Photo by Michael Kienitz

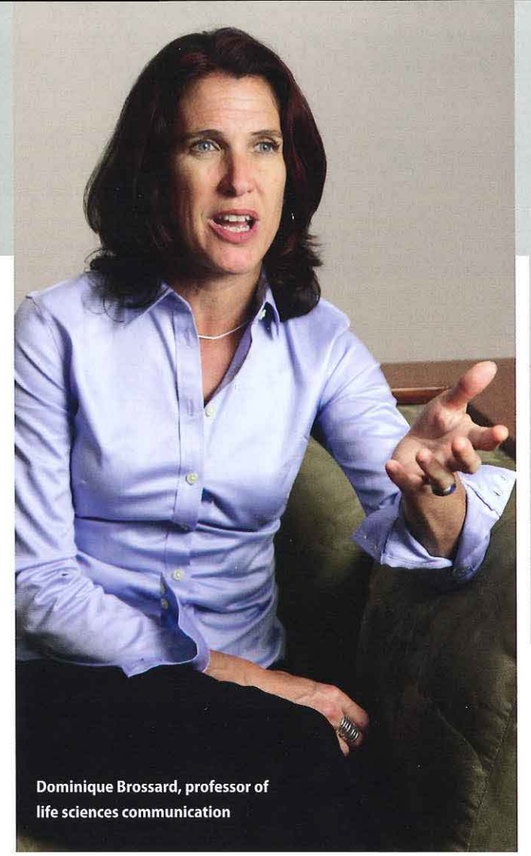
Two months after retiring from the Madison-based *Wisconsin State Journal*, where for 34 years he'd reported primarily on science and the environment, Ron Seely splays his hand on the table and points to a small knot of flesh on his palm.

It's from how he cradled his iPhone, his physician told him, especially when Seely was constantly tweeting live from such events as legislative hearings on mining in Wisconsin.

"It was exhausting," says Seely, who like many journalists balanced the new duties of tweeting and other social media tasks with researching and writing his stories, all while meeting daily deadlines. "It's a vicious cycle: You create the expectation that people will have news instantly."

Seely began his career in daily journalism with hot type and ended it with hot tweets. And his career—which includes serving as a teacher of life sciences communication at CALS—reflects the seismic changes that have jolted science journalism.

Take it from anyone who has ever struggled through freshman biology or o-chem: science news was hard enough to understand before the collapse of traditional media. Then Twitter and other social media exploded, blogs proliferated, reader comment sections swelled—and the science got even more complex.



Dominique Brossard, professor of life sciences communication

"We used to believe that if we only explained to people what the science is about, they would understand and support it."

It's no longer just the newspaper plopping on your doorstep—the science journalism of years past, when discoveries were presented in one-way fashion by writers with science expertise and passively consumed by a trusting public. Science reporting was hit hard by the economic collapse of traditional media, with many science reporters laid off or not replaced upon retirement (example: the *New York Times* closed its environment desk early this year). As science journalism migrated online, web technology blurred the lines between professionally trained journalists, bloggers and other commentators, the public and, most notably, the scientists themselves, who face new and evolving challenges in understanding science communication.

Today, coverage is tweeted, retweeted, "liked" on Facebook, interpreted and reinterpreted by any willing participant—and is the target of instant and often rude, politically tinged reader commentary. With one in seven people actively using Facebook and Twitter users posting 340 million tweets daily, understanding the interaction between science news and readers is crucial.

In short, science communication is being reborn while the media reinvents itself online. That collision raises concern about how society views the science that can solve energy problems, mediate climate change, improve health and feed a hungry planet.

Stem cells, genetically modified organisms, nanotechnology, bioenergy and other complex advancements have all poured down on an American public ill prepared to understand even basic science. The National Science Board, for instance, in 2010 reported that only 73 percent of U.S. adults were able to answer correctly that the earth revolves around the sun; only 52 percent could say how long that takes. And a recent survey by the Pew Research Center for People and the Press found that only 47 percent of respondents knew that electrons were smaller than atoms.

That lack of knowledge, combined with built-in attitudes about science among much of the public—often rooted in religious or political beliefs—makes groundbreaking discoveries difficult to grasp or embrace.

"We're no longer just using microscopes. We're using scanning, tunneling nanoscopes that go into 1,000 times more detail," notes Dietram Scheufele, a CALS professor of life sciences communication. "The science is more complex, and just as complex is the question of what we want to do with that science."

