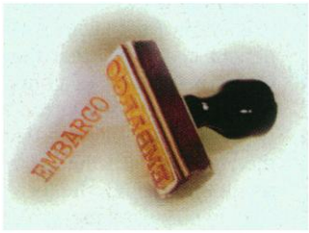
An arrangement aimed at keeping scientific findings out of the media until they are published by a journal draws mixed reviews; it is under pressure from Web-based publishing, and most physics publishers have already abandoned it



Embargoes: Good, Bad, or 'Necessary Evil'?

Every Wednesday or Thursday, more than 1400 reporters around the world get a sneak preview of the research articles that will appear in *Nature* a week later. The journal sends out faxes and e-mails highlighting the most newsworthy stories, and reporters can order the full text of any article. Two days later, more than 1200 journalists get similar advance notice of articles to be published in *Science* the following week. FedEx or priority mail brings early copies of medical journals like *The New England Journal of Medicine* (*NEJM*) and *The Journal of the American Medical Association* (*JAMA*). Reporters' e-mail inboxes and fax machines, meanwhile, fill up with announcements from other journals, universities, and institutes promoting new scientific findings. Most of this information carries a prominent warning: EMBARGOED. Public use of the information is forbidden until a specified date and hour to coincide with a journal's publication date.

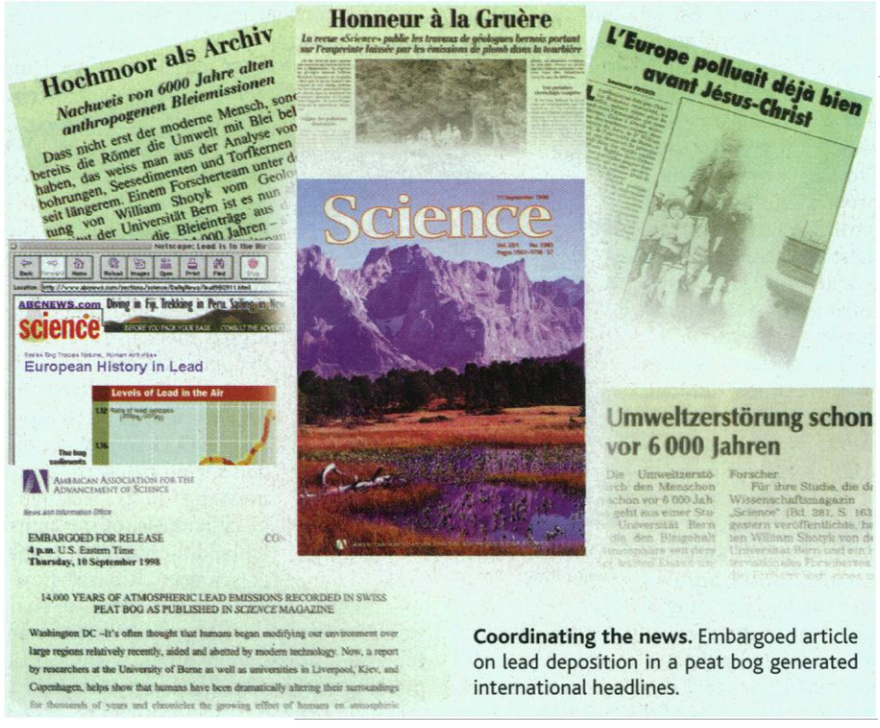
EMBARGOES

This special focus looks at the role of the embargo system in communicating scientific results to the public and to other scientists. Meetings and the special case of astronomy bring out some of the strains inherent in the system.

▶ EMBARGOES
MEETINGS
ASTRONOMY

What is most remarkable about this vast private traffic in science news is that it almost never leaks prematurely to the public. Hundreds of news-hungry reporters sit on the information, as they are bidden by journal publishers, until the designated release time. Welcome to the embargo system—a gentlemen's agreement between science journals and reporters designed to manage the flow of new scientific results to the public. The embargo system is the final stage of a process in which journals impose vows of secrecy not only on journalists but on the authors of the scientific papers they publish. No other area of journalism has such a cozy, formalized arrangement between reporters and their sources of news.

This odd system has developed and flourished over several decades because it offers advantages for everybody involved. Journals get maximum publicity, journalists get time to report complex stories, and scientists get more widespread and more accurate public exposure for their work. Indeed, the system is so successful that it has recently expanded with the debut of Internet-based clearinghouses that funnel embargoed information from a variety of sources to reporters who agree to abide by the rules. Behind the scenes, however, the embargo system is increasingly embattled.



Coordinating the news. Embargoed article on lead deposition in a peat bog generated international headlines.

It's a system wracked by built-in tensions. Science is supposed to progress through rapid communication of results among scientists, but the embargo system can erect barriers to this exchange of information. Nowhere is this more apparent than at scientific meetings, where scientists are often unclear on the rules for discussing results that are under review or in press at a journal (see p. 867). Newspapers and their reporters thrive on scoops, yet scoops are ruled out by the embargo system—and even some science reporters say the system encourages lazy reporting and undue attention to incremental advances. When a big science story comes along, however, competition is hard to suppress until a paper is published (see p. 862). Moreover, intense commercial interest in molecular biology has created new problems when information that can send a company's stock price soaring is distributed to hundreds of journalists under an embargo (see p. 865).

