To Think, To Write, To Publish

Science and Innovation Policy through the Looking Glass of Creative Nonfiction

By Lee Gutkind, David Guston, and Gwen Ottinger

To Think, *in which two different kinds of people have to learn to think together under difficult circumstances and do things that, while not utterly unprecedented, are still rare and challenging.*

Sonja Schmid knows she has only three minutes to make her point—and she has to share that time with her new partner. Ross Carper is standing behind her. He's in his early 30s, balding, wearing a striped jersey, and reading over her shoulder as she follows her notes. She describes a cigarette break she shared with an aging Russian nuclear reactor operator she had been interviewing, which led to a special moment when their conversation went beyond technical talking points to a personal topic—his relationship with his reactors.

Schmid, with a cascade of wavy black hair, black-rimmed glasses, and chic red scarf, is an assistant professor in the Department of Science and Technology in Society at Virginia Polytechnic Institute and State University. Carper is a writer with the Environmental Molecular Sciences Laboratory at the U.S. Department of Energy's Pacific Northwest National Laboratory. Schmid has a PhD in Science and Technology Studies and Carper an MFA in fiction writing. They met each other only a few hours ago and yet they are already collaborating on a writing project that will consume them for 18 months. Now they have but three minutes to convince four very critical editors that readers—educated people who had rarely, if ever, given thought to nuclear reactors or their operators—would *want* to read about Schmid's research. Their secret weapon: the ancient art of storytelling, embodied in a genre called creative nonfiction.

This was the pitch slam, the focal event of "To Think, To Write, To Publish," a project aimed at promoting deeper public understanding of Science and Innovation

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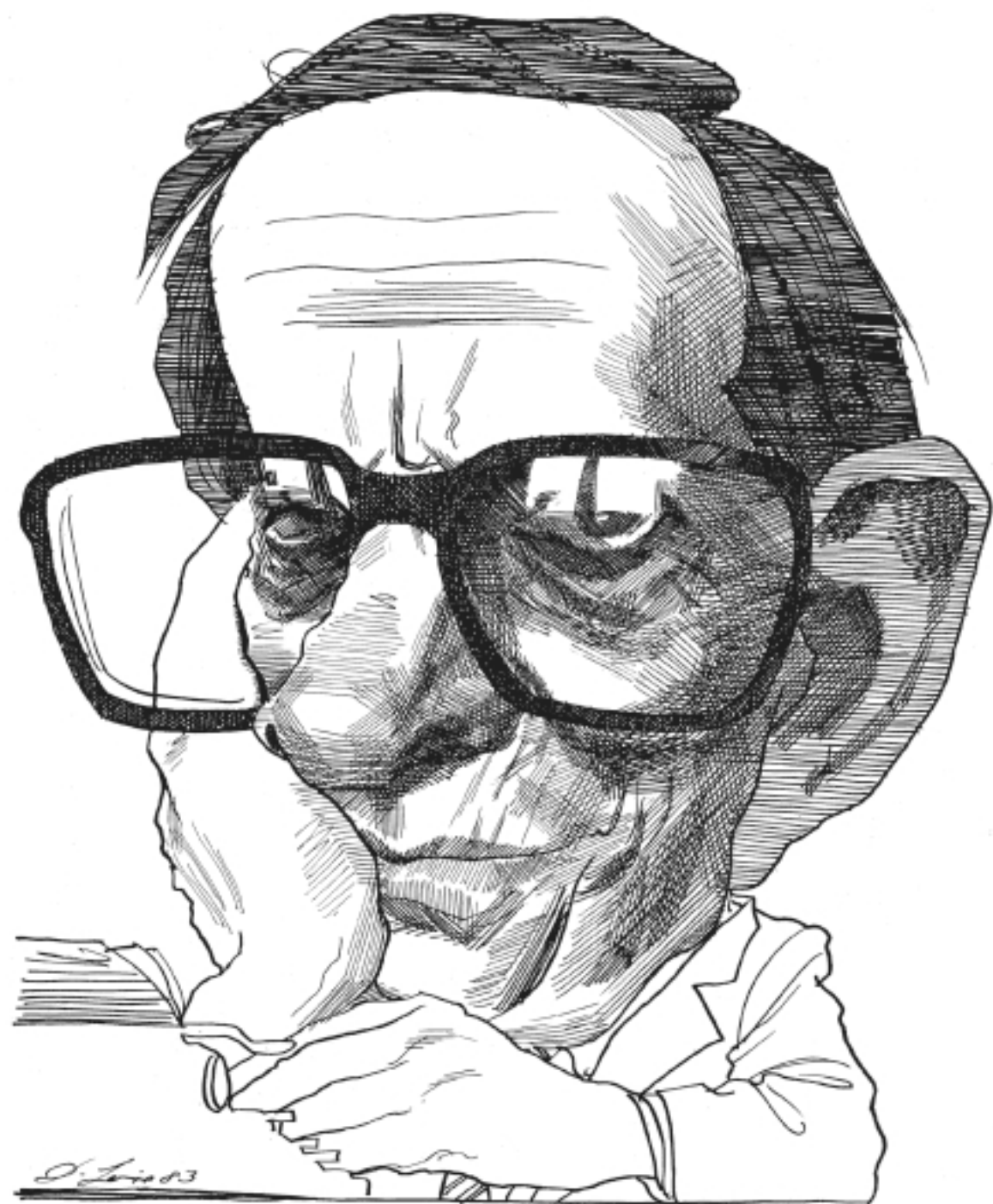
Policy (SIP), the principles, guidelines and courses of action developed by society for using the work of scientists and innovators. The idea behind the 2010 project, which was supported by the U.S. National Science Foundation (NSF), was that, by working with communicators, SIP scholars could render academic findings more cinematic and, by introducing real characters behind the facts, tell a true story with action and excitement in order to communicate information about their subject in a way more compelling than would generally be possible with straight exposition or academic argumentation. The NSF typically funds research in the natural sciences and engineering to advance both fundamental knowledge and socially beneficial innovation. The NSF is also interested in two activities in conjunction with these goals: funding scholarship that helps explore and explain SIP; and communicating to broad public audiences the importance of science and innovation. The NSF achieved both these goals by supporting "To Think, To Write, To Publish," and helped bring together scholars of science and innovation policy (like Schmid) and communicators of science and innovation (like Carper).