Small wonder that when the public turns to the media, it is often flummoxed, whipsawed by Internet trolls' nasty comments and unsure what to think of the science's legal, social and ethical implications. In the process, is innovation handcuffed by public opinion at just the moment when society needs it most?

Against that backdrop, Scheufele and his colleague Dominique Brossard are in the vanguard of researchers who are trying to understand the emerging media landscape and its volatile dynamics.

"We used to believe that if we only explained to people what the science is about, they would understand and support it," says Brossard, professor and department chair of life sciences communication at CALS. "Today, it's not just about the communication—it's about how the communication takes place."

Notes Scheufele: "Global climate change is not just a political problem or a communication problem or an oceanic and atmospheric problem. It's all of the above—it's science meeting society."

Science carries ethical, legal and social implications that demand reasoned, informed debate. If scientists botch communicating the importance of their work, they can end up saddled with unwelcome consequences, Brossard and Scheufele agree.

In a commentary they co-authored in the journal *Science* early this year,

Dietram Scheufele, professor of life sciences communication

"We are creating an environment where the facts are reinterpreted based on how loudly we yell at each other."

the pair concluded: "Without applied research on how to best communicate science online, we risk creating a future where the dynamics of online communications systems have a stronger impact on public views about science than the specific research that we as scientists are trying to communicate."

The fallout from a poorly

informed debate can be costly, says Molly Jahn, a CALS professor of agronomy and genetics. Genetic modification of foods has been one of science's biggest PR battlegrounds in recent years. Jahn says it's important to understand the dialog between scientists and the public—and its consequences.

"One side yells, 'It's safe! It's safe!' And the other yells, 'We hate big corporations!' Because of that, we don't get anywhere for decades," Jahn notes wryly. "That's where the barriers occur in delivering on the promise of the technology. And those failures often affect people who are not principals in that debate, such as food-insecure people in other parts of the world who could benefit."

As a result of a complex dynamic of corporate decisions, government regulation—and public outcry—there are a "host of plant species and traits that might never be developed," Jahn says.

Science communication research, Jahn says, is crucial to helping scientists dispel public fears about innovation. "Scientists tend to underestimate the extent to which any innovation tends to create consequences in politics and business."

Public attitudes can directly affect researchers' ability to conduct their work. Chris Kucharik BS'92, PhD'97, a CALS professor of agronomy and environmental studies whose research focuses on connections between climate and agriculture, has experienced that on the ground. On occasion, farmers who are wary of his motives or of climate change itself have refused to cooperate with graduate students gathering data. But hardened attitudes seem to be mellowing as people gain more knowledge, he observes.

As a way of addressing the problem, Kucharik emphasizes public outreach as part of his work. At a beer-and-bratwurst meeting at a town hall in southern Wisconsin a couple of years ago, Kucharik mingled with 75 people before stepping up to give a talk about climate change in Wisconsin and its impacts on agriculture.

Not everyone was buying it. In the front row sat a woman, arms folded and offering an occasional, high-arching eye roll as the soft-spoken and measured researcher spoke. Afterwards she challenged him on the existence of long-term climate change. He did his best to explain, but the woman would not be persuaded. The next day, a frustrated Kucharik found that she had blogged about his appearance, claiming that he'd predicted "Armageddon was coming and that everyone had better watch out." He had not. Yet her online verdict was likely to reach more people than his personal appearance.

Such experiences raise questions about the value and nature of online coverage of science. Some science journalists insist that online coverage and commentary provides more information and greater accountability. Others say that the Internet give-and-take can bring down the quality of discussion.

Ron Seely noticed the damaging effects most when covering such polarizing topics as climate change. "With electronic and social media coverage, the differences became the story because controversy plays better on social media. It hurts the science," Seely says.

Exactly how much and what kind of damage may online debate be doing? Dominique Brossard, Dietram Scheufele and several colleagues coauthored a study early this year zeroing in on the effects of nasty online comments by Internet "trolls"—people who comment on news stories with malicious intent, sometimes for pay—on the way readers perceive news stories.

The study, which garnered international attention and coined the term "the nasty effect," asked 1,183 people to read a carefully balanced story about a type of nanotechnology offering such potential benefits as antibacterial properties and such risks as water contamination. Half of the sample was exposed to civil reader comments at the bottom of the story and the other half saw an uncivil back-and-forth.

The results, Brossard says, were disturbing. "Just the tone of the comments can polarize readers," she says. People who read uncivil comments became more entrenched in their views of the science than those who read civil comments. Those who began with a negative view thought the technology was even riskier after reading disparaging uncivil comments, and people who started off with a positive view became even more convinced when they read a comment like "If you don't see the benefits ... you're an idiot."

