sank into the deep sea. This particular study (Qaim, M., & Zilberman, D. 2003, *Science* 299, 900-902) found up to 83% yield increase in Bt cotton, based on farmer interviews and "trial records" supplied by Mahyco-Monsanto – the company who conducted those putative trials, and obviously had stake in such publications. Moreover, the study did not consider the confounding effects of late (by 2 months) sowing of the crop, and of better water supply to the Bt-cotton fields compared to the non-Bt varieties. When GM crops are promoted at the expense of scientific rigor and sensibility, the whistle blowers cannot find their whistles, or else are out of their breath to blow the whistles.

What surprises me most is the critics' evasion of the fact that Bt toxin is a known insecticide, and biotechnologists have chosen this toxin for incorporation into crop plant precisely for that purpose. However, whenever a study shows a toxic effect on non-target insects, it is immediately branded as "bad science". It requires little understanding of insect physiology to surmise that continuous flux of the insecticidal toxin from a Bt-plant source into the soil and run-off water is likely to eliminate at least some non-target insects. One may argue about the exact extent of mortality of this or that species, but the lethal effect of Bt toxin on non-target insects is well established (see Hilbeck, A. and J.E.U. Schmidt 2006, *Biopestic. Int.* 2 (1): 1-50). The effect is certain when insect predators and parasitoids consume "Bt-susceptible and sublethally-damaged herbivores" (J., M. Meissle & F. Bigler 2006, *Nature Biotechnology* 24: 63 – 71). Do the critics perceive any policy implication of these findings?

Debal Deb

Centre for Interdisciplinary Studies, Barrackpore, India. (Current address: Energy & Resources Group, University of California- Berkeley)
debaldeb@wildmail.com

Posted by: **Debal Deb** | 21 Sep, 2009

Dear Sirs, it is just the other way around: it is the duty of serious scientists to criticize weak or junk science, simply in order to at least make a remark for those who can read that there is a piece of weak or junk science. We have seen again and again that in a world triggered by a greenish mainstream any piece of science which casts some doubt on GM-plants will be pimped up by NGOs, media and scientifically illiterate politicians for justifying unjustifiable political actions. The most recent one is the ban of Mon 810 by the German minister of Agriculture and some other European governments, which is based on extremely weak science. It is also common experience made by many of those scientists working on GM-plants at universities or public research institutes that they are accused by NGOs or greenish politicians as being bought by the multinationals, not to name hate mails, blogs or other types of harassments. In case Emily Waltz needs names, she is free to contact me.

Posted on behalf of Hans-Joerg Jacobsen, Leibniz Universität Hannover, hj_jacobsen@mac.com

Posted by: **Roseann Campbell** | 05 Oct, 2009

Waltz's News Feature 'GM crops: Battlefield' about genetically modified crops that produce insecticidal toxins from *Bacillus thuringiensis* (Bt) notes that our review summarizing evidence of insect resistance to Bt cotton was challenged by a scientist who now works for Monsanto. We would like to point out that resistance to Monsanto's Bt cotton that produces toxin Cry1Ac is well documented in some U.S. populations of bollworm (*Helicoverpa zea*), a major cotton pest (B. E. Tabashnik et al., *Nature Biotechnology* 26, 1074-1076; 2008). The evidence includes control problems in the field, increased survival of insects on Bt cotton leaves, and extensive laboratory bioassay data. Rapid resistance was anticipated in this case because the crop does not deliver a sufficiently high dose of toxin against this pest (http://www.epa.gov/scipoly/sap/meetings/1998/0298_mtg.htm). We also note that Monsanto allowed its U.S. registration of Bt cotton producing Cry1Ac to expire in September 2009. Sales have been shifting largely to Monsanto's newer Bt cotton that produces Cry1Ac and Cry2Ab, which is more effective against Cry1Ac-resistant insects.

Although most targeted pest populations remain susceptible to Bt crops, undisputed evidence of insect resistance to Bt maize has been reported from Puerto Rico and South Africa (S. R. Matten et al. 2008, pp. 27-39, in J. Romeis et al. [eds.], *Integration of Insect Resistant Genetically Modified Crops within IPM Programs*. Springer, New York; M. Kruger et al., *Crop Protection* 28, 684-689; 2009). In Puerto Rico, sales of GM maize producing Bt toxin Cry1F have been suspended because of insect resistance. Although planting "refuges" of non-Bt crops to delay resistance by promoting survival of susceptible insects is required in many countries, low farmer compliance with this strategy probably hastened evolution of resistance in South Africa.

While attempts to discount documented cases of insect resistance to GM crops are counterproductive, systematic analyses of such examples can enhance understanding of pest evolution and yield insights that help to boost the durability of GM crops for insect control. More generally, we encourage scientists to set aside passions for or against GM crops and focus instead on bringing evidence to bear on the issues. Objective, rigorous evaluations on a case-by-case basis can help to resolve controversies, limit negative impacts of GM crops, and maximize their benefits.

Bruce E. Tabashnik, Yves Carrière
Department of Entomology
University of Arizona
brucet@ag.arizona.edu, ycarrier@ag.arizona.edu

Posted by: **Bruce Tabashnik** | 13 Oct, 2009

Add your own comment

You can be as critical or controversial as you like, but please don't get personal or offensive, and do keep it brief. Remember this is for feedback and discussion - not for publishing papers, press releases or advertisements, for example. If you ramble on in an annoying way too often, we may remove your posting privileges.

You need to be registered with Nature to leave a comment. Please log in or register as a new user. You will be re-directed back to this page.