"Creative" in creative nonfiction refers to the style—not the substance—of the work; it differs from fiction and scenario writing in the sense that nothing may be fabricated or imagined. Instead, it is based in careful research and observation, just like journalism or academic writing—making it well suited to relaying the conclusions of long-term scholarly research. The editors that Carper and Schmid hoped to convince were largely receptive to the idea of combining SIP and story: Laura Helmuth, a short, trim, outdoorsy brunette who seems perfectly matched to the *Smithsonian Magazine*, where she is a senior editor; Leslie Meredith, a slender, soft-spoken, and conservative-mannered vice president and editor at Simon & Schuster; and Scott Hoffman, founding partner at the New York literary agency Folio Management, a boisterous presence in the room, with a booming voice and biting wit. All three are well aware of the growing endorsement of creative nonfiction within the publishing community and are actively encouraging the genre among their colleagues.

The fourth editor, Kevin Finneran—tall, thin, neatly bearded, and immaculately professional in blazer and tie—represents the august U.S. National Academy of Sciences and its wonk-ish policy publication, *Issues in Science and Technology (IST)*. Finneran was perhaps the most unlikely to buy into the idea that story can communicate policy to the general public as well as to experts and scholars. In his ten years as editor of *IST*, Finneran has published four issues each year with eight to ten articles per issue, and not a single one has ever been of the creative nonfiction genre. Yet by the end of the pitch slam, he had committed *IST* to publishing pieces produced by Schmid and Carper and the eleven other participating scholar-communicator pairs. Finneran left it up to them to figure out how to turn scholarship into story.