These built-in tensions are exacerbated by a new factor: the Internet and the World Wide Web. The Web is not only transforming scientific publishing, it's also changing the rules of the embargo system. In a world in which scientific papers can be disseminated to online subscribers as soon as they are accepted, the publication date of the printed version—and the embargo release time—becomes somewhat arbitrary. More-

CREDITS: PHOTO ILLUSTRATIONS BY ANNE ELLIOT CUNNINGHAM

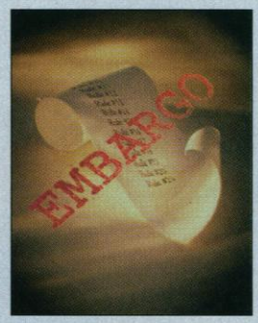
over, the Web has created new avenues for circulating scientific information—from preprints of whole articles to bulletins of new astronomical observations—outside the embargo system, providing fodder for enterprising journalists (see p. 868).

All this is prompting many journals to rethink their embargo policies. Most physical science publishers have already abandoned the system, the American Chemical Society has virtually scrapped it, and even some biology and general science journals may follow suit. For example, Nicholas Cozzarelli, editor-in-chief of the *Proceedings of the National Academy of Sciences* (*PNAS*), says he's in favor of "getting rid of the embargo" in its present form and is proposing a new policy to his board this week.

This package of articles examines these issues from the perspectives of journal editors, reporters, and the scientists who are often caught in the middle. But first, by way of full disclosure, it should be noted that *Science* itself has a stake—or, rather, several different stakes—in the embargo system. The scholarly publishing side of the journal has a strict embargo policy (see Editorial, p. 877), and the American Association for the Advancement of Science, *Science*'s publisher, has launched an ambitious Web-based clearinghouse for scientific information, EurekAlert!, that includes embargoed press releases. The News section, on the other hand, is on the receiving end of the embargo system: *Science*'s journalists report independently on scientific developments published in this journal and others, and on data presented at meetings and elsewhere. Sometimes, the process even comes full circle when advance copies of *Science* news articles are distributed to other journalists under embargo.

Franz Ingelfinger's Legacy Shaped Biology Publishing

Franz Ingelfinger, a revered figure in biomedical publishing, drew up some rules for authors in *The New England Journal of Medicine* (*NEJM*) in 1969, shortly after becoming the journal's editor-in-chief. His decree forbidding prior publication in other media sharpened *NEJM*'s policies and created a legacy that's been invoked by numerous editors over the past 3 decades. Yet when he devised the rule, Ingelfinger acknowledged that it was not based on any exalted principle: It was basically a good business decision. Ingelfinger wanted to be sure that the articles he published were original and "newsworthy."



Ingelfinger explained the origin of the rule in his 1977 Shattuck Lecture to the Massachusetts Medical Society in Boston. He was "jolted" to adopt a new policy, he said, when he saw the "essence" of a report due to appear in the *NEJM* pasted across the pages of *Medical World News*. "Imagine my dismay," he continued, when "illustrations and tables practically identical to those submitted to the *Journal*" appeared in a competitive publication. "We had been scooped."

Determined to prevent a recurrence, Ingelfinger ran an editorial on 18 September 1969 spelling out his decision: *NEJM* would accept no "material" that had been contributed previously to "any book, journal, or newspaper." He made an explicit exception for scientific meetings, allowing speakers to publish abstracts of talks and engage in some contact with the press. "When a reporter notes what is said by a speaker at a public meeting," Ingelfinger wrote, it is "difficult" to draw a line between reasonable and excessive press communication. His rule of thumb was that the scientist's paper might be rejected by *NEJM* if "the speaker makes illustrations available to the interviewer, or if the published interview covers practically all the principal points contained in a subsequent submitted manuscript."

The Ingelfinger rule has been adjusted several times since 1969—for example, to allow the rapid release of data that might be important for public health and to permit scientists to share unpublished material with impunity in congressional hearings or other government proceedings. But the main points are still enforced by *NEJM*'s editors, and they form the basis of similar rules applied by most other medical and biological journals. **–E.M.**

Lofty purposes

Ask journal editors why they employ the embargo system, and the answer usually revolves around one issue: quality control. Insisting on secrecy from authors until their papers are published guards against public release of data that might not pass muster in peer review, and giving reporters a few days' advance access to papers that have passed review yields more accurate news. "The fundamental thing," explains Jerome Kassirer, editor-in-chief of the *NEJM*, "is the protection of the peer-review process." Says *JAMA* Editor George Lundberg: The system ensures that "quality is played out maximally in the public media."

It was the *NEJM* that formalized the current system almost 30 years ago, when it published a set of principles known as the Ingelfinger rule, after the journal's editor at the time, Franz Ingelfinger. The Ingelfinger rule (see above) is still the guiding principle for the *NEJM*, but an estimated 300 other journals follow guidelines laid down by a group of medical editors calling themselves "the Vancouver group," a reference to their first meeting place in Canada in 1978. The bottom line of their 25-page list of rules, updated most recently in 1997 (www.ama-assn.org/public/journals/jama/sc6336.htm), is virtually the same as that of the Ingelfinger rule. Journals "do not wish to receive a paper on work that has already been reported in large part," the Vancouver rules state, regardless of whether it has appeared "in print or in electronic media." They warn authors to expect "prompt rejection" of any manuscript judged by editors to be a "duplicate publication." Presenting the data at scientific meetings is fine, but sharing "tables and illustrations" with reporters is not.