[Log in / register](#)

Nature ISSN 0028-0836 EISSN 1476-4687

[About NPG](#)[Privacy policy](#)[Nature News](#)

© 2009 Nature Publishing Group, a division of Macmillan Publishers Limited. All Rights Reserved.

[Contact NPG](#)[Legal notice](#)[Naturejobs](#)[RSS web feeds](#)[Accessibility statement](#)[Nature Asia](#)[Help](#)[Nature Education](#)

partner of AGORA.

HINARI, OARE, INASP, CrossRef and COUNTER

[About Nature News](#)
[Nature News Sitemap](#)

Search:

"Who would have guessed that the working record of a mathematical project would read like a thriller?" Timothy Gowers and Michael Nielsen, page 879

Battlefield: hitting the supporters of biotechnology

SIR — You misidentify the victims in your News Feature on conflicts among scientists over genetically modified (GM) crops (*Nature* 461, 27–32; 2009). The real victims on this "battlefield" are not the handful of people criticized for their research, but those scientists who want to realize the potential of plant biotechnology and the farmers who apply authorized products.

These people have to endure bomb threats, insulting letters and telephone calls, destruction of their fields (almost no UK field experiment has survived since 2000) and harassment of their children at school. As author of a UK Food Standards Agency report concluding that organic food provides no additional nutritional or health benefit, Alan Dangour was bombarded with hate mail from activists.

The whole biotech debate is an emotionalized mess, fuelled by lobbyists and society's zero-risk mentality. Scientists should not be wary of publishing their results just because they could be deliberately misinterpreted. But they must be vigilant. As Kai Diekmann, chief editor of *Bild*, the largest newspaper in Germany, said in a recent television broadcast, "More than 10 million readers is a huge responsibility. I have to consider every single word before it is printed."

Why are some scientists so sensitive if weak data are published? When I first met Ingo Potrykus, the inventor of the famous transgenic 'golden rice' (so called because of its extra β -carotene content), I was still Germany's top anti-GM campaigner with Friends of the Earth. Some 15 years after our public debate, I now understand his frustration. As a humanitarian and Roman Catholic, he has worked hard to develop rice varieties he believes could improve the lives of millions of poor



children likely to become blind. But Greenpeace and other activists are sabotaging his efforts with false claims, initially that children could be poisoned by excess vitamin A (see go.nature.com/DFzvpc) and later that 4 kilograms of rice is the daily requirement for a therapeutic effect (see go.nature.com/GvklD9).

Scientists should think more carefully about the impact their words might have on the future of society, and their responsibility towards it.

Jens A. Katzek An der Elbe 5,
39104 Magdeburg, Germany
e-mail: katzek@biomitteldeutschland.de

Battlefield: useful debate needs caution and civility

SIR — The rage that is sometimes unleashed by proponents of genetically modified (GM) crops when they encounter evidence for potential risks is well described in your News Feature (*Nature* 461, 27–32; 2009). Several pointers could help remedy the problem of abuse in this "battlefield".

Reviewers and editors of scientific journals should insist that critiques of GM studies are well-reasoned and constructive, and free of emotionally charged language that might inflame the issues. They should resist the temptation to publish potentially

exciting but very preliminary studies that might attract unwarranted media attention (this also applies to findings on the potential benefits of transgenic crops).

Authors of controversial papers must be prepared for their conclusions to be misinterpreted and quoted out of context, even by reputable science writers, as the news flashes around the globe. Oversimplification by the media is prevalent, but careful wording of the paper's findings will encourage more accurate reporting.

Without caution and civility by all participating scientists, effective debate on the benefits and risks of GM crops will continue to be hampered.

Allison A. Snow Department of Evolution, Ecology and Organismal Biology, 318 W. 12th Avenue, The Ohio State University, Columbus, Ohio 43210, USA
e-mail: snow.1@osu.edu

Commercial pressure quelling creation of new microscopes

SIR — Your collection of articles on microscopy (*Nature* 459, 629–639; 2009) rightly celebrates the success of innovators in the field. Unfortunately, the supply of new technologies is being threatened by commercial concerns.

Microscope manufacturers

are obliged by world competition to specialize in a few high-end products only. Even though these products are hugely expensive, their total sales volume is now so small that the profits do not support the research and development of new microscopes. High prices call for purchase by a group, so the specification list expands and the cost spirals up.

Companies are wary of producing a low-cost microscope, such as SPIM (selective plane illumination, ideal for low-bleach imaging of embryos) for fear of losing their high-end sales. Several other new technologies, including CARS (coherent anti-Stokes Raman scattering microscopy, which provides chemical information similar to that given by infrared spectroscopy) and PALM (photoactivated localization microscopy, which brings the resolution down to a few nanometres), are not yet available commercially. Another method of super-resolution is being produced (STED, or stimulated emission depletion microscopy), but is not working as well as it does in the hands of the inventor.

Sadly, there are now several examples of inventions that might have been beneficial to science and medicine being suppressed by companies for marketing reasons — including one of my own design, an attractive and inexpensive confocal system.

Given that the normal route of exploitation is grinding to a halt, perhaps inventors could be funded directly to clone their inventions. There should be a pre-commercial phase of development by the public sector. It would also help to set up, where it does not exist already, an institute with the capability (optics, software, electronics experts and biologists) to develop these elaborate new microscopes. It is too much for any individual university or biomedical lab.

Brad Amos, Cambridge, UK

A. SOTIRIOU/GETTY