Lee Gutkind and David Guston were responsible for bringing Schmid and Carper—and the eleven other teams—together. Gutkind, dubbed by *Vanity Fair* as "the Godfather behind creative nonfiction," led the field's vanguard by creating graduate programs in creative nonfiction at the University of Pittsburgh and Goucher College in Baltimore. Guston, co-director of the Consortium for Science, Policy & Outcomes (CSPO) at Arizona State University—recently ranked fourth in a list of "global go-to think tanks" in the area of science and technology—is a well-published and highly cited scholar in science and innovation policy who has always aimed for that broader audience. Their idea, simply enough, was to bring promising writers and scholars together, in pairs like themselves, and train them in creative nonfiction.

Gutkind and Guston had noticed that, while scholars of science per se have found a popular audience, SIP scholars had not yet done so. The communication of science demands a mind-set and an understanding of processes and terminology that seems foreign and elusive to many readers. Yet narrative books about science, technology, and related topics have always attracted readers. Lewis Thomas' *The Lives of a Cell* inspired many young men and women to become doctors and scientists, while Tracy Kidder's *The Soul of a New Machine* ushered in the computer age. We hardly need mention Carl Sagan's great science documentary, *Cosmos,* and *Godel, Escher, Bach*, by the mathematician Douglas Hofstadter.

Communicating science policy, however, doubles the complexity and challenge of communicating science because policy is as foreign in its practice to most people as science is. Yet such global challenges as the recent nuclear disaster in Fukushima, Japan, climate change, and the risks posed by emerging technologies, as well as such U.S. domestic concerns as the innovation economy and the immigration of high-tech workers, demand attention to social and policy aspects, not just technical ones.

While most of us did heat a test tube or dissect a frog in chemistry or biology lab in high school, it remains likely that our closest exposure to the policy process is pulling a lever in a voting booth every couple of years. And precious few of us have given any thought to the fact that one of every eight discretionary dollars the U.S. federal government spends goes on scientific research and development (R&D), or the role that data and standards play in fostering environmental health and safety, or how people interact with complicated technological systems such as nuclear power plants.

Compounding the problem, SIP scholars—who often have undergraduate degrees in science or engineering and graduate degrees in the social sciences—are not experienced or comfortable writing for the general public and explaining what they do. They'd rather write for policy makers, whose background and sensibilities are similar to their own. Using social science research techniques, interviews and observation, for example, many SIP scholars aim to distinguish their work from that of journalists and

convince skeptical readers that their accounts should be deemed reliable knowledge and not "just stories." So even as doctoral and MFA programs in creative nonfiction are spreading across the globe; institutes and programs in narrative science, narrative history, narrative law, and narrative medicine are blossoming; and subspecialties of narrative genetics, narrative neuroscience, and narrative psychiatry are emerging, SIP scholarship is largely stuck in its traditional mode of plodding academic articles tucked away in journals whose subscription base would equal the guest list of a medium- to large-sized wedding.

And while it is true that more and more writers and journalists are recognizing the value of writing about science, the fact is that science writers are generally more interested in reporting the excitement of scientific discovery or the allure of emerging technologies, rather than the obscure details of policy, about which they may be less aware, or in some instances totally unaware. Gutkind recently approached a group of journalists—all of whom were veteran reporters and journalism professors, and about half of whom specialized in science reporting—and requested a letter in support of one of his writing projects. Two of the group had no idea what was meant by science policy. One veteran reporter and director of a prestigious journalism program asked, "By science policy, do you mean like what Oliver Sacks does?" He was referring to the neurosurgeon most known for his book of creative nonfiction essays, *The Man Who Mistook His Wife for a Hat*. Another, a veteran science writer who teaches for a prestigious science writing program, said that having studied a science policy website, she could see how policy related to some of her colleagues who write about genetics or robotics, but she couldn't see how policy could relate to her chosen field of astronomy.

Because of journalists' and editors' lack of awareness of SIP issues, important critical perspectives are often left out of even the most successful writing about science. A good example is journalist Michael Specter's essay in the *New Yorker* in December 2010 on synthetic biology. Specter produced an incredibly lively, readable piece about cutting-edge biology and the scientists, like Jay Keasling at the University of California, Berkeley, who are doing it. Better still, he coaxed the scientists into discussing some of the ethics and policy questions that surround the field, including issues of safety and security in the creation and introduction of organisms novel to evolution (and public health). But Specter stopped short of including other scientists' accounts of these policy and ethics questions—either by not recognizing or not pursuing the work of insightful SIP scholars whose views of the prospects, risks, and benefits of synthetic biology might be different from those scientists actively involved in the research.

