
Science Blogging: The Essential Guide

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UNIVERSITY PRESS

New Haven and London

The authors gratefully acknowledge the assistance of the Alfred P. Sloan Foundation and the National Association of Science Writers. This project was funded in part by a grant from the National Association of Science Writers. Reference to any specific commercial product, process, or service does not necessarily constitute or imply its endorsement of or recommendation by the National Association of Science Writers, and any views and opinions expressed herein do not necessarily reflect those of the National Association of Science Writers.

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Designed by Sonia L. Shannon
Set in Scala type by Integrated Publishing Solutions
Printed in the United States of America.

Library of Congress Control Number: 2015946024
ISBN 978-0-300-19755-6 (paperback)

A catalogue record for this book is available from the British Library.

This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

10 9 8 7 6 5 4 3 2 1

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Preface

Why are you here?

We don't mean that in the existential sense. But what are you doing, right now, with this book in your hands? (Or more likely with this book displayed on some electronic device?) What is it that you want to know about science blogging?

Online science communication has come a long way from the early days of LiveJournal and Usenet. Bloggers are no longer sending messages in bottles with only blogrolls and hyperlinks to keep us connected, each of us in our own little far-flung corner of the Internet. Platforms such as Twitter and Facebook may not feel all that new, but they're revolutionary tools that have allowed us not just to interact with each other but also to reach wider and more diverse audiences. Many of us are now clustered together in official networks, under the umbrella of large, mainstream magazines or newspapers. Some independent blogs have grown into high-traffic sites, destinations unto themselves. Science bloggers are no longer limited to blog posts but are also writing books, recording podcasts, and uploading videos to YouTube. For many, science communication is a viable career.

When the three of us started blogging, the crowd was smaller. There were fewer science blogs, which meant it was easier to distinguish ourselves from other bloggers. It was easy to find our voices and to make ourselves heard. It was a time when someone sufficiently motivated could read just about every new blog post written about science each day.

That is no longer the reality. Today breaking in to online science communication can seem almost impossible. It can seem like there are dozens of new science blogs—not to mention YouTube channels and podcasts—popping up each day. But the Internet is still very much a frontier for science communicators. It's the Wild West. Each time the scene threatens to become too settled, someone or something new arrives, keeping us all on our toes. The struggle was once to become heard at all; now the struggle is to remain relevant.

Maybe you're reading this book because you wish to be that someone new. To disrupt the status quo. Or perhaps you're here to get new ideas. Maybe you're here to get your blog to the next level, to transition from blogging as a hobby to blogging as a career. Or maybe you're here to figure out just where your voice fits in the online world.

No matter your goals, this book is here to help. We've brought twenty-seven of the most successful, insightful online science communicators together to share with you what their years of experience have taught them. All of their expertise is as current as we could make it; as of this writing all of the online references you'll see are up-to-date and available.

But you don't need to read this book cover to cover to learn what you need to know. Depending on your goals, there are different chapters, different paths through this book that will help you on your way. Here are just a few ideas.

Science Blogging 101

Maybe you are getting started as a blogger and need ideas about how to proceed. In that case, you might start with [Chapter 3](#), to learn the basics of setting up a science blog from Khalil A. Cassimally. Make sure you use and display images and artwork responsibly by checking out [Chapter 4](#) by science artist Glendon Mellow. Then you might check out [Chapters 7 and 8](#) by Danielle N. Lee and Zen

Faulkes. They present two different views on science blogging, one from within an official blog network, and one at a personal, independent site.

As you get in gear, check out [Chapter 1](#) by Christie Wilcox to remain mindful of why you're blogging and what you want to achieve. And don't forget that, though it is still young, science blogging has a rich history. See Carl Zimmer's history of our online community in [Chapter 2](#).

Once you have your blog up and running, it's time to think about how you might best communicate your science to the wider world. It doesn't all have to be long essays. Joe Hanson discusses how to be effective by being brief, in [Chapter 10](#). And in [Chapter 22](#), Rhett Allain covers some of the specific challenges that might arise when tackling the hard sciences.

Telling Your Own Story

No one starting as a science communicator wants to get lost in the crowd. We all have different stories to tell, different angles we can use to communicate. But sometimes it can be difficult to find your own unique voice.

Your approach to science blogging might be influenced by your life experiences. In [Chapter 11](#), Ben Lillie talks about using your personal experience to drive your works. Many bloggers are also heavily influenced by their identity. Alberto Roca offers thoughts on blogging as a minority-group member in [Chapter 12](#), while Kate Clancy offers advice to other female bloggers in [Chapter 13](#).

Many people come to science blogging through their careers. Colin Schultz writes about the benefits of blogging as an early career journalist in [Chapter 14](#), while Marie-Claire Shanahan covers blogging as an educator in [Chapter 16](#). Karl M. Bates considers blogging from inside the ivory tower as a public information officer in [Chapter 15](#). For researchers who are blogging as a form of scientific outreach, Jason G. Goldman covers blogging as a graduate student in [Chapter 17](#), while Greg Gbur takes it to the tenure track in [Chapter 18](#).

While many fine blogs exist to explain concepts and cover research papers, not all of them need to conform to this standard. Scientist Travis Saunders and science writer Peter Janiszewski describe how they use their blog to cover scientific conferences in [Chapter 21](#).

I Have a Blog. Now What?

If you're already an experienced denizen of the online world, this book still has plenty to offer. Maybe you've been a small fish in the big science pond too long, unsure about how to find readers. Ed Yong offers insights on how to find your audience in [Chapter 5](#). Many science bloggers are held back by their discomfort with self-promotion, but Liz Neeley will show you, in [Chapter 20](#), that you have nothing to fear. Some bloggers may want to try moving beyond using words alone. To use interactive tools so that your readers will become participants rather than passive viewers, check out what Rose Eveleth suggests in [Chapter 9](#).