The multidisciplinary journals have similar policies. *Science* uses "a variant of the Ingelfinger rule," says Editor-in-Chief Floyd Bloom, "to educate the public broadly and accurately." He says that there are benefits for scientists, too: Embargoes draw attention to new findings, and this builds public support for science. Publicity also attracts "the best authors." Philip Campbell, editor of *Nature*, says his journal's embargo rules are motivated by a sense of "fairness"—a wish to make results available to "everyone at the same time"—and by a wish to maintain quality. But he also acknowledges some "self-interest," in that the embargo system "maximizes the profile of the journal." Publishers also argue that editing increases the value of articles and that the embargo system helps reward journals for their contribution. (*Cell* Editor Benjamin Lewin declined to discuss the embargo policy of his journal, which has taken a strong line on prepublication publicity, especially at meetings; see pp. 866 and 867.)

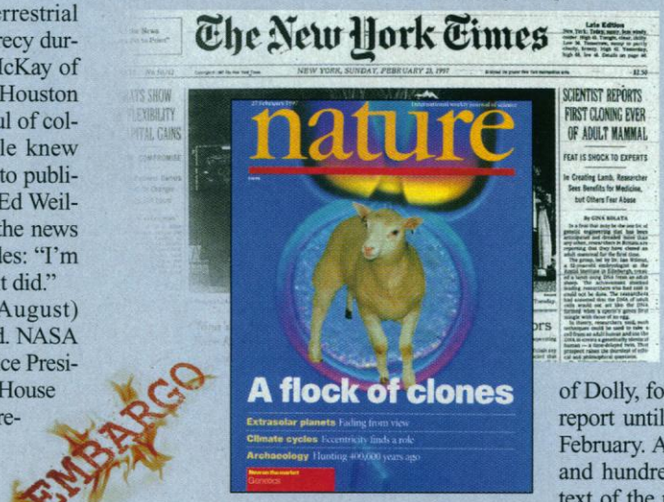
Medical editors cite another reason for embargoes: They don't want physician-subscribers to be caught off guard by stories in the media before they have the issue in their hands. Says Lundberg: "We believe that physicians have a right to have access to the full information in the article prior to being asked by patients to explain what the TV or the newspapers said about a drug they're taking or a disease they may have." Richard Smith, editor of the *British Medical Journal*

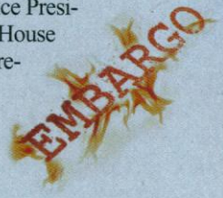
Too Hot to Hold: Life on Mars and Cloned Sheep Couldn't Be Kept Under Wraps

Science embargoes—designed to keep research papers under wraps until they are released by a publisher—tend to break down if the news is really big. Word of a discovery may leak to someone who isn't part of the confidential news network. Or it may reach a reporter from an independent source. When that happens, the publisher loses control of the material. Other reporters declare an "embargo break" and demand that the information be released early. Generally, but not always, the publisher gives in.

This happened at *Science*, for example, in August 1996, just as it was about to publish a hot paper about a martian meteorite with what looked like traces of extraterrestrial life. The paper was held in tight secrecy during review. Lead author David S. McKay of NASA's Johnson Space Center in Houston had restricted circulation to a handful of colleagues. "Only four or five people knew about it" during the 6 months prior to publication, says NASA science official Ed Weiler. Weiler says he didn't even spill the news to his wife. Nevertheless, he concedes: "I'm surprised it stayed secret as long as it did."

As the publication date (16 August) neared, the circle of insiders widened. NASA Administrator Dan Goldin briefed Vice President Al Gore and a group of White House staffers in late July. (*Time* magazine reported afterward that Dick Morris, a political adviser to the president who was later forced to resign in a sex scandal, learned in advance about the Mars news and told his girlfriend about it.)





Science and NASA had planned to hold a joint news conference just before the article was to appear in print, but they were forced to move more than a week early by a news item in the 5 August issue of *Space News*. Under the headline, "Meteorite Find Incites Speculation on Mars Life," it mentioned the rock's correct name, gave its age, and reported that "NASA is expected to provide more details in mid-August, timed with release of a scientific paper. ..." Leonard David, author of the note, says, "I had no idea that anything was embargoed," because he doesn't get advance news packets and hadn't seen the paper. David explains that "I have a good network of people who do Mars research," and he pieced together bits of information collected over a long period.

CBS TV noticed the *Space News* blurb. At this point, recalls Diane Dondershine, a spokesperson for *Science* and its publisher, the American Association for the Advancement of Science: "CBS news said, 'We are going to report this very soon,' and then [AAAS] started getting more and more calls from people as CBS was making the rounds," asking for comment on the life-on-Mars hypothesis. Dondershine asked CBS to hold off airing the news, but by the afternoon of 6 August, as more and more calls came in, she says, "we decided to release it." The embargo was lifted and experts were summoned—one from his tent in a remote area of Texas—to talk to reporters.

When an embargo begins to erode on a big story, as in the Mars case, reporters look for an excuse to ignore the rules. *New York Times* reporter Gina Kolata describes this process in her book, *Clone*, about the making of the sheep Dolly. (The book jacket identifies Kolata as the "reporter who broke the story" on Dolly.) Kolata explains that on 20 February 1997, she received an embargoed tip sheet from *Nature* describing the cloning of Dolly, forbidding public mention of the report until *Nature*'s publication date, 27 February. A day later, *Nature* gave Kolata and hundreds of other reporters the full text of the paper on Dolly by Ian Wilmut of Scotland's Roslin Institute, under embargo.