In contrast, Rebecca Skloot's *The Immortal Life of Henrietta Lacks* combines good science with fine narrative story telling—and simultaneously illuminates

serious challenges for science policy and research ethics. Skloot received an MFA in creative nonfiction and worked as an assistant editor at *Creative Nonfiction*, the first literary magazine to publish creative nonfiction exclusively. Prior to publishing the book in 2010, she also taught creative nonfiction at the University of Pittsburgh and the University of Memphis. Skloot excavated the story of Henrietta Lacks and personalized the narrative of how immortal cells, the HeLa line, from her ultimately fatal cervical cancer became vital to the development of the polio vaccine, as well as for drugs used to treat herpes, leukemia, influenza, hemophilia, and Parkinson's disease; how her cells helped uncover the secrets of cancer and the effects of the atom bomb, how her cells led to important advances in the spheres of cloning, in vitro fertilization, and gene mapping; how since 2001 five Nobel Prizes have been awarded for research involving HeLa cells; and how her family, the descendants of slaves, were unaware of these contributions decades after her death. In creating her *New York Times* bestseller, Skloot also drew significantly on the work of SIP scholar Hannah Landecker.

So to encourage the next Specter to cast a wider net and draw out the next Skloot into putting it all together, Gutkind and Guston conceived "To Think, To Write, To Publish." Through broadly circulated appeals, they recruited a dozen early career SIP scholars (of more than three dozen applicants). These scholars included a philosopher of science concerned with the narrow scope of bioethics in the U.S., a sociologist who investigates the interaction of science and the marketplace, and an expert in marine science and policy who studies how small fisheries innovate to prevent bycatch of protected species. They also recruited a dozen early career communicators (from more than twenty dozen applicants!), including a recent MFA graduate in creative nonfiction interning at *Wired*, a children's literature specialist and contributing editor to Otata.org, a Chicago-based collective of photographers and writers, and a publisher of genre fiction from Portland, Oregon. The twelve collaborative two-person teams—composed of a "next generation" SIP scholar and a "next generation" writer—would learn creative nonfiction and narrative techniques and would write a creative nonfiction essay together, based on the scholar's research.

To Write, in which two actual people survive an exasperating collaboration to complete a task neither could have done alone.

Six months after the pitch slam, the second of the "To Think, To Write, To Publish" pieces for *Issues in Science and Technology* arrived in the inboxes of the organizers and *IST* editor, Finneran. For Gutkind, it left something to be desired: "What we're looking for," he explained over the phone to authors Gwen Ottinger and Rachel Zurer, "is

something with more… *narrative*." Gutkind went on to point out several places where their collaborative piece about Ottinger's research had lapsed into lifeless exposition.

When Zurer called an exasperated Ottinger to regroup, she honed in on a particularly abstract section of the article. Ottinger—a Berkeley-trained anthropologist with an undergraduate engineering degree and knack for asking the kind of question informed by both fields of her academic training—had spent the best part of a decade studying efforts to measure the ambient air concentrations of toxic chemicals in communities adjacent to oil refineries and other petrochemical facilities. She wanted their piece to make the point that increased and extensive air monitoring was only useful if it was combined with research on health in the community. Their argument hinged on a criticism of existing regulatory standards and screening levels for toxins in the ambient air, which serve as the yardstick against which air quality can be measured. In short: these yardsticks can vary greatly depending on who is setting the standards, in large part because they are—almost necessarily—one part research, one part extrapolation, and one part expert judgment.