"You notice the words 'fool' and 'idiot' and make quick judgments," says Brossard. "That is what we found most troubling."

The study—the first to examine the potential effects of online comments on public perceptions of science—prompted vigorous discussion about the value of moderating online comments and removing off-topic or uncivil screeds. The managers of PopularScience.com cited the study in their decision to discontinue the site's comments section.

Meanwhile, the debate continues. Los Angeles–based science blogger and author Jennifer Ouellette is concerned that communication can be smothered by rudeness.

"Sometimes it seems that those who comment are the least informed, the most biased—when they're not inane," says Ouellette, who has a personal science-and-culture blog at *Scientific American* called "Cocktail Party Physics." "I find myself deleting many comments when I moderate. Maybe that's how it should be—commenting as a privilege, not a right."

Advocates for various causes see the power of online comments. Last spring the Climate Reality Project, a group overseen by Al Gore, created a website that automatically searches for comment opportunities and provides its followers a way to weigh in.

"We are creating an environment where the facts are reinterpreted based on how loudly we yell at each other," Scheufele says. "Scientists cannot engage in that kind of arms race because we will be outspent and outcommunicated—and we will lose every time."

Brossard, coming out of a one-semester sabbatical she used to develop a new course on science and social media, is working on more research that assesses the effects of re-tweets and has trained computers to analyze more than 200,000 tweets on nanotechnology.

"Let's say you blog and you have a great story," Brossard says. "I re-tweet it and change or repurpose it. How does that change how people perceive that story? We need to find out."

What are some paths

toward improving our science discourse? To start with the basics, nearly everyone observing the field agrees that better science education for Americans is essential. Educators this spring unveiled sweeping new science teaching guidelines called the Next Generation Science Standards, developed by state governments, scientists and teachers. They include recommendations to teach climate change and evolution, a hot-button issue for some religious conservatives.

But those changes will take years, and crucial science debates are happening now. There is much that scientists and communicators can do—and still much more to be learned—to promote a more evidence-based, respectful discourse.

Five Surefire Strategies *for* Communication Failure

1. Be reactive rather than proactive, i.e., start going public only after a crisis hits.

2. Address only issues and ignore values, emotions, etc. that people bring to the table.

3. Assume that scientific facts will triumph over everything else (including how they're initially framed in public discourse).

4. Assume that new and social media don't matter as much as traditional media.

5. Assume that public communication is an art rather than a science, i.e., rely on intuition rather than communication experts.

—Dietram Scheufele

Engaging with the public in person is one option. A number of CALS scientists feel they can change minds and solve problems by going into the community and discussing their work, as the Wisconsin Idea intends.

Through that process, agronomist Chris Kucharik has learned to be a better communicator. Experiences such as his town hall beer-and-brat gathering have helped him hone his presentations, framing them with an eye toward public opinion and how his messages will be perceived. "I'm adapting the ways I deliver this information, always finding ways to improve it," says Kucharik.

Describing how he interacts with his audience, Kucharik says, "I always encourage a meaningful back-and-forth discourse. It is the only way to educate the public on new research and consider their experiences as well."

And when things don't go so smoothly? "It is upsetting when personal attacks occur and my words are twisted,"

Comments *about* Comments

A *Milwaukee Journal Sentinel* story about the effect of online comments on science literacy—based on a study by CALS researchers Dominique Brossard and Dietram Scheufele—drew a spicy selection of comments, thus (however inadvertently) helping to illustrate the researchers' point.

Health News

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Online comments hurt science understanding, study finds

By Mark Johnson of the Journal Sentinel Jan. 3, 2013

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A new obstacle to scientific literacy may be emerging, according to a paper in the journal Science by two University of Wisconsin-Madison researchers. »Read Full Article

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stanton12 - Jan 04 at 4:26 PM - Report Abuse 1 4

I think you can take all these studies by pointy headed scientists, 99% of whom are socialists and communists, and stick them where the sun don't shine. Just listen to Rush and Hannity, and you will learn why you shouldn't trust "science." It is all designed to let the government control every aspect of our lives.

bagman00 - Jan 03 at 8:44 PM - Report Abuse 7 24

Let's see: The global warming ruse was base on fraud not science. Fair media reporting, xnay to that one. Lack of real science being taught in the schools rather than students being steered towards an opinionated solution. University of Wisconsin Professors bewildered by science opinion being questioned rather than being accepted as told. Progressives trying to control information and getting called out when they are misinforming have their feelings hurt.

ind voter - Jan 03 at 9:43 PM - Report Abuse 18 3

No doubt in my mind that online comments are contributing to the dumbing down and polarization of America. The Journal-Sentinel would be doing a service to the community if it did away with them. Only useful purpose is for sports articles, and stories about cougar sightings.

aarons - Jan 03 at 10:19 PM - Report Abuse 7 1

The sad part is I can't even tell which of the moronic comments here are trolls, and which are expressing the actual view of the poster.