Many science bloggers and communicators may think they are reaching the audience they want, but aren't really sure how to look at their metrics. How do they know if anyone is really listening? Matt Shipman offers important insights on metrics in [Chapter 19](#).

Writing on the Internet can be daunting. In [Chapter 23](#), Emily Willingham covers how, and why, we might choose to write about controversial topics, and Melanie Tannenbaum gives some tips for countering trolls in [Chapter 24](#). In [Chapter 6](#), Janet D. Stemwedel shows how carefully we must consider ethical issues as we share information on the Internet.

Many blogs are written simply for the love of science and science communication. But career science communicators also need to pay the bills. ~~Bethany Brookshire discusses getting paid for blogging in Chapter 25.~~ And in the final chapter, [Chapter 26](#), Brian Switek explains how your blog can serve as a sort of “writing laboratory” to help you develop ideas for the ultimate in long-form writing: a book.

By bringing together some of the most experienced voices from around the science blogosphere, we hope this book will have something to teach everyone. Whether you’re just getting started, have some blog posts under your belt, or are looking for fresh inspiration, you are not alone. The science communication community may seem overwhelming, but it’s friendly. Dive in and show us what you can do. Seriously. Tweet us and show us your stuff. And use our hashtag, #SciBlogGuide, and find us online at <http://www.theopennotebook.com/science-blogging-guide>.

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To Blog or Not to Blog

CHRISTIE WILCOX

What does a budding scientist, science communicator, or science writer have to gain from writing about science on the Internet? What are the benefits of getting started in social media? Popular blogger Christie Wilcox of Discover Magazine Blogs takes you through the many reasons why you, yes, you, should start communicating about science on the Internet.

You picked up this book, so you must be at least a little curious about starting a science blog. Or maybe you already have one but could use a little validation. You want to know *why* you should write a science blog. After all, aren't there a million blogs out there?¹ Isn't the Internet bursting at the seams already? Why should you, a busy academic/scientist/journalist/writer/public information officer/insert-your-title-here take the time to write online (especially if it's unpaid at first)? Why should you bother with this often-maligned medium, when there are journal articles or features to be written? Really—why should you, of all people in the world, be blogging?

While I can share my personal experiences and give you a hundred reasons to blog, ultimately they boil down to two philosophical principles: altruism and narcissism. If you ultimately decide to blog, you will be either for yourself, for the good of others, or a bit of both.

Make the World Better for Science: The Altruistic View

If you like to think of yourself as a giving person, then blogging is definitely right up your alley. What's a better way to share your passion and love of science with the rest of the world? And the truth is, the rest of the world needs it.

Now, more than ever, science is fundamentally intertwined with national and international political issues. Our climate is changing. Animals and plants are going extinct at an alarming rate. Life-saving technologies like vaccines are denigrated and misrepresented. Every day technologies advance in ways that are rarely explained well to the rest of society. To make informed decisions on a wide range of political issues, the people of the world need to understand the science behind the most hotly debated topics. But to do that, they need interpreters who speak the lingo, who can take jargon-filled research and put it into terms that anyone can understand.

Nowhere is this more true than in the United States, where former Senate majority leader Trent Lott can call his four years of science and math in high school “a waste of my time and a waste of my teachers' time” and receive roaring applause.² The only way to change the negative attitude toward science is to show people why they should care. To do that, we have to show people how incredible, important, and intriguing science really is.

But you already know that. You've already had moments where your passion just bubbled out of you uncontrollably, and you saw the spark in someone's eyes when you told them something really, *really* cool. Maybe you explained how the Higgs Boson particle works or got into a conversation about the ballistic penises of male ducks. Somehow you found yourself in that place of authority where you were sharing with others something new and fascinating, and you changed how they think about the

world—just for a moment, or perhaps forever. You inspired them. You want to do it again. And you can use a science blog to do it.

There's a reason that major grant agencies like the National Science Foundation require outreach and communication from the scientists they fund. Reaching out and sharing science is a moral responsibility for those who "get it." As the American Psychological Association's David Ballard says, "We have an obligation to be out there in public because there is nobody better informed or more expert."³

So why not attend more conferences or go talk to students in their classrooms instead? Because we live in a digital age where ten-year-olds carry smart phones and information is never more than a Google search away. More than half of Americans say they "talk" to people online more than they do in real life.⁴ As social media platforms continue to grow exponentially, people are turning more and more to online avenues for connection and communication. If we want to be involved in the conversations about science, we have to be online as well. We need to be found in search results, and get real, accurate science into online conversations.

Most importantly, online avenues target the everyday adult. While we can improve education in public school and try to fight the battle in the next generation, we have to go beyond to really shift our culture. Anyone born before 1980 (and some born after) didn't learn about stem cells in high school. They aren't going to be taking a traditional class to better understand climate change or the causes of autism. They will learn about and understand these issues better only if they have access to content that explains them clearly.

Blogs reach out far beyond even the most gregarious person. I've had blog posts translated into Chinese, Romanian, and French. Commenters come from around the world to weigh in on the science I discuss on my blog. And because it's the Internet, what is written on a blog doesn't just stay on that blog; a wide variety of media outlets and other major traffic sources link to it as well. "Just simply by having a blog," says Travis Saunders of *Obesity Panacea* (<http://blogs.plos.org/obesitypanacea>), "we've been able then to go and get our message out to literally hundreds of thousands or even millions of people through these other much, much larger engines."⁵

I've seen firsthand the immense reach of blogs. When I wrote about DNA fingerprinting to explain how Osama bin Laden's body was identified, more than eighty thousand people read the post on my blog over the next couple days, and it was linked by PBS *NOVA*, NPR, *Nature*, *Discovery*, and a suite of mainstream news organizations, not to mention other blogs. It took only thirty minutes for me to explain the science behind something I do every day, yet millions of people learned about genetic fingerprinting and were able to explain to their networks how we knew bin Laden was dead.

That's the point, isn't it? To get people talking about science, thinking about science, *caring* about science. To help people find science in the everyday.