The manuscript they submitted had *said* as much. Zurer, a newly minted MFA deeply committed to her craft of creative nonfiction and gently dogged in her desire to understand the subjects she wrote about, now wanted them to figure out how to *show* it. She suggested inserting standard-setting as a scene in their narrative. But a scene of a regulator sitting at a desk and sifting through a stack of scientific studies, deciding what safety factors to apply and how to combine the results, hardly seemed cinematic. Besides, Ottinger complained, if they made a regulator their main character, they could only show the process of making one set of standards and not the larger context, where uncertainties, disparities, and omissions become obvious and limit the usefulness of standards for residents and policy makers trying to understand whether emissions from an industrial facility are affecting a community's health.

"So who is seeing that larger context? Who is making the argument?" Zurer asked, perhaps hoping that some charismatic community activist could become the cornerstone of their article.

"Nobody!" Ottinger snapped. Then she sighed, "I mean… I am."

Ottinger went on to explain that this was why it was so important to her to publish her research in a policy journal like *IST*. In general, scholars, especially those early in their careers, confine themselves to academic journals, where every article is reviewed by two to four experts on the subject matter before it can be published. The peer review process certifies the quality of research, and despite such journals' small readership, publishing in them establishes an academic's reputation and allows her or him to advance in the university. Writing a narrative piece for *IST* would hardly help Ottinger's tenure case. Yet she felt she had something to say that people beyond her hundred closest colleagues needed to hear.

Various community and activist groups she studied had been advocating for—in some cases quite successfully—more ambient air monitoring on petrochemical facility fence lines. But increased monitoring data would be of little use without better tools with which to interpret it. And building these tools would require that the problem be acknowledged, not just by community groups, but also by scientists and policy makers who could offer resources to the project.

It was no surprise that Ottinger identified problems through her research that others hadn't recognized, or that she would assume policy positions that were not necessarily advocated by the activists whose campaigns she'd studied. This is, in fact, part of the nature of scholarship. Academic researchers have a unique perspective: they can take a big picture view, looking at large structures as well as particular circumstances, and they can take years to untangle what is happening at multiple levels and see how it all fits together. Policy recommendations based in scholarship are thus likely to be far-reaching, long-term, and relatively novel.

But creating a narrative that would not only convey but also truly drive the communication of a scholar's perspective on air monitoring in communities at the fence line really challenged Zurer and Ottinger. Good stories have characters, they have conflict, and they have resolution. What the scholar-communicator pair had was an on-going problem that no one was even fighting about yet—except perhaps Ottinger herself, and then only through her academic writing and occasional advice to activist groups.

"So we should do that," Zurer said after listening to Ottinger explain how she'd actually come to the conclusions that she wanted their article to convey, "We should tell your story."

Zurer's suggestion was a radical one: policy scholars write about their observations and analyses, not about themselves and their learning processes. Nor do journalists usually allow themselves to become characters in their own stories. But having tried everything else they could think of, Ottinger squelched her discomfort and began the piece with the sentence, "I was at the most undignified moment of moving into my new office—barefoot and on tiptoes on my desk, arranging books on a high shelf—when one of my fellow professors at the University of Washington, Bothell, walked in to introduce himself."

And the story finally emerged. Within the first two paragraphs, the unnamed colleague provided the conflict the narrative needed, asking the vexed question of whether emissions from oil refineries really make residents of the communities at their fence lines sick. Ottinger's struggle to answer "The Question" then sweeps the reader with her through an Oakland, California internship and fieldwork in Norco, Louisiana, to Zurer's meeting with activist Marilyn Bardet in Benicia, California, back to Ottinger's office and, finally, inside her head where she formulates a plan for more extensive environmental health monitoring upon which better ambient air standards

could be based, by imagining the answers that *could* come from extensive new air monitoring programs in communities like Benicia:

> I wandered off to the faculty holiday party conjuring a new daydream: The National Institute of Environmental Health Sciences would call for proposals for studies correlating air monitoring with environmental health monitoring; the EPA [U.S. Environmental Protection Agency], making ambient air toxics standards a new priority, would demand that data from fenceline communities be a cornerstone of the process; and Marilyn Bardet would seize on the new opportunities and make her community part of creating a better answer to The Question.