At this point, Kolata writes, she and her editor "decided that news so important was unlikely to wait for the usual *Nature* embargo to end." She decided to get "a major story ready to go," then watch the news wires closely to see if anyone broke the embargo. "In journalism," Kolata explains, "the rule is that once a newspaper, television show, or radio show reports on an embargoed story, it is fair game for everyone to break the embargo." Thus, on 22 February, after the *Times* editors spotted a story on the cloning of Dolly by Robin McKie in *The Observer* of London, they decided to run Kolata's story the next day. McKie later said he had developed his own story without using *Nature*'s information. *Nature* investigated and accepted his account. No one was punished. **–E.M.**

(*BMJ*) and a member of the Vancouver group, agrees, although he tries to take a flexible approach to embargoes. "It's in everybody's interest," Smith believes, "to publish simultaneously the full scientific paper together with any media coverage." That way, "if you're a critical reader, you can have a good stab at making up your own mind on whether you believe it or not."

Once the journals are ready to publish, a multifaceted public relations enterprise swings into action, sending embargoed press releases from journals, institutions, and funding agencies to accredited reporters. Web-based science news services have recently sprung up to provide a central point for such information. EurekAlert! (www.eurekalert.org), launched in May 1996 and financed in part by ads, is the prototype: It posts releases for university press offices, scientific societies, research institutes, publications, and government agencies in a public area and an embargoed news area, which 1860 certified reporters can access by password. Users pay nothing, but organizations pay up to $1000 a year to have material distributed. Adding to the PR blitz are several independent news services, notably Newswise (www.newswise.com), which has scientific, medical, and academic clients similar to EurekAlert!'s; business services such as PR Newswire and the Dow Jones News Service; and an astronomy PR clearinghouse run by astronomer Stephen Maran.

Uneasy alliance

Journalists who use this embargoed news generally appreciate the ready access to privileged information and the extra time to prepare complex stories. Says Tim Friend of *USA Today*: "I don't support [the embargo system] for any deep moral or philosophical reason," but "I do think it's useful. It gives us all time to do the reporting and research that's needed." TV reporters are appreciative, too. "Embargoes are useful for us because TV has to get a picture to go with the story,"

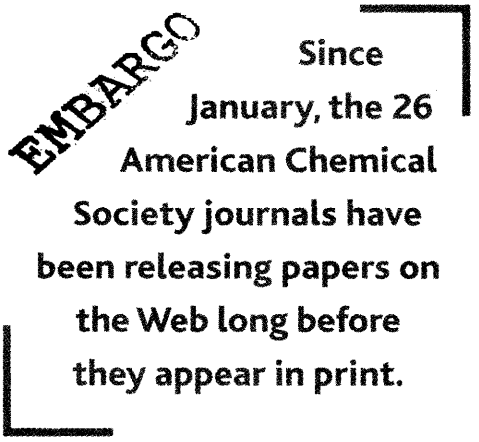
which takes time, says NBC science correspondent Robert Bazell. Bazell also likes the way embargoes create news, as it's hard to get on the air without an event. "We can all have broadcasts the night before [publication], run headlines the next morning, and it's news," Bazell says. ABC's medical reporter Timothy Johnson sees the embargo system as an "honor code" among reporters that elevates the quality of information.

But journalists who benefit from the system are not dewy-eyed about its origins or its aims. Its chief purpose, many believe, is to generate publicity. "There's an awful lot of self-serving rhetoric about the orderly dissemination of information," says Bazell, adding that it's "shot through with hypocrisy." Dan Greenberg, founder and former editor of the biweekly *Science and Government Report*, allows "some rationality" in the idea that "you want to give science writers time to digest the material." Moreover, he sees nothing wrong with seeking publicity, because "the first obligation of a publisher is to stay in business." But he dismisses the high-minded defense of embargoes as wrapping "a selfish purpose in a flag of public good." As for the argument that doctors need to get the news before their patients, it's "absolute nonsense," according to Greenberg. "I don't think I've ever come across a physician who reads [*NEJM*] the instant it comes through the mail slot."

Lawrence Altman, a science writer at *The New York Times*, may be the system's most dedicated critic. He speaks of the "greed" of the journals, which in his view purvey "taxpayer-financed research" and boost their prestige—and hence their circulation and ad revenues—with embargoed news releases. In a two-part essay in *The Lancet* in May 1996, Altman suggested that journals seek to "swell advertising coffers by intimidating scientists and physicians into silence."

Others worry about the effects of the system on the way science is covered. Tom Siegfried, the science editor of the *Dallas Morning News*, says the system has "broken down from what it was intended to be"—a method of sifting wheat from chaff by helping reporters find the hottest news—and become "a barrier" to getting information. The worst effect is "what happens before a paper is submitted," he says: Scientists won't talk about research they're developing for fear that publicity will kill the chances of publication. The result, Siegfried says, is that embargoes "prevent precisely the kind of reporting that most people think would be better"—the type that seeks to document the gradual development of knowledge. Instead, he sees embargoes contributing to hype about "breakthroughs."