Science blogging is truly a noble pursuit because it seeks to inform and excite others. It's all about injecting your personality, your passions, and your reasons for loving science into online content that educates and inspires. The ultimate aim is to change the world—a lofty goal with all the feel-good, heartwarming hope you could ever want in an activity.

It Really Is All about Me: The Narcissistic View

The simple truth is that no matter how much good we want to do for the world, we are all limited. We are, as they say, only human. We have jobs that need to be done, money that needs to be made, and personal lives to attend to. So why should you make time in your busy schedule for blogging? Because

ultimately, you're the one who reaps the most rewards from it.

Let's start with the most immediate benefit: exposure, or as marketing professionals refer to it, "personal branding." A long time ago, when you applied for a job or met a new person, they only had one thing to judge you by: what you told them. Now, in less than a minute, a potential employer or colleague can learn a lot about you. If you had Googled my name before 2006, for example, the top result would have been a quote my eighth-grade self gave to my middle school newsletter.⁶ The Internet never forgets, and you can either lament that fact or do something about it. Blogging is content over which you have 100 percent control. That means when someone searches your name and finds your blog, they are seeing what you want them to see—your words, your thoughts, evidence of your skills and expertise.

Nowadays, it's more likely that a lack of web presence will damage you as you apply to new jobs. Just ask danah boyd, an assistant professor in media, culture, and communications at New York University and a visiting researcher at Harvard Law School. "There is no doubt that all faculty searches include a Google search," writes boyd.⁷ "One of the things I hear most frequently about a new hire is how disturbing it is that he doesn't have a web presence. Something must be wrong, right?"

The best part of having your own blog is that these potential employers, colleagues, or whomever will get to see the *best* you. Instead of being a name and a résumé, you'll be a person—and you've already begun charming them, even if they haven't met you face to face. In that way, blogging provides another benefit: it's like regular networking, but without the pesky limitations of location and timing. Blogs are inherently interactive platforms. With comment threads and the ability to link around the world, they're all about conversations. Instead of rubbing elbows with a handful of people at a small, in-person function, you're chatting with thousands of people from all walks of life, any of whom might become an important contact later on. I know firsthand that this can occur: I first met one of my collaborators on my dissertation thanks to blogging.

Others have similar stories. Bertalan Mesko of scienceroll.com feels that "blogging and Twitter don't just help me in my research but totally changed the way I interact with other researchers and collaborators." Similarly, John Fossella (who blogs at genes2brains-2mind2me.com) has found that blogging has expanded his scientific network. "Instead of getting feedback from the same handful of folks I regularly see in the lab, I'm getting comments and new ideas from folks who I used to work with 5, 10 and even 20 years ago, not to mention new folks who I've struck up online interactions with."⁸

"Science blogging literally changed my life," explains Australian science writer Bec Crew, who didn't know how to get started when she graduated with degrees in arts and media. Initially, she started blogging to satisfy her need to write while working an office job to cover the bills. As she gained attention for her posts, opportunities opened up, and Crew credits blogging with launching her career. "I was completely unqualified for the position I applied for at one of Australia's few science magazines, *COSMOS*," she explains, "but there was no questioning my enthusiasm for science communication, which helped me get the job." She was even approached to write her first book, *Zombie Tits, Astronaut Fish, and Other Weird Animals* (which came out in October 2012), through her blog. When it comes to blogging, Crew says the time put in is 100 percent worth it. "It's proof of your commitment to the industry, which is especially handy if you haven't had the opportunity to work in it professionally yet." More importantly, while it's easy to say you're a good writer, hardworking, or committed, showing it is much harder to do—and so means a great deal more. Blog posts can serve as writing samples to show editors, and because they're online, an interested editor will have an immediate, easy way to contact you. As Crew writes, "What will set you apart is the fact that you've

been writing about science in your own time, and training yourself to be better at it; because you love it and you think it's important."⁹

This is especially true for the scientist blogger. Science is a labor of love. You do what you do because you think it matters, and you publish your research because you think it's worth talking about. What better way to make sure your research is talked about than to start the conversation yourself? Multiple studies have shown that media attention can positively influence paper citations.¹⁰ This is especially true because, as U.K.-based geneticist Daniel MacArthur has noted, "a fairly hefty proportion of the readership of most science blogs consists of other scientists, so having your work disseminated in these forums . . . increases your profile within the scientific community, promotes thoughtful discussion of your work and can lead to opportunities for collaboration."¹¹ And if your research is already being talked about widely, you *definitely* want to be blogging. As GrrlScientist explains in a post about scientists blogging, "A blog can be used to rapidly correct errors in mainstream media reporting, and to highlight the value of one's findings while doing so. But perhaps most important, a blog provides scientists with a public platform where they can defend their research from misuse or misrepresentation by politicians and corporations that seek to abuse scientific data to bolster their agendas."¹² As the #arseniclife scandal made blatantly clear, your research is fair game for other science bloggers. When NASA-funded scientists published the shocking finding that some bacteria can replace phosphorus with arsenic, they found out the hard way that in this Internet age, scientists will not just challenge your results academically, they'll also do it online in full view of the public.¹³ "Savvy scientists must increasingly engage with blogs and social media," explains Paul Knoepfler, professor of cell biology at the University of California, Davis School of Medicine, in a comment for *Nature*. "Even if you choose not to blog, you can certainly expect your papers and ideas will increasingly be blogged about. So there it is—blog or be blogged."¹⁴

For all writers of all kinds, from journalists to novelists, there is no better way to get yourself and your work out there than to write more. A blog is a writing laboratory where you can experiment with types of content and see what works best and what doesn't. You can play with images, videos, and all sorts of multimedia. It requires commitment, which means you're putting words to the page, showing potential employers that you have the dedication and ability to produce content. Blogging also keeps you keyed in to the most recent and relevant scientific discourse, and allows you to interact with other writers and the scientists whose work you write about. You'll sit at the same table with some of the most well-respected science communicators out there and gain insight into what they do and how they do it.