This interweaving of policy recommendations with Ottinger's quest for answers earned the approval of both Finneran and Gutkind; Ottinger and Zurer's article went on to become part of *IST* readers' introduction to science policy in narrative form.

***To Publish**, in which at least some of our scholars and writers, having overcome the trials and tribulations of thinking and writing, succeed in their ultimate goal.*

Prior to the pitch slam, the agent Scott Hoffman and the editors Laura Helmuth, Leslie Meredith, and Kevin Finneran had offered advice to the newly forged narrative-SIP teams. But at times even they didn't seem to get it. Their experience seemed to be editing material in which science was the subject, and not the object, of study. In which scientists were the narrators or central protagonists and not problematic characters themselves in need of explanation. In which the book sells because it is selling the excitement of science. In which one word titles and Nobel laureates demand attention to their own view of the future. And while this is a necessary evil in today's challenging publishing environment, there are other important considerations.

"How much room is there in commercial nonfiction for ambiguity, ambivalence, and criticism around science and technology, rather than promotion and adulation?" Guston asked.

A general laugh followed the response, "That's a tough market!"

Helmuth from the *Smithsonian* took the idea of criticism in the wrong direction, responding that "It's hard to do a book-length treatment of scientists misbehaving, although people have done it."

But critical doesn't always mean searching out the seamy side of science—the method, for example, journalists William Broad and Nicholas Wade adopted in *Betrayers of the Truth*, a book about scientific fraud and misconduct drawn from

their front-page *New York Times* stories. In comparison, SIP scholars approach science with a level of constructive, learned, critical engagement the way, say, a movie critic approaches a film. A Roger Ebert for science and innovation would understand not only the role of the actors who perform the science, but also the research directors who organize it, the producers who finance it, and the audiences who are moved by it. He would understand whether the purpose was profit, passion, politics, or pure creativity. He would leave room for ambiguity and ambivalence alongside the adulation.

Hoffman, the agent, was modestly more expansive in his understanding of criticism, but nevertheless maintained that readers "want to know what is possible rather than what isn't possible. And so what you're selling is, to a certain extent, a fantasy or a possibility." But properly done, creative nonfiction derived from SIP scholarship can extend possibilities rather than rein them in. Just as in art class, criticism goes hand-in-hand with appreciation. SIP scholars recognize science as a cultural achievement worthy of praise, and they acknowledge effective, legitimate science and innovation policy as doubly remarkable in its success. The desire to examine and account for science and innovation doesn't diminish that appreciation; indeed, it stems from it. Collaborative story-telling between scholar and writer both enables a critical perspective and allows scholars' wonder to shine through by adding color, richness and texture to central analytical points. The combination of perspective and richness makes it easier for a reader not immersed in the worlds of science or science policy to nonetheless appreciate them as part of civic life and not pristine, isolated, and remote from it.

The editor Meredith pointed toward ambivalence and even controversy as a challenge to editors and writers alike, but also held it as a potentially productive force. After learning the hard way from editing a book that was a "nice story" but was universally reviewed as presenting a one-sided view of the science, Meredith says, she now asks her "expert authors, 'who dissents from you in all this?' And it provides narrative tension if you have to defend yourself." But she still saw dissent in terms of a controversy within the scientific community, rather than a conversation among scientists and non-scientists about the purpose and meaning of the enterprise and how scientific practice reflects those aims. Meredith, like Michael Specter, hadn't yet included SIP scholars—as credentialed, hard-working, public-regarding, and brilliant as the scientists themselves—as actors to engage in this critical dialogue with scientists and facilitate such a dialogue with the public.

The academics behind the thinking and the writing illustrate the profound challenge that communicating science and innovation policy faces. But it was harder still, the participants were to discover, putting it into practice. Several of the collaborations foundered on the all-too-familiar shoals of conflicting professional demands and incompatible

agendas between scholars and communicators. Some modes of failure could be ascribed to the organizers. For example, due to other demands on the group of scholars, they were not tutored in creative nonfiction with the writers, leaving them to learn this new craft from their partners, some of whom were fresh out of MFA programs and still working to master it themselves. Further, the structure of professional training meant that "young" scholars were as much as a decade older than their "young" communicator counterparts. The unions of writers and scholars were also arranged by Gutkind and Guston, leaving each pair to struggle to discern the meaning of their match.

