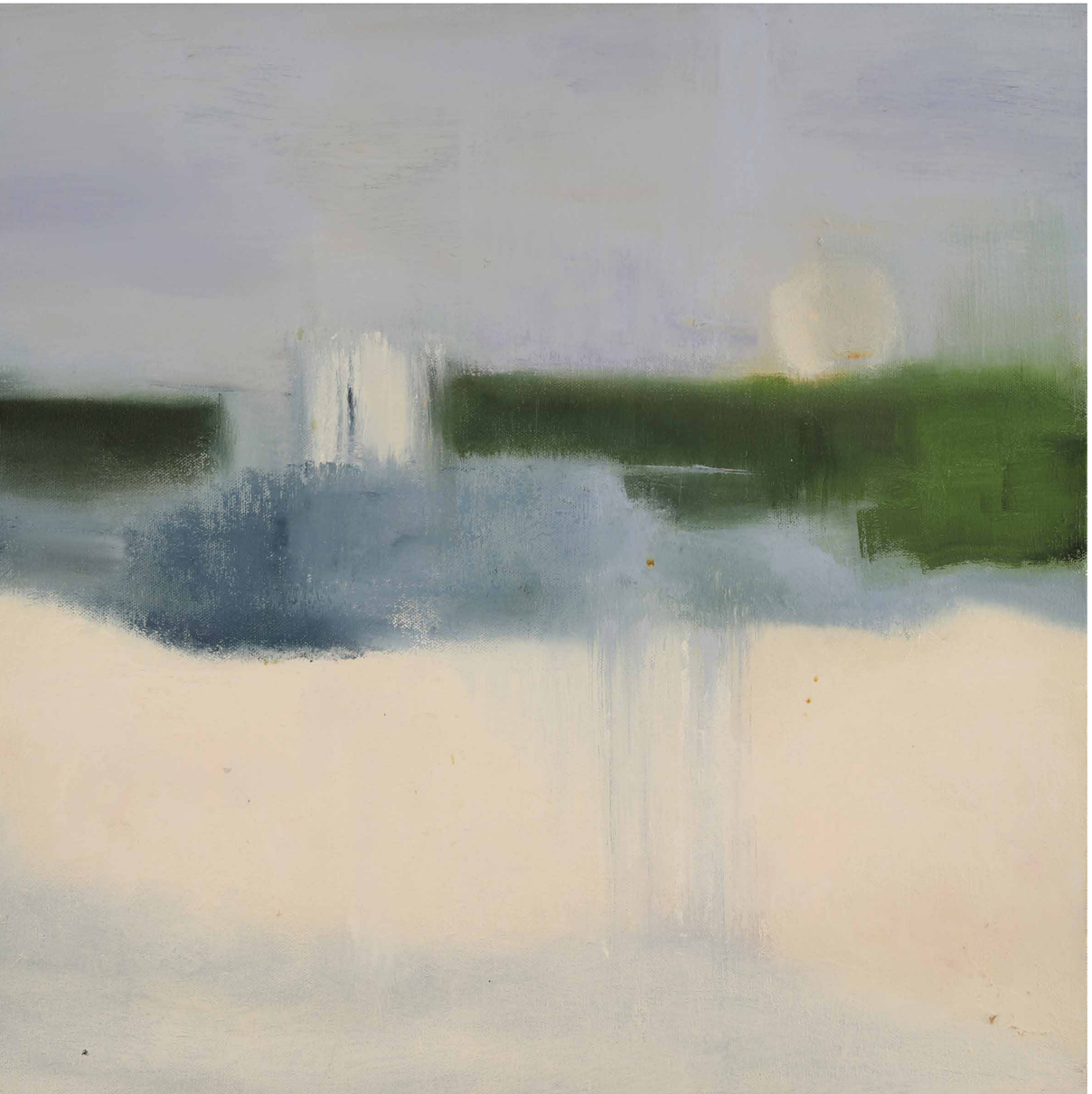
LIZ FRACCHIA

Portal XIII, 2013
Oil on canvas, 20 x 20 in.



COURTESY THE ARTIST

SUSAN M. GAINES

An Anthropocene Ménage à Trois:

Science, Nature, Literature

When I was a young woman, I fell in love with molecules. This was not something anyone expected, least of all me. I fancied language and literature, bird-watching and nature, the wild places of my California childhood. I wanted to be a novelist. Or a forest ranger. The only chemists I'd ever seen were the white-coated guys promoting laundry detergent on TV. It hadn't occurred to me that science could be a means of understanding and celebrating the natural world, let alone that it could, even should, be the stuff of literature.

Back then, in the 1970s, science was still a distant, alien blip on the radar of most peoples' lives. Science education in public schools was minimal, as was news coverage. In the public eye, science was reduced to what it allowed us to *make*—spacecraft, pesticides, medicines, vaccines, nuclear bombs—rather than what it allowed us to *comprehend*. TV shows, magazines, and nonfiction books dedicated to scientific discovery were just beginning to gain popularity. "Science fiction" was more likely to be concerned with intergalactic wars and Martian invasions than with humans endeavoring to understand the workings of the natural world. Physics got some attention in fiction, but the counterintuitive tenets