Science journalist Carl Zimmer has found that blogging allows him to expand his topic range and elaborate on new ideas. "I blog about things that I find very cool but that I won't be able to turn into an article someone will pay me to write," says Zimmer. "Very often, I will mine these posts for my books, and I sometimes even manage to produce articles on topics I first visited on my blog."¹⁵

If nothing else, blogging helps develop essential skills. "A wonderful side effect," says Ph.D. student Drew Conway, "is that the overall quality of your work will also increase, as you become a better writer, researcher and conveyer of complex ideas."¹⁶

National Geographic blogger Ed Yong reminds us that for a journalist, blogging is a great form of practice. "When I write for my blog, I do so in exactly the same way as I would for a mainstream organization. I ask whether stories are worth telling. I interview and quote people. I write in plain English. I provide context. I fact-check . . . a lot. I do not use press releases, much less copy them."¹⁷

By blogging you practice writing, cohesive thinking, effective communication, and web skills like HTML programming, skills you will use no matter what future career you find. "It's really an

opportunity to work on your writing and presenting skills,” says Saunders. “I found that having an excuse to write every day, trying to distill research down into lay terms . . . gave me a lot more confidence in my writing ability and also my confidence in presenting.”¹⁸ As every writer knows, the best way to improve as a writer is to write—and blogging not only nudges writers to write more regularly; it also provides wiggle room to explore different narrative structures and writing styles.

While blogging might seem a selfless act at first, it opens the door to real career-enhancing opportunities, whether that means broadening your professional network, increasing your exposure, or simply making you more marketable through new and enhanced skills. You can even end up making money off of it, though I wouldn’t recommend getting into science blogging for the cash. Blog because you like to communicate, and because you have a passion for scientific topics that need someone like you to convey them. Blog to gain exposure and network, and to expand your career.

The Win-Win of Science Blogging

Scientist bloggers can gain a wider audience for their research, network with other scientists they might never have otherwise met, and establish their name as experts in their fields. Bloggers who focus on science, whether they’re scientists, journalists, writers, or simply enthusiasts, can use their blog for self-promotion, draw in larger audiences, practice important skills, and try out new ideas and media types. Meanwhile all science bloggers benefit from being involved in a conversation and receiving feedback and ideas from a much bigger audience than they would reach with traditional outlets. And they get to do all of this while doing the important work of sharing what they love with the world, shifting negative cultural attitudes toward science, and combating pseudoscience and misinformation.

So you, enthusiastic science-y person, why aren’t you blogging already? If you’re feeling inspired but still unsure of the next best steps, the rest of this book will help you start with advice and howtos from the best in the business, so you can begin to reap the many rewards. And if you are already blogging, this book has information for you as well: their insider know-how will help you take your blog to the next level, so you can reach whatever goals you have set for your little corner of the Internet.

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Notes

1. Actually, there are hundreds of millions of blogs—over 70 million on Word-Press alone.
2. Jeffrey H. Toney, “Physics: ‘A Waste of Time?’,” *Huffington Post*, July 6, 2011, http://www.huffingtonpost.com/dr-jeffrey-h-tonney/physics-a-waste-of-time_b_845184.html.
3. Anna Miller, “You: The Brand,” *gradPSYCH*, November 2012, <http://www.apa.org/gradpsych/2012/11/you.aspx>.
4. Alex Trimpe, “Google Think Insights,” *Think Quarterly* (April 2011).
5. From a video by Saunders posted in Peter Janiszewski, “Social Media for Scientists: A Lecture,” *Science of Blogging*, October 12, 2002, <http://scienceofblogging.com/social-media-for-scientists-a-lecture>.
6. Seriously. See my quotation at <http://bit.ly/SsbLuE>.

7. danah boyd, "Bloggers Need Not Apply: Maintaining the Status Quo in Academia," *Apophenia*, July 11, 2005, http://www.zephorias.org/thoughts/archives/2005/07/11/bloggers_need_not_apply_maintaining_status_quo_in_academia.html.
8. Quoted in Hsien-Hsien Lei, "Scientists and Social Networking: A Primer (Part 2)," *HUGO Matters*, February 17, 2010, <http://www.hugo-international.org/blog/?p=145>.
9. Bec Crew, "How Science Blogging Can Lead to a Science Writing Career," *Scitable* (blog), *Nature*, September 11, 2012, http://www.nature.com/scitable/blog/scholarcast/how_science_blogging_can_lead.
10. David P. Phillips et al., "Importance of the Lay Press in the Transmission of Medical Knowledge to the Scientific Community" *New England Journal of Medicine* 325, no. 16: 1180–1183; Vincent Kiernan, "Diffusion of News about Research," *Science Communication* 25, no. 1 (September 2003): 3–13; Gunther Eysenbach, "Can Tweets Predict Citations? Metrics of Social Impact Based on Twitter and Correlation with Traditional Metrics of Scientific Impact," *Journal of Medical Internet Research* 13, no. 4 (2011): 123.
11. Daniel MacArthur, "On the Challenges of Conference Blogging," *Wired*, June 3, 2009, <http://www.wired.com/wiredscience/2009/06/On-the-challenges-of-conference-blogging>.
12. GrrlScientist, "Science Blogging for Scientists: Planting the Seed," *Living the Scientific Life (Scientist Interrupted)*, *Science*, September 24, 2008, <http://scienceblogs.com/grrlscientist/2008/09/24/science-blogging-planting-the>.
13. Rosie Redfield, "Arsenic-Associate Bacteria (NASA's Claims)," *RRResearch*, December 4, 2010, <http://rrresearch.fieldofscience.com/2010/12/arsenic-associated-bacteria-nasas.html>; Carl Zimmer, "This Paper Should Not Have Been Published," *Slate*, December 7, 2010, http://www.slate.com/articles/health_and_science/science/2010/12/this_paper_should_not_have_been_published.html; Carl Zimmer, "Did Rosie Redfield Just Refute #arseniclife on Her Blog?," *The Loom, Discover*, August 2, 2011, <http://blogs.discovermagazine.com/loom/2011/08/02/did-rosie-redfield-just-refute-arseniclife-on-her-blog/#.VN47iMZZUzV>.
14. Paul Knoepfler, "My Year as a Stem-Cell Blogger," *Nature* 275 (July 2011): 425.
15. Quoted in Eva Amsen, "Who Benefits from Science Blogging?," *Hypothesis Journal* 4, no. 2 (September 2006): 10–14, <http://www.hypothesisjournal.com/?p=665>.
16. Drew Conway, "Ten Reasons Why Grad Students Should Blog," *Zero Intelligence Agents*, June 8, 2010, <http://drewconway.com/zia/2013/3/27/ten-reasons-why-grad-students-should-blog>.
17. Ed Yong, "Am I a Science Journalist?," *Not Exactly Rocket Science, Discover*, June 28, 2011, <http://blogs.discovermagazine.com/notrocketscience/2011/06/28/am-i-a-science-journalist/#.VN6KucZZUzW>.
18. From a video by Saunders posted in Peter Janiszewski, "Social Media for Scientists: A Lecture," *Science of Blogging*, October 12, 2002, <http://scienceofblogging.com/social-media-for-scientists-a-lecture>.