Yet via the completed work, Finneran saw that the genre could make SIP issues dealt with in his journal more accessible and appealing. As he wrote in his "New Voices, New Approaches" introduction to the series of articles in *IST*, "[T]his is hard to believe [but] some people would rather read a compelling story than a meticulously organized piece of rigorous academic argument." As much as even the published essays bear some scars of difficult collaborations in thinking and writing, as Finneran says, "the analysis is as perceptive as the story is engaging." The pieces also show that creative nonfiction is, ultimately, a strong genre for what we in science and innovation policy want to say.

For Ottinger and Zurer, the narrative in "Drowning in Data" helped show that unknowns in science—"The Question" of whether emissions from refineries are really making people sick—are as important as the knowns. In order to expose this problem of the ambivalence of data, they had to break with conventions of both academic writing and creative nonfiction by making an author the story's main character.

For Schmid and Carper, "The Little Reactor that Could?" demonstrated that you can't tell the whole story of science and innovation without both people and things as actors, and without the relationships between them being part of the central dynamic. These dynamics are often acknowledged only metaphorically, and—like good creative writing—science and innovation policy can be ruled by a dominant metaphor: Schmid's Russian informant likened supposedly identical, large nuclear reactors to "children; each one is different." So, Schmid and Carper ask quite reasonably if small, modular nuclear reactors can really be regarded as "batteries"—or whether humans must continue to be attentive to the complexities and uniqueness of each individual machine.

For Sarah Whelchel and Elizabeth Popp Berman, "Paying for Perennialism" exposes how human lives and futures are tied up in complex systems of money, policies, nature, knowledge, and technologies. Perennial grain crops could be a great boon for the environment, reducing the stress on soil that annual plantings and regular tillage induce and increasing through larger root systems the amount of carbon that such plantings would sequester. Whelchel and Popp Berman weave together the

narratives of three men—a Kansan agricultural activist, a Washington state wheat breeder, and a Cornell plant geneticist—to show how at least some in the agricultural community are attempting to perform long-term, high-payoff research on perennials even as they are opposed by declining federal research budgets, hostile corporate agendas, and a skeptical and even complacent scientific community. Yet even their colorful and moving stories may fade to irrelevance without policy makers to bestow priority on perennial research.

And for Meera Lee Sethi and Adam Briggle, "Making Stories Visible: The Task for Bioethics Commissions" performs for synthetic biology what Michael Specter's piece did not: it shows how scientists work in stories, and potentially controversial ones at that. Detailing the personal narrative of one real life character—from comic book and science kit-loving kid to high profile SIP analyst and master furniture maker—Sethi and Briggle highlight the variety of ways we can tell stories about synthetic biology and thus the variety of policies we might have for governing it. They also wield a metaphor, the Geiger counter built by their lead character as a child, to remind us that both science and story are built from powerful but elusive elements that take technique and patience to reveal and control.

In response to Guston's pre-pitch slam question, Finneran had agreed with his fellow editors that publishing creative nonfiction around science and innovation is "a challenge, it's an extraordinarily difficult challenge," especially "without becoming seen as 'anti-science'." But he hoped that the people involved in this project could "start us down this path." Finneran declared that we would all like to see "a more ambiguous, more richly thought-out critique and understanding of science, so that it isn't so remote and so distant from ordinary people… You get it right, we'll publish it." The writer-scholar teams thought and wrote. Finneran kept his word, and published.

Now, nearly two years later, the results of this unique experimental program are quite promising. *IST* has published four of the collaborators' essays and two more are under consideration. One of the communicators has launched an online creative nonfiction social action journal. Another "next gen" participant has become publisher of a medical science oriented book series. Three of the collaborators have been offered speaking or writing engagements as a direct result of their efforts. The NSF has recently funded a follow-up program, with a much more comprehensive plan. And the ambiguous, nuanced, and narrative critique of science that Finneran envisioned stands poised to become a force in public discourse about both science and science policy.