Foreword

Some forty years ago, during a long subway ride to a junior high school math-team competition (the geek version of an away game), our coach pierced the din of rattling metal wheels to ask a handful of us why we loved mathematics. Even in the most conducive of circumstances, "mathletes" are not the most introspective bunch. While we'd jump all over a challenge like finding triangular numbers that are also perfect squares, or calculating the probability that two people in the subway car shared the same birthday, articulating a personal reflection on, well, anything, generated a more reserved response. We let the thunderous clatter of the express train fill the silence. No one said a word.

But it did get me thinking. Why *did* I love math? The thrilling moment when the solution to a problem snaps into focus, the beauty of constructing an elegant proof, the power of understanding a hidden pattern—all of these surely resonated with my budding seventh-grade mathematical mind. Still, I remember thinking that the most compelling answer was simply this: math works. A well-posed problem has a definite answer. Regardless of the approach you take, the calculative scheme you invoke, the oblique angle you follow, barring any mistakes you will get the answer. *The* answer. The rock-bottom certainty of problem solving was, for me, a welcome anchor in a post-1960s' world that seemed awash in uncertainty.

Yet, it is that very certainty in a rolling sea of uncertainty that makes the science writer's job so challenging.

When mathematics is applied as a scientific tool to explore the real world—not to solve artificial problems encountered on exams or competitions—precision is possible only because researchers encircle themselves with thick walls of assumptions that keep undue complexity at bay. When we calculate the orbital motion of the earth, we assume the earth is a solid ball moving solely under the influence of the sun's gravity. When we want to get closer to truth, we take account of the influence of the moon and other planets, and even the earth's complex internal structure. It's a mode of operation recapitulated across the sciences: progress takes place in the ever-shifting overlap between simplification and relevance. Science is the art of knowing what to ignore.

The science writer thus has to continually strike a delicate balance between the precision of scientific results—certainty—and the morass of qualifications upon which such results rest—uncertainty. As a scientist who also writes, I've experienced this from both sides. In countless interviews with science journalists, I've repeated "Yes, but . . ." emphasizing one crucial caveat necessary to make my description of a scientific advance accurate but rendering the responsible journalist's story murky. In my own writing, I've countlessly wrestled with finding descriptions that capture the excitement of scientific advances while remaining faithful to the precise and ever-present limits that accompany each advance.

In essence, we scientists are just as protective of what we know as we are of what we don't. Our ignorance is a precious commodity. It not only defines the boundary of understanding but provides the terra incognita that beckons exploration and, on rare occasion, plays host to a remarkable new insight.

Scientists and science writers have not always done a great job of communicating this to the public. Breathless articles are surely exciting but over time they suggest that science is unstable, buffeted this way and that by a steady stream of revolutions that, one would naturally think, continually rewrite the textbooks. But the fact is that science is remarkably stable. New insights typically don't obliterate existing understanding but, instead, extend its reach a few additional steps into the realms of darkness. This is an essential quality of the whole scientific enterprise that I find is often misunderstood.

In fact, the continuity of science plays an even more vital role, something that can be difficult for a reader to tease out of even the best journalism. One of the greatest scientific achievements of the twentieth century was Albert Einstein's completion, in 1915, of the General Theory of Relativity, a new and more powerful approach to understanding the force of gravity. In 1919, Einstein's theory was confirmed through astronomical observations of distant stars during a solar eclipse. The story was widely covered, with two *New York Times* articles (both reprinted in this volume) being those I've most often seen referenced. Understandably, the articles give only modest attention to Einstein's radically new view of gravity, framed in terms of warps and curves in space and time—it often takes years of hindsight, even for scientists, to find the right language for communicating the most abstract of ideas to those without technical training. And, correctly, the articles emphasize that in the everyday manifestations of gravity we all experience, from the arc of a tossed ball to the trajectory of a dropped cup, Einstein's and Newton's theories hardly differ in their predictions.

But what the reader is unlikely to discern from the articles is that however revolutionary Einstein's discovery, Newton's approach to gravity was one of the essential guiding lights leading Einstein to his theory of relativity. Between 1912 and 1915, as he groped his way through a terrain of complex mathematics, Einstein diligently required that any new equation he developed be reduced to Newtonian gravity when applied to ordinary situations, like the motion of the moon, where Newton's ideas had already proved impressively accurate. Indeed, in applying this very requirement in 1913, Einstein committed a technical error that set back the discovery of General Relativity two years. And so, far from throwing Newtonian gravity overboard, Einstein tightly grasped the Newtonian lifeline and rode it to an unfamiliar but spectacularly beautiful shore.