From Page to Pixel

A Personal History of Science Blogging

CARL ZIMMER

The Internet is relatively young, and science outreach on the Internet is even younger. Carl Zimmer, an award-winning author, journalist, and blogger at National Geographic, discusses the history of the blogosphere, implications for the future, and his own transition from traditional journalism to becoming one of the world's best-known science bloggers.

Today blogging is one of the standard ways in which we tell the stories about science. This state of affairs is relatively new. For those of us who entered the science-writing world back in the twentieth century—as opposed to the twenty-first—the memories of a life before science blogging are still fairly fresh. Understanding the origins of science blogging can help us do it better now, and to push it into fruitful new experiments.

My own memories of life before science blogging start around 1990, when I got my first job in the journalism business—as an assistant copy editor at *Discover*. At the time, it was one of the biggest of the many magazines focused on science. It had a robust circulation of over a million readers. And it had no connection to the Internet whatsoever.

In that format, science writing had a simple one-way flow from writer to reader. A writer would research a story and write it. An editor would edit it, a fact-checker would make sure it was accurate, a designer would lay it out in an upcoming issue, a printer would produce millions of copies of the magazine, and truck drivers and ship captains would deliver it to the world.

In this one-way arrangement, it was rare for us writers to hear from our readers. Sometimes someone would sit down with pen and paper and write out a letter to the editor. But we had little sense of our audience. We had no way of knowing how many people read a given story, or how many of them talked about it with their friends.

The technology that would turn our journalistic world upside down already existed at the time. Though journalists had little idea that the Internet even existed, scientists had been using it since the 1970s. I stumbled across the Internet in 1994, when I was interviewing a scientist about his work on simulations of black holes. He explained to me that I could see his simulations on my own computer—and he wouldn't have to send me a CD-ROM. I loaded Mosaic software onto my computer, and it carried me, to my astonishment, to the scientist's web page. It was as if I had been hurled from New York and landed in a chair next to him in his office in Urbana, Illinois, thousands of miles away.

Even as I came to appreciate the web, it would have been hard to imagine then that my own stories would someday jump into the screen, that most people would read my work online rather than in print. The modems were too slow, the computer memories too infantile, the monitors too pixelated.

As a science writer, my own transition to the Internet was motivated by practicality. In 1999, I left *Discover* to become a full-time writer of books and articles. I wanted a place online where I could display my magazine articles in order to persuade editors that I could write for them. I also wanted to post information about books I had written and links to places where people could buy them. I discovered that no one had yet claimed carlzimmer.com and started to build a website. The site was

useful, but it was also a lot of work. The primitive software of the day meant I ran a huge risk each time I wanted to make the slightest change. It was like replacing a jet engine at thirty thousand feet.

I was therefore amazed to discover that a few people had websites that they updated *every day*—and some of them were writing about science. The earliest of those science writers I can recall include Chris Mooney (writing on science and politics), Razib Khan (human genetics), P. Z. Myers (evolution and development), and Derek Lowe (drug development). Their topics and politics varied enormously but they all shared the same lively, personal style.

The medium they used also gave them a power that print could not offer. As soon as something happened in the news, they could write a piece of commentary and post it within hours—or even minutes. Publishing was as simple as pressing a key. The bloggers, as they called themselves, could incorporate photographs easily into their text. To back up what they said, they could link to original sources. And they offered readers an opportunity to respond, by providing comment threads.

Intrigued, I started playing around with blog software. I was attracted to blogging because I wanted to write about things that weren't very welcome in print publications, and I wanted to write in ways that didn't fit their style. Because I was my own publisher, I didn't have to ask anyone's permission to write what I wanted. In 2003, I launched my blog, which I dubbed *The Loom* (an obscure reference to a line in chapter 93 of *Moby Dick*). It's been an intimate part of my writing life ever since.

In hindsight, I can see that my experience was just a small part of a turbulent chapter in the history of journalism. Print publishing was beginning to slide. In the 1990s, magazines and newspapers were so lucrative that corporations gobbled them up. Debts soared on the assumption that the good times would never end, and that print would always reign supreme. The *New York Times* spent over a billion dollars buying the *Boston Globe*, reportedly because they had the best color printing presses in the country. Color printing, not the Internet, was the future of journalism.

And then the crash came.

Corporations tried to pay off their debts by squeezing bigger profits out of their publications. When the profits weren't forthcoming, they cut costs by slashing staffs. Special science sections vanished from newspapers; science writers were laid off. Editors became anxious about stories that wouldn't grab as many people as possible. No essays about altruistic slime molds, please.