From the biological or biomedical scientists' perspective, however, the embargo may be a good thing, says molecular biologist Tom Cech of the University of Colorado, Boulder. It may chill relations with reporters a bit, Cech says, but "I think it inhibits people from making premature announcements" before their work has gone through peer review. That's just fine, he says, because "we shouldn't be rushing to the press." Others are less enthusiastic. Neuroscientist Solomon Snyder of Johns Hopkins University believes it is mainly the "vanity of the journals" that sustains the embargo system. Nathaniel Landau, a molecular biologist at the Aaron Diamond AIDS Research Center in New York City, who canceled a public talk in 1996 to avoid jeopardizing a paper under review in *Cell*, says the Ingelfinger rule is really about self-promotion. He questions whether journals "have any business" asking authors to be silent.



In spite of such complaints, most biology and medical journal editors—and the reporters who feed off them—seem to feel that the system's benefits outweigh its disadvantages, and they are prepared to hold the course. Says Lundberg: "I don't see [the embargo system] changing much in the near future."

Cultural divide

Yet one substantial branch of scientific publishing has been undergoing a radical change of course: the physical science journals. Many journals in physics and astronomy once maintained strongly worded embargo policies, but they have gradually relaxed them in recent years. "It was certainly quite strict back in the good old days," says Gene L. Wells, managing editor of *Physical Review Letters* (*PRL*), which has become the most prestigious journal in physics since its first issue on 1 July 1958. Now any restriction on publicity is at best informal, says Stanley G. Brown, administrative editor for The American Physical Society (APS), which publishes *PRL* and a number of journals focused on subfields of physics. Brown and Wells both say they doubt that early press coverage erodes the readership of their journals, pointing out that press reports seldom contain the scientific details of interest to readers of APS journals.

Embargo policies are no more draconian at the American Institute of Physics (AIP), an umbrella organization for APS and nine other learned societies, which publishes eight major journals itself, including *Applied Physics Letters*, *Chaos*, and *Physics of Plasmas*. Authors are simply asked—with little threat of enforcement—to wait until a paper is released to the printer before initiating any publicity, says Martin Burke, director of editorial operations at AIP. At that stage, peer review has run its course. Indeed, AIP itself often puts out an unembargoed tip sheet when a paper is accepted for publication in an APS or AIP journal, and reporters are free to write about the work well before it appears in print. Phillip Schewe, chief science writer at AIP, acknowledges that embargoes can catch attention: "There's nothing like putting an embargo on a press release to jack up the blood pressure of a reporter," he says. But "it's pretty transparently self-serving."

Topflight astronomy journals have followed the same route, relaxing previously strict embargo policies. "The change is that in recent years there have been huge numbers of reporters attending conferences," says Helmut A. Abt, editor-in-chief of *The Astrophysical Journal* (*Ap. J.*), which is owned by the American Astronomical Society (AAS) and published by the University of Chicago Press. Reporters listen to talks or attend press conferences on results that will appear later in *Ap. J.* and *Ap. J. Letters* and write stories from the meeting, says Abt. "So we gave up trying to have an embargo," he says. Paul Hodge, editor of *The Astronomical Journal*, another AAS publication, says that "when authors bring up the question about talking with reporters," he asks them not to do so until a paper has been accepted for publication. But there is no sanction for not adopting the suggestion, and no paper has been rejected just because its content was publicized too soon, says Hodge.

Why the difference between the life and physical science disciplines? It could boil down to an ingrained openness that helped erode the embargo system from the inside, and the reality that few physics discoveries have an immediate impact on a company's stock price or a patient's questions, says Benjamin Bederson, a physicist at New York University who was editor of *Physical Review A* from 1978 to 1992 and editor-in-chief of APS from 1992 to 1997. "Physicists have not only been free in spreading their

Trading in Science: A Volatile Mix of Stock Prices and Embargoed Data

When the U.S. stock market opened on Tuesday, 13 January, the share price of a small biotech company, Geron Corp. of Menlo Park, California, started to climb. The company had some hot research in press: a paper by Geron researchers, with colleagues at the University of Texas Southwestern Medical Center at Dallas, on an enzyme called telomerase that prolonged the life of human cells in culture. But the paper, under wraps at *Science*, was not to be released until 4 p.m. on 15 January, the day before its official publication date. Word had leaked out, and the Internet was abuzz with messages touting Geron's find.

The embargo break, ironically, was triggered in part by worries about the legal ramifications of potential publicity while the paper was under an embargo. A group called the Alliance for Aging Research (AAR), which promotes research on aging, had scheduled a news conference with some of the authors for 1:30 p.m. on 15 January to discuss the findings. Geron's lawyers, fearful that the press conference might be seen as an effort to pump up the company's stock price before the findings were officially announced, asked AAR to push the event back to 4 p.m. to coincide with the timing of *Science*'s embargo. The group agreed, but sent out a notice of the schedule change on a business news service that also goes to stock traders. When the stock price took off, *Science* lifted the embargo (*Science*, 23 January, p. 472).

The episode—and a similar embargo break in 1995 involving a *Science* paper on the obesity-regulating hormone leptin (*Science*, 4 August 1995, p. 627)—illustrate the increasingly complex relationship between science publicity and big money. As University of Colorado, Boulder, biologist Thomas Cech notes, "Everybody knows that a *Science* article could be worth millions of dollars in the marketplace." News of a biotechnology development—even one as remote from application as Geron's—is eagerly sought by investors, and companies love the publicity that publication in a major journal brings. But problems can crop up while a paper is going through review and is under prepublication embargo.