—Excerpts from JSonline.com

he says. "At that point, I still try and educate. That's what I'm here for, right?"

Agronomist and geneticist Molly Jahn, too, has found that one of the best ways to dispel skepticism about science is by facing skeptics. As criticism of plant genetics mounted, Jahn engaged with both critics and supporters. "I talked to the people I was supposed to be innovating for instead of assuming I knew the right answer," she says.

Seely notes that scientists today have an unparalleled chance to make their case. "It's more important than ever for scientists to communicate science clearly, and to take on some of that responsibility themselves," he says. Moreover, they should consider taking their communication online. "The scientist who doesn't blog today is missing out on a great opportunity."

The key is learning to do it right—and that's where life science communicators offer help. Brossard, mindful of her study on Internet trolls, warns that scientists untrained in communication could venture into blogging and get more trouble than they bargained for. Brossard argues for scientists to be trained in communication, preferably early in their careers. Otherwise, she says, "We may hurt the cause without knowing it."

When communicating scientific advances, framing the issues is key, Scheufele says. Framing is based on the assumption that we all make sense of new information by attaching it to our existing frames of reference. "It's about presenting issues in a way that connects with what people already know and what's relevant to their daily lives," he says.

As an example he points to the power of the environmental group Greenpeace's "Frankenfood" campaign last decade, an effort that helped demonize genetically modified food

Framing is based on the assumption that we all make sense of new information by attaching it to our existing frames of reference.

by linking it, with a catchy name, to a concept we already found frightening: scientists overstepping ethical bounds to create something monstrous.

Framing is about understanding and teaching, not marketing, Scheufele insists. "If I have the feeling that you don't understand something I'm trying to explain, I will try to find different analogies or ways of describing the same issue that resonate better," he says.

Learning to do that is a crucial task—and it's a central goal of efforts to increase collaboration between scientists and science communication researchers, Scheufele says. Such efforts could lead to a better understanding of how science communication works and help scientists more effectively build bridges to various audiences. Schools of agriculture and the life sciences, as natural "hotbeds" of the kind of research that can draw controversy, are well positioned to foster that work, he says.

The process is gaining momentum. Organizations such as the American Association for the Advancement of Science, the National Science Foundation and many universities have begun programs to teach scientists how to interact with journalists and non-academic audiences.

Scheufele and Brossard have emerged as national leaders in the effort, presenting their findings ("The Science of Science Communication") at such highly visible venues as the Arthur M. Sackler Colloquia with the National Academy of Sciences and writing articles for (and being quoted in) a number of popular and academic science publications. Scheufele serves as co-chair of the National Academy of Sciences' Roundtable on Public Interfaces of the Life Sciences, which is devoted to collaboration among scientists and social scientists and convenes workshops to explore needs, challenges and opportunities for public communication about the life sciences.

On a more hands-on level, in the CALS' life sciences communication (LSC) department Seely has started teaching a course in communicating science to a lay audience, aimed specifically at graduate and postdoctoral scientists. The course is popular enough to have a waiting list. He's also been conducting one-semester seminars on writing and communicating science with other UW departments, including botany and chemistry. "It would be nice to think that at some point in the future, science departments would all require the completion of at least one science communication course for graduation," says Seely.

And a new LSC course titled "Science, Media and Society" focuses on the complex relationship between science and the public, emphasizing that beyond teaching scientists to write for a lay audience, scientists also must learn the mechanisms behind science–public interactions. The course drew more than 100 students when it debuted last spring.

In the meantime, Scheufele and Brossard are carrying on with their research. More is needed, they say, to help identify solutions even as communication technology changes at a blinding pace.

"We're trying to fix a car while we're going 70 miles per hour down the highway. We're not in the parking lot and there's not going to be a rest stop anytime soon," says Scheufele. "The opportunity is that here in CALS we have just about every piece of expertise on board."