The point is that there is uncertainty at the frontier of knowledge—which is what makes science exciting—but there is a core of scientific insight that you can count on. Einstein's discovery of the General Theory of Relativity does not mean your effort in high-school physics to understand Newtonian gravity was a waste of time. Unlike that ultra skinny tie in your closet, deep scientific understanding doesn't go out of fashion.

On occasion, many of us who write on science have fallen into the trap of letting the singular excitement of a breakthrough overshadow the fundamental continuity of scientific progress. I understand well the push-pull of announcing that we've crossed into virgin territory with the reality that such territory typically comprises a nearby suburb that tightly borders all that we've so far understood. The best science journalism, evidenced by so many articles in this wonderful collection, walks that border without even making it apparent that there is a line to walk.

And toeing this line is vital. In an era that will inexorably rely ever more on the insights of science and the products of technology, it is increasingly urgent for the public to have not only a familiarity with scientific results but also a sense of scientific process. Progress in science extends the reach of certainty into precisely articulated realms of uncertainty. Much like my youthful subway epiphany, the general public needs to know, and know deeply, that science works.

—*Brian Greene*

Introduction

Fittingly, the first mention of science in *The New York Times* came in its very first issue—September 18, 1851. On page 2 (out of four), what was then called *The New-York Daily Times* reported the death of the Reverend Sylvester Graham, the famed nutritionist who invented the graham cracker—and whose *Lectures on the Science of Human Life* contained "a systematic, and in some degree, a scientific exposition of the author's peculiar views."

What struck the obituary writer as "peculiar" about Graham's views is lost to history. In its early, candlelit, hand-typeset decades, *The Times* was far from becoming the journalistic powerhouse it is today, and its coverage of science, as of the news in general, could itself be quite peculiar. The paper's founder, a charismatic, ambitious, and somewhat quixotic Republican politician named Henry Jarvis Raymond, meant it to be "the best and the cheapest family newspaper in the United States," substituting "cool and intelligent judgment, for passion" (and, not so incidentally, undercutting its competitors by selling for just a penny a copy). Among Raymond's best hires was John Swinton, an editorial writer who made sure *The Times* outdid the competition in science coverage, going so far as to write three to four columns a *day* on major scientific conferences. It was Swinton who commissioned a pioneering, sympathetic and still highly readable book review (reprinted on pages 278–86) about Charles Darwin's *On the Origin of Species* in 1860, when the theory of evolution was often attacked and derided, to the extent it was understood at all. But Swinton left the paper after Raymond's death in 1869, and science news "languished for half a century," as Meyer Berger wrote in his swashbuckling, compulsively enjoyable centennial biography of the paper, *The Story of The New York Times 1851–1951*.

All of that changed with the arrival of Adolph Ochs, the young Tennessee publisher who bought the failing *Times* in 1896 with $75,000 in mostly borrowed money (the equivalent of about $2 million today) and whose descendants, the Sulzberger family, still run the paper. Ochs stands as one of journalism's most heroic visionaries. The author of the slogan "All the News That's Fit to Print" and of the proud mission statement "to give the news impartially, without fear or favor," he was a Roman candle of ideas (most of them good) and a wizard at surrounding himself with talented people who wanted to work as hard as he did.

Perhaps the most talented was Carr Van Anda, whom Ochs brought on as managing editor in 1904. Van Anda was not only a hard-driving journalist: he was a mathematician who at least twice found errors in the equations of the young Albert Einstein. Ochs and Van Anda shared an "eager curiosity for news about the unknown in the sciences and about the remote unexplored corners of the world," Berger wrote, adding:

> Without Ochs' willingness to pay almost any sum for exclusive rights to stories on modern exploration, on the advancement of science, . . . Van Anda could never have made *The Times* a leader in that kind of journalism, but Ochs gave Van Anda his head. Between them they won for *The Times* a leadership in the field that was never overtaken.