Companies can be in trouble if they pass privileged information to investors who buy or sell shares before the information is publicly announced. So, potentially, could journalists who receive embargoed press releases and their sources, with whom they discuss their stories. Indeed, *Nature*'s weekly press tip sheet carries a warning that "Anyone dealing in securities using information contained in this document ... may be guilty of insider trading" under British criminal law.

Companies must also walk a line between exaggerating the value of new data and keeping them too close to the chest. They feel compelled to reveal important information quickly to limit insider trading, but they also want the prestige that comes with publication of results in a peer-reviewed journal. There's also a temptation to publicize any favorable results, no matter how sketchy, to spur investment. Some have solved the dilemma by announcing a discovery with a general press release while withholding the science, so as not to divulge company secrets. The practice can preempt the embargoed announcement of a rival's discovery. For example, Millennium Pharmaceuticals of Cambridge, Massachusetts, did this in November 1996. Two weeks before a group at Oxford University was to publish a paper on the discovery of a type 2 diabetes gene in *Nature*, Millennium put out an announcement that it had found a type 2 diabetes gene. The company didn't reveal the details. In an editorial, *Nature* advised readers to treat the press release as "business news," not "hard science."

Myriad Genetics Inc. of Salt Lake City did much the same in January 1997 when it announced the identification of "the first major gene responsible for glioma," a form of brain cancer. Myriad was in a tight race to beat two academic groups to the goal. Again, the press release contained few details (*Science*, 28 March 1997, p. 1877). Myriad's vice president for research, Mark Skolnick, said that the company had an "obligation to communicate whatever we say to all of our shareholders," not necessarily to give priority to peer reviewers or journal editors.

Richard Horton, editor of *The Lancet*, says, however, that the embargo system can be useful in helping authors resist corporate image promoters, although he doesn't like the Ingelfinger rule itself. When a commercial sponsor is trying to get an author to release unpublished clinical data, usually to boost PR or investor confidence, *The Lancet* can "support the investigator," Horton says. It can tell a sponsor: "If you exploit these data in the public domain ... that will jeopardize publication of a paper in a peer-reviewed journal, which undermines the very thing that you want to achieve." **–E.M.**

results—they're eager," says Bederson. Asked whether there has been any change in the quality of press coverage of physics since embargoes have fallen by the wayside, Bederson says: "I didn't notice any serious change at all."

The Internet: Changing the rules

Despite the wide-open attitude of physics publishers, many of them have long disliked one development: an electronic preprint server based at Los Alamos National Laboratory in New Mexico that freely distributes full-text copies of unpublished articles deposited there by authors. The archive (xxx.lanl.gov) is the work of physicist Paul Ginsparg, who began it in 1991. It signaled that the Web was about to change the rules of scientific publishing, providing a way to circulate papers widely outside the formal embargo system and potentially undermining conventional journals (*Science*, 9 February 1996, p. 767). That's exactly what Ginsparg intended. "Embargoes are clearly not in the best interests of scientists," he said in an e-mail interview, adding that they "are shamelessly self-serving on the part of the journals."

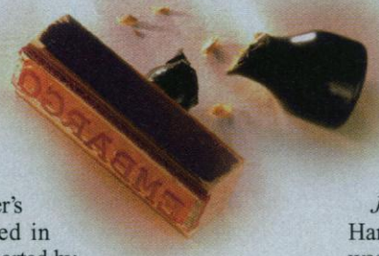
The archive posed an immediate challenge to journals that do not accept articles that have been published elsewhere. Most physical sciences journals have reluctantly decided, however, to consider papers that have been posted on Ginsparg's archive, although many would prefer not to. "It's a form of prepublication release," says Alex Dalgarno, editor of *Ap. J. Letters*, "and it could impact the value of the journal." The editors' dislike of the server is widely disregarded, says Frederick Lamb, an astrophysicist at the University of Illinois, Urbana-Champaign. Lamb says if journals decline to consider papers that have been posted on the Web, researchers would "vote with their feet ... and just go elsewhere."

Nature recently decided it will publish papers that have appeared on a public Web site. "Our policy," says Editor Philip Campbell, "is that preprint servers are operating primarily as an intrascientific communication network and have the same sort of significance as a conference talk or list of published abstracts." Internet release doesn't count as prior publication, he says, because the author is not implying that the article has

Public Lashings and Blackballing Enforce System Built on Trust

What happens when journalists or scientists break the embargo rules? Most journal editors interviewed by *Science* said they could not recall ever withdrawing a paper from publication because an author had spoken out of turn to reporters. Three said this has happened at least once, but none could name a scientist who had been punished.

A few journalists, however, have been disciplined, most spectacularly, Tim Friend of *USA Today*. *Nature*'s former Editor John Maddox lashed Friend by name in a 6 July 1995 editorial under the banner: "Journalists who break agreed embargoes damage not only themselves but also their profession." Friend's misfortune was to be present at a 27 June 1995 congressional hearing where Duke University researcher Allen Roses leaked word that a new Alzheimer's gene was going to be described in *Nature* 2 days later. This was reported by Peter Jennings on ABC's network news that evening, with an account of the implications but not the scientific details. Friend says he had already written his story before the hearing, based on information from other scientists and not just the embargoed article. His editor judged the ABC coverage to be an embargo break and ran the story the next morning.