That editorial fretting didn't stop newspapers and magazines from losing huge numbers of readers, many of whom shifted to the web. Meanwhile, the advertising that had buoyed magazines and newspapers began to evaporate. Classified ads migrated to Craig's List. Luxury ads also moved online. Sadly, most print publications didn't give serious thought to a better way to cope with the changes in journalism: by investing in good websites. For years, their websites were little more than copy-paste dumping grounds for their print edition.

Like other science writers, I did my best to tread water. I wrote freelance articles for magazines and newspapers, figuring out the sorts of stories that worked for each outlet. When I needed to write for myself, and for like-minded readers, I blogged.

The greatest pleasure I got from blogging was surprise. I would delve into strange corners of biology—a wasp that turns a cockroach into a zombie in which it can lay its eggs, for example. And I could see that people really did like to read about such stuff—and share it with their friends. The analytics for my blog showed me that I had readers from all over the world. I could see how other bloggers linked approvingly to the zombie post. Eventually the wasp ended up as a villain in a video game. A band posted a video on YouTube in which the members sang about the wasp's attack as a metaphor for a romance gone especially bad. I could see the unpredictable ways in which the things I wrote spread through the maze of culture.

Blogging also let me jump right into the biggest science news stories of the day. In 2005, a judge i

Pennsylvania was hearing a case brought by parents complaining that creationism—in its latest form “intelligent design”—was being slipped into their local school. Judge John Jones delivered a devastating rejection of intelligent design and his decision was posted online. I grabbed a copy and read through it, blogging as I read. As I updated my post, readers were having their own discussion in the comment thread, making collective sense of this historic moment.

I sometimes responded to creationists on my own blog. Traditional publications didn't see such responses as part of their mission. I disagreed, and used my blog to explain why creationist claims were wrong. By the time I had finished explaining how scientists know that the world is not just six thousand years old, I had explained geochronology—real science.

For the first few years of my experiments with blogging, some of my more distinguished colleagues in science journalism were baffled that I was “wasting” so much of my professional time. I was frustrated sometimes trying to explain why I enjoyed it so much. I couldn't get them to see the possibilities that blogging—both the software and the cultural practice—opened up for science writing. They joked about how I was going to end up living in the basement of my mother's house, blogging in my pajamas.

There's a hostility laced into such jokes. Many journalists saw themselves as professional gatekeepers, who used careful judgment to decide what kinds of science should become part of the public record, and to decide how their stories should be told. Now anyone could launch a blog and make a mess of things.

Professional journalists didn't just view bloggers as degrading the craft. They also viewed bloggers as an existential threat. By the mid-2000s, traditional science journalism was in a dire state. The pay that writers could get for their journalism fell. Instead of painstakingly researched investigations, editors seemed to favor superficial, quick blurbs—and lots of them. In addition to their print editions these editors were now trying to fill their websites with what they now referred to as “content.”

Somehow, the bloggers must be to blame. They had flooded the market with reading material—material they had produced not for money, but for the sheer pleasure of blogging. They undermined the work of real science journalists, and the whole edifice collapsed.

The idea that some pajama-clad basement-lurkers could destroy a major sector of the media is absurd. The real reasons for the collapse of traditional science journalism are more complex, and they stretched back long before the rise of science blogging in the early 2000s.

Today, things have changed far beyond what I could have imagined when I started out in journalism. From 1950 to 2000, American newspapers tripled their revenue from advertising, to \$48 billion a year. Since then, revenue has crashed to \$22 billion—a level not seen since 1950. Today there are fewer people employed by newspapers than in 1947.

Science reporting has been utterly transformed by this industry-wide change. During the 1970s and 1980s, U.S. newspapers set up new science sections at a steady clip until they reached a peak of ninety-five. Since 2000 most of those sections are gone—only seventeen remain. Many prominent science magazines, like *Omni* and *Science 80*, shut down.

These statistics are an ugly reality for people whose mortgage depends on the economics of journalism. But they are also a distraction from the mission of science journalism. We should judge the success of science journalism not by how many people it employs, but by how well it supplies readers with the stories of science. And by that standard, it is a huge success.

Traditional media have finally taken the Internet seriously. They see their websites as the core of their operation, where they can deliver news quickly and efficiently. Readers can now sit down with a tablet and read about science in newspapers and magazines around the world, from the *Guardian* in England to the *Jakarta Post* in Indonesia. A quick Google search can deliver even pre-Internet articles

from digital archives.

Newspapers and magazines have stopped looking at blogs as the enemy and have started seeing them as an opportunity. They now realize that they can use the format to report quickly, to give their writers a more personal presence, or to build a community of readers through forums and comment threads.

Science blogging, I would argue, has become so mainstream that the term is becoming obsolete. As I write this chapter in 2014, there's an ongoing boom of new, innovative news operations—places like *Vox*, *Fivethirtyeight*, *Matter*, and *Mosaic*—that put science at the center of what they publish. These publications are purely digital and they use innovative ways to display information (interactive maps for example), while hosting writers who don't have to hide their voices or their obsessions. They follow the tradition of blogging without feeling the need to use the word.

Those who are starting out in science writing would do well to understand this history. Some scientists set up blogs to emulate their scientist-writer heroes. They may envision themselves as the next Stephen Jay Gould or Lewis Thomas, for example. But a scientist writing essays in 2015 is doing something fundamentally different from a scientist writing essays in 1975. Scientists like Gould and Thomas could take advantage of the one-way, bottlenecked flow of information, publishing their pieces in, respectively, *Natural History* and *New England Journal of Medicine*. Today a blog post will not march off and find its own audience, because the structure of publishing has changed so much in the past few decades.

Bloggers today may not have the special platforms that Gould or Thomas had. But they have many many consolations provided by digital publishing. Most important, they can use their new tools to bring innovative, meaningful writing about science to desktops around the world.