One of the paper's first Pulitzer Prizes went to Alva Johnston, "for distinguished reporting of science news"—in particular, his coverage of the 1922 meeting of the American Association for the Advancement of Science, which produced the memorable headline "Scientists Witness Smash-Up of Atoms." Johnston was a general-assignment reporter whom Van Anda plucked from the newsroom to cover the meeting, but in those days *The Times* often turned to specialists, even commissioning news articles by scientists and explorers. Waldemar Kaempffert, one of the earliest bylines in this collection, was an engineer before Ochs brought him on as an editorial writer in 1927. And William L. Laurence was hired in 1930 as the first newspaper reporter assigned exclusively to cover science. (Laurence was later nicknamed "Atomic Bill" for his assignment by the War Department in the 1940s to serve as official historian of the Manhattan Project, the crash effort to develop nuclear bombs. He could write about the project for *The Times* on the condition that he disclose nothing before the war's end—a deal it is hard to imagine a *Times* reporter making today.)

Over the decades, as *The Times* has enhanced its leadership in science journalism, the balance between generalists and specialists has shifted. Since the 1940s, with a few notable exceptions, most science reporters have been journalists first: women and men who may or may not have advanced degrees but who are imbued with the kind of passionate curiosity that drove Adolph

Ochs and Carr Van Anda. These reporters know how to find things out, how to distinguish between real news and public-relations puffery, how to cultivate expert sources who can help them grasp the significance of new discoveries and the postgraduate-level science that underlies them. And how they can write!—often on punishing deadlines that leave no margin for artful revision. John Noble Wilford, who as a young man set his sights on political writing but found himself captivated by the 1960s space race, later collected two Pulitzer Prizes for science reporting. Here he is covering a rather routine astronomical conference celebrating the tenth anniversary of the Hubble Space Telescope:

> Hubble's pictures of faraway galaxies and brooding clouds of stellar nurseries have impressed astronomers and ordinary people alike. One of the more recent pictures shows dazzling fireworks in the constellation Aquila. Rings of glowing hot gas and showering streamers of cooler gas are visible around the central stellar remnant. It is an image of what the Sun will look like in its death throes some six billion years from now.

And here's Natalie Angier, who won a Pulitzer for beat reporting just ten months after arriving at *The Times:*

> With its miserly metabolism and tranquil temperament, its capacity to forgo food and drink for months at a time, its redwood burl of a body shield, so well engineered it can withstand the impact of a stampeding wildebeest, the turtle is one of the longest-lived creatures Earth has known.

Small wonder that more than a century after Ochs's arrival, science writing is still a *Times* mainstay. Science Times, the paper's Tuesday science supplement, was born in 1978. (An evocative twenty-fifth-anniversary account of the blessed event is reprinted on pages 438–40.) One the very few freestanding science sections left on the diminished landscape of American newspapers, it remains one of the paper's most popular features.

The New York Times Book of Science collects 125—best? no, let's say most representative—articles from more than a century and a half of science reporting. Some are indisputably great: no collection of this kind could overlook John Wilford's heart-stopping lead story on the *Apollo 11* moon landing of July 20, 1969. (The landing also occasioned the boldest headline to that point in the *Times*'s history—MEN WALK ON MOON—and perhaps its only front-page poem, also reprinted here.) Wilford is well represented, as are Angier and such past and present giants as Kaempffert, Laurence, Willia Broad, Walter Sullivan, Malcolm W. Browne, Lawrence K. Altman, Nicholas Wade, Gina Kolata, and Dennis Overbye.

But if journalism is indeed "the first rough draft of history," it's important to include some stories that didn't quite get it right, or missed the mark altogether. The most irresistible, about Einstein's 1919 confirmation of his General Theory of Relativity, carries the weirdly poetic headline "Lights All Askew in the Heavens," a skein of subheads including "Men of Science More or Less Agog," "A Book for 12 Wise Men," and "No More in All the World Could Comprehend It." The article's lead sentence candidly admits defeat: "Efforts made to put in words intelligible to the non-scientific public the Einstein theory of light proved by the eclipse expedition so far have not been very successful." But at least *The Times* knew it was on to *something* important, and less than a month later it recouped in fine style by paying a visit to the great man himself and letting him explain relativity in his own words.

Nor can a collection of this length remotely do justice to the broad sweep of scientific endeavor chronicled by *The New York Times* over the past 164 years. There is no chapter on chemistry, for example; the most interesting stories we found on that elemental discipline seemed to fit more comfortably in the chapters on physics and technology. Some towering scientists and accomplishments will not be found here. This book is less survey course than nonfiction narrative, a newspaper's story—in its own words—of the evolution of science journalism over an immensely consequential period for both science and journalism. Fortunately for readers seeking more detail, the three previous books in this series—on physics and astronomy, mathematics, and medicine—have that in abundance.

—David Corcoran