Maddox ruled that Jennings had not been at fault because he had only used information from an abstract, while Friend had used details in the article itself. *Nature* stopped sending Friend embargoed material, but Friend says he continued to get it from colleagues and continued to honor the embargo. About 8 months later, after Maddox had retired, Friend was restored to *Nature*'s list of trusted journalists.

Other organizations have been just as vigilant, although not necessarily so public, in tackling offenders. Nan Broadbent, public affairs chief for the American Association for the Advancement of Science (AAAS), says several newspapers have been dropped from *Science*'s embargo list. She also enforces the rules for a public Internet-based service called EurekAlert!, owned by AAAS, which provides embargoed information from 265 contributing scientific organizations to more than 1800 registered journalists. To get access to EurekAlert!, reporters sign a contract agreeing to abide by the embargoes on material posted there, and deliberate disregard for the rules is a contract violation, says Broadbent. "The effectiveness of the system is in its discipline," she says, adding "You can count [violations] on one hand over many, many years."

Another journal that has taken a hard line is *Cell*. In 1984, *Science* reported on work presented at a meeting that was also in press at *Cell*. *Cell* Editor Benjamin Lewin accused *Science* in an editorial of breaking *Cell*'s embargo. Lewin was angered again in 1993 when the now-defunct *Journal of NIH Research* published an article about work by Harvard University angiogenesis researcher Judah Folkman that was in press at *Cell*. *Cell* subsequently added the following clause to the standard letter it sends authors when their paper has been accepted: "It is an absolute condition of publication that there is no release of information to *Science* or to the *Journal of NIH Research* until after the relevant issue of *Cell* has actually been published." Authors were told they could share embargoed information with reporters from other publications before the issue date, however. The rule still applies to *Science*. Lewin would not discuss any aspect of the subject with *Science*, stating in a one-sentence e-mail: "Because *Science*'s practices do not meet acceptable journalistic standards, we will not release material to *Science* under embargo or respond to enquiries on scientific or other matters." **–E.M.**

been peer reviewed or that editors don't make an important contribution. "We haven't suffered yet," Campbell says. Elsevier Science, adding yet another twist, says papers submitted to its journals may appear in a public archive or a home page as first drafts, but not editor-improved versions.

Science, however, is standing by its policy of not publishing papers that have been posted on the Web. *Science* Editor-in-Chief Bloom says: "If a paper has been publicly released on the Internet in the form that it was sent to us, then we consider that prior publication," and *Science* may decline to take it. However, "if you assure us that you have a restricted site, we won't disqualify it" right off the bat. Monica Bradford, managing editor of *Science*, says physical scientists have been "very vocal" about their dislike of the policy. But, she says, "our physical sciences submissions have actually been on the increase, so I don't get the sense that it's been a problem." She adds that rapid changes in the online world ensure that *Science* will continue to assess the policy.

So far, Web-based preprint publishing is mostly limited to the physical sciences. Ginsparg has opened a biology section in the archive, but entries are relatively sparse. And a separate venture run by HUMMOLGEN, a nonprofit human genetics resource in the Netherlands, recently announced that it would post biology preprints after "low-key peer review" of submissions (*Science*, 19 June, p. 1807). But biologists are not yet clamoring to be published in it.

Nevertheless, at least one medical journal, the *BMJ*, is thinking the unthinkable: allowing potential authors to post electronic preprints on its own Web site. Editor Smith says *BMJ* already regards its Web site as the "primary" route of publication that has allowed it to reach "an entirely new audience" in the United States. His staff is now debating "whether to move to e-prints, as the physicists do." *BMJ* might set up an area on its site where authors could post articles and receive comments, Smith says. If the author later wanted to submit the article for print publication, the *BMJ* would review it. "We're also looking at possibilities for doing peer review entirely openly on the Web," says Smith: "I'm absolutely convinced that this is going to change everything."

Few other editors are thinking of taking such radical steps, but a major scientific publisher, the American Chemical Society (ACS), has adopted a novel online publishing policy that changes the way papers are released to subscribers and the public. Beginning in January, the 26 ACS journals began releasing papers on the Web when they have been edited and checked by authors, sometimes as many as 11 weeks before they appear in print. ACS made the change because "authors wanted us to offer faster publication," says publications director Robert Bovenschulte, adding that the decision was driven mainly by the technology. ACS felt it was embracing "the wave of the future," adds ACS spokesperson Denise Graveline. Journalists are free to write about articles when they appear online, but this hasn't ended embargoes. Graveline says that ACS still notifies some journalists in advance of "a selected number of articles" before they are posted online.

Some medical journals have also used the Web for quick public release of papers that have important public health implications. Last year, for example, *NEJM* used

the Mayo Clinic Web site to release a paper on heart valve injury associated with the fen-phen diet drug combination. And *JAMA* used the Internet last summer to distribute a paper on the adverse effects of a drug for hypertension. Lundberg says publishing online allowed the journal to post the full text, "bango, the same afternoon" that it cleared his desk. "Everybody responded beautifully, and we felt really good," Lundberg says.