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Carl is based in Connecticut. Find him on his website at <http://carlzimmer.com> or follow him on Twitter, [@carlzimmer](https://twitter.com/carlzimmer).

How to Set Up a Science Blog

KHALIL A. CASSIMALLY

If you've decided to start a blog, there are several ways to get started and options that are available to you. Khalil A. Cassimally, community coordinator at The Conversation UK, goes step by step through the basics.

When I started blogging around ten years ago, a blog, to many people, was the evolution of the leather-bound diary. Instead of chronicling the day by writing in pen on paper pages that no one would read, bloggers typed into an Internet browser window and clicked “publish.” I did this too.

Now it's popular to blog about more than your life. The universe and everything are also frequent blog fodder, and setting up a blog is simple, rapid, and free. To create a blog, you merely have to choose a blogging service, come up with a good name, and have some ideas or views you want to share.

There are a number of blogging services to choose from. At the time of this book's publication, two of the most popular are Blogger.com and WordPress.com. Blogger was created in 1999 and WordPress in 2003; both provide users with all the basic blogging tools necessary to write and publish.

Blogger is owned by Google, so if you live in the Google online ecosystem (which you do if you use Gmail, Google Drive, Chrome, and/or Android), you may find it advantageous to host your blog there. You'll find yourself instantly at ease with Google's familiar clean and minimalist style. Blogger also allows you to change easily the appearance of your blog.¹ There are multiple templates to choose from, and the possibility of fiddling with attributes such as color and layout. You can even add Google services for your readers such as translating your posts with Google Translate, emailing your work to others via Gmail, and adding a “+1 button” to track reader interest. Blogger also comes with a built-in statistics page. This allows you to see how many people are looking at your blog generally and at specific blog posts, and shows you what other sites have led them to yours.

While Blogger is a simple, reliable blogging service, it may seem a little limiting to those who want to have more control over their blog's look and capabilities. For example, you might want readers to be able to access your posts based on when they were published. Or you may prefer to have links to some of your best posts. You can easily choose between these options and more with WordPress. Don't forget that you can also add multiple pages to your blog—think of an “about” page, a “contact” page, a “portfolio” page—to turn your blog into a proper website.

In addition to offering near complete control of your blog's look, WordPress has a decent spam filter (which, trust me, is a wonderful defense against a barrage of Viagra ads). It also has good built-in social media integration, allowing readers to share your blog posts on Twitter, Facebook, and numerous other networks.

One hugely important benefit of WordPress is that it makes it easy to back up and send posts to other websites.² This allows WordPress to serve as what's known as a “content management service, or CMS, used to run entire websites.³ Websites such as *Scientific American*, *Quartz*, and *Re/code* operate entirely on WordPress, so you can imagine the flexibility that it provides. This is something to consider if you intend to spin off your blog into a mini-media empire. Considering the myriad of

possibilities provided by WordPress, it is perhaps inevitable that it is not as user-friendly as Blogger, but the added benefits are considerable.

Founded in 2007, [Tumblr.com](https://www.tumblr.com) is one of the few successful social networks built around blogging. Tumblr is worth considering especially if you intend to post graphics with minimal text. As opposed to Blogger and WordPress, where each blog post is essentially a webpage, a post on Tumblr is a shareable entity that will travel around among Tumblr users. The uniqueness of the Tumblr experience started with a focus on the “share” button. Users can also follow you and get your updates the next time they log in. Because the emphasis on sharing is so obvious on this service, shorter, snappier, and media-full posts tend to receive more attention because they are quicker to consume and therefore shared more frequently.

In 2012 Ev Williams, the man who started Blogger and Twitter, created another blog outlet, *Medium*. I think writing on *Medium* is a beautiful experience. The blog editor is refreshingly simple, with the focus very clearly on your words and photos. It uses a WYSIWYG (what you see is what you get) editor. Like Tumblr, *Medium* is very network focused. You can add a post on *Medium* to a “collection,” which includes posts written by other *Medium* users based on a certain topic. Users can follow collections, which help them discover your work. Your page on *Medium* shows just a few links to your *Medium* posts (for an example, see my page at [Medium.com/@NotScientific](https://medium.com/@NotScientific)). This emphasizes *Medium*'s focus on individual posts rather than an individual blogger.

To set up a blog on any of these services, you first need to create an account. The process is as simple as creating a profile on social media networks. Generally social media networks require a username, password, and a name for your blog. Your chosen username can help brand and identify you, and thus you should think about how you want to present yourself to the world. Do you want to tie your blog or social media to your real name? Or do you want a pseudonym in order to separate your writing from your personal life or other professional career?

Your blog's name is also worth some careful consideration. It is one of the first things that a new reader will see, and first impressions are important. All visitors have the ability to leave and never come back or never to come in the first place. When I discuss blog names with potential bloggers, I always ask them to choose one that has a connection with the themes they will explore on their blog. Once you think you have an adequate name, make sure you Google it to verify that no one else had your same eureka moment.

With your blog created and named, you are free to take over the world. You just need to find readers. My first few blog posts had zero comments: a disheartening experience shared by most new bloggers. Then, slowly, some of my blog posts began getting one or two comments. And gradually, ten or more comments. To find and retain readers, you need to tap into the particular communities of bloggers and readers who will find your blog posts especially interesting. This does not happen overnight.

Start with the Content

First, always strive to publish quality blog posts. Writing quality posts is time-consuming and draining, but stick to it. Publishing a blog post that you are proud of is rewarding and chances are that readers will enjoy it too.

Try to blog regularly. No one likes a blog that has not been updated in months. What if you run out of ideas? I have found that talking to friends, lab partners, or my parents has helped me to clarify ideas for posts and spark my enthusiasm. Another great way to keep myself blogging regularly even when I am not particularly full of ideas is to send out a lot of short (just three- to four-hundred-word)

“quick-fire” commentary blog posts that capture my thoughts about a particular article or blog post that I had read recently.