Does this new use of the Internet augur a major change in the way biology journals handle newsy reports? Lundberg is doubtful. High-priority articles are rare, he says, and *JAMA* is not planning to follow the ACS's lead yet and routinely post articles online before they appear in print. Kassirer, who says he tries "not to be too stiff-necked" about the rules, says things may change "over time ... but at the moment, we are holding to our Ingelfinger rule."

But some are ready to chuck tradition. *PNAS*'s Cozzarelli, for example, would gladly go to early release on the Internet. "I believe that online preprints have made the embargo obsolete," he says, and he'd like to rid science of the embargo system's "arbitrary" rules. But for many writers and editors struggling to keep up with science news, embargoes remain, as a biotech reporter says, a "necessary evil" that make the job more manageable. **–ELIOT MARSHALL**

With reporting by James Glanz.

EMBARGOES
MEETINGS

Scientific Meetings Produce Clash of Agendas

Sponsors want publicity, journals don't want to be preempted, reporters want stories, and scientists can be caught in the crossfire

All the pressures inherent in the embargo system converge at scientific meetings, often producing conflict and confusion. Scientists want to communicate their results freely, and meeting sponsors want maximum publicity for results presented there. But these goals can clash with the desire of publishers to see that papers due to appear in their journals are not preempted. Scientists are often caught in the middle, uncertain of the rules, and fearful of losing a publication if they make the wrong move.

Almost all journal editors say they don't want to impede scientific discourse. Physical science editors have gone furthest in this regard, permitting scientists to hold press conferences at meetings even if they have a paper under review or in press. *Science* Editor-in-Chief Floyd Bloom says *Science* tries to explain its policy in "big, bold, block letters": Authors are free to discuss whatever they wish at meetings. But they're asked not to take part in a press conference or distribute a manuscript until the week before the paper will appear, at which point the journal distributes copies to journalists who agree to honor the embargo. Researchers are free to clarify points from their talks with journalists provided they don't go beyond the material they presented. *Nature* Editor Philip Campbell says scientists are "absolutely free" to say what they want at meetings. "The general principle is that we do not get in the way of intrascientific communication." He adds, however, that "we do not like [authors] going into details in the press in a way that helps the press preempt the publication over and above what they've said in the talk."

"We've never had a problem with people describing their data at a meeting," says Jerome Kassirer, editor of *The New England Journal of Medicine*: "That bugaboo has been around for a long time, but I don't think it's real." Indeed, even the famous Ingelfinger rule says that meeting presentations do not constitute prior publication. George Lundberg, editor of *The Journal of the American Medical Association*, says: "Basically, whatever authors have presented in their talk to colleagues is fair game and can be reported and should not be held against those authors at all."

That sounds clear enough, but sometimes conflicting pressures on scientists can be intense. Take the case of Donald Umstadter, a physicist at the Center for Ultrafast Optical Science at the University of Michigan, Ann Arbor. Two years ago, Umstadter gave a talk at an American Physical Society (APS) meeting about his recent success in accelerating electrons to high energies using laser pulses. He was also asked by officials at the American Institute of Physics (AIP), which promotes APS conferences, to repeat the substance of his talk in a briefing with reporters. Umstadter, however, had a paper in press at *Science*. "Of course I knew about the embargo policy," says Umstadter. "So I called [*Science*] and asked if it would be OK if I participated in this press conference." He was advised that it would be fine to give the talk but not to hold the press conference. He complied.

The decision led to discussions between Judy Franz, APS executive officer, and Richard Nicholson, executive officer of the American Association for the Advancement of Science, which publishes *Science*. "I thought of it as the policies of *Science* magazine interfering with the open exchange of information in our meeting," says Franz. "It made us uncomfortable to have some secrecy imposed." Phillip Schewe, AIP's chief science writer, who had asked Umstadter to hold the press briefing, was later quoted in the *APS News* saying the decision "amounts to an act of extortion: Forgo a press conference or possibly forfeit your paper in *Science*." But Schewe concedes that his objection to embargoes has limits: APS embargoes material to be discussed at meeting press conferences. "If reporters have bought a plane ticket to come to the meeting, we have a special proprietary feeling in hanging onto that information," he says.

Paula Tallal, a neurologist at Rutgers University in Newark, New Jersey, was caught in a similar situation when she presented a paper at the Society for Neuroscience meeting in November 1995. Tallal discussed a technique she and Michael Merzenich of the University of California, San Francisco, had developed for training learning-disabled children. At the time, a paper on the work was under final review at *Science*, and Tallal was worried that if her talk got too much attention, *Science* might kill the paper.

Reporters from *The New York Times*, *Newsday*, and other media were "all over my poster," she says. The society's public affairs chief, Joe Carey, was trying to get her to give a press conference, but she canceled. Tallal recalls that a representative of her sponsor, the Dana Foundation, was trying to steer the publicity to television. Tallal was so concerned, she says, that she dodged reporters' questions, refusing to clarify her results for *Newsday*'s Jamie Talan. But Tallal had already discussed her work with a reporter for *The New York Times*, Sandra Blakeslee, on the understanding that Blakeslee would not go to press before the official publication date. When Blakeslee announced in a tense encounter in front of Tallal's poster that she intended to publish a story on the research from the meeting, Tallal recalls, "I nearly had a nervous breakdown."

Blakeslee says she had "sat on that story for a year" before the neuroscience meeting: "I had visited [Tallal's] center at Rutgers. I had met the children. I had talked to the parents. I