When I write longer blog posts, though, I find it a good idea to jot down the structure of the posts before I start writing. I typically summarize each paragraph into one sentence and think about the link between the paragraphs. This helps to ensure that I don't get stuck halfway through the piece, not knowing how to proceed. I'm also a big fan of Hemingway's "dictum to end each day's writing in the middle of a passage, or even a sentence," as science writer David Dobbs eloquently put it.⁴ When I start writing the following day, I then know what I'm going to write, so very rapidly get in "the zone."

Once you get in the habit of blogging, you will find it easier to keep going. The creativity floodgates of your mind are open and ideas for future posts will randomly but frequently pop up. Keep a note of those ideas so that you can explore them later on. Your developing audience will also motivate you to write with their constructive comments and indicators of approval, such as Facebook likes, Google +1s, and Twitter retweets.

Again, make sure you read other science blogs that cover themes similar to your own blog as well as those which you simply find interesting. In addition to a web search, you might try exploring the science blog repository *ScienceSeeker* (<http://scienceseeker.org/index>). Reading other science blogs allows you to learn from other bloggers who have been at it for a long time. Study their techniques and let them inspire your own unique writing.

Index and Share

The next step is to get your blog out there. Shout! The biggest difference between a diary and a blog is that a blog resides in an open web. But this poses a problem: how do readers find your blog among the millions of others?

There are a number of ways to get your blog out there. Start by submitting it to search engines such as Google and Bing.⁵ These search engines will index your blog and display links to it in people's search results. Having your blog appear on search results is one thing but having it appear among the top results will bring more people to your content. For this reason, it is a good idea to think about what's called search engine optimization (SEO), or the use of writing and coding techniques or strategies to lift a blog to a higher rank when people search for it.⁶ A web search will bring up many articles about SEO, but Google itself offers some guidelines.⁷

You should also add your science blog to a blog repository. If you blog about peer-reviewed research, *ScienceSeeker* allows you to mark those specific blog posts with a few lines of code (which merely involves copying a few lines and pasting them into your blog post) that it will then identify in order to list your blog post among other such "research blog posts." In essence, *ScienceSeeker* gives you the opportunity to have your blog posts listed with those of others, including more experienced bloggers, and to be linked into the science blogging community.

Join the Community

A few years after I began blogging, social networks started garnering attention. Many of my friends were on a social network called hi5, which was like a stripped-down version of today's Facebook. After much reluctance, I caved in and created a hi5 account, which I used to rant about football, friends, and my teenage life. All in all, it was nothing that would be of much interest to anyone . . . except friends. My friends began to read my posts religiously, and conversations about our lives and

experiences sparkled. I was engaging with a very real, albeit small, community.

I began writing about science around then and a few years later I joined a budding network of bloggers. The network already had a good, established community, and my science contributions tapped into it. By periodically sharing links to my science posts on my hi5 account, I slowly broadened my community, which led to more readers and more discussions.

The science blogosphere is close-knit. If you contribute good blog posts and comments, you will likely get more attention. So it is essential to engage. The main approach is through social media (Facebook, Twitter, and other social networks) and, of course, through blogging. Your aim should be to get your name out there. If people know you, they will click on your links.

A good way to find strong science bloggers is to visit science blogging networks (you might try first <http://blogs.scientificamerican.com>, <http://blogs.discovermagazine.com>, <http://wired.com/category/science-blogs>, and <http://phenomena.nationalgeographic.com>). Read the blogs that interest you and interact with bloggers on social media and in the comments. Expand your network.

Blog comment sections in particular are great places to interact. Take the time to compose well-structured and opinionated comments. If you feel that a comment is not enough to get your message across, write your response on your own blog and share a link in the comments for others to follow. Not surprisingly, comment threads are a great place to discover new bloggers. It stands to reason that if someone wrote a thoughtful comment, that person's blog might be worth reading as well.

In addition to interacting with other bloggers and sharing their posts, you should of course share your own content. For example, you may consider creating dedicated social media pages for your blog, for example on Twitter and Facebook. As you engage with people, they will start to notice you and follow you back. They may also begin to retweet your tweets to their followers or help to promote your work. Slowly, you will build your own base of followers who will click on the links you tweet.

The key to attracting more people to your blog is to make sure that visitors see that you have a unique voice and offer them great posts. Science blogging is sharing what you are passionate about with others, giving them the same buzz you get when you read about space, Darwin, or panda sex. It is about sharing knowledge . . . while hopefully getting some recognition. That's cool, too.

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Notes

1. "Blogger Template Design," Google, accessed February 13, 2015, http://www.chicagomanualofstyle.org/16/ch14/ch14_sec245.html.
2. "Moving a Blog," WordPress, accessed February 13, 2015, <http://en.support.wordpress.com/moving-a-blog>.
3. "Showcase," WordPress, accessed February, 13, 2015, <https://wordpress.org/showcase>.
4. Bobbie Johnson, "David Dobbs: 'Exquisite Wisdom Can Be Hard to Follow,'" *Medium*, June 20, 2013, <https://medium.com/@bobbie/david-dobbs-exquisite-wisdom-can-be-hard-to-follow-1a7f0644ce92>.
5. "Website Owner," Google, accessed February 13, 2015, <http://www.google.com/submityourcontent/website-owner/>; "Submit Your Site to Bing," Bing, accessed February 13, 2015, <http://www.bing.com/toolbox/submit-site-url>.
6. "Search Engine Optimization Starter Guide," Google, accessed February 13, 2015, https://static.googleusercontent.com/external_content/untrusted_dlcp/www.google.com/en/us/webmasters/docs/search-engine-

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- <http://www.gateaerospaceforum.com/?library/The-Innocents--BFI-Film-Classics-.pdf>
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- <http://www.gateaerospaceforum.com/?library/The-Other-Side-of-the-Night--The-Carpathia--the-Californian--and-the-Night-the-Titanic-Was-Lost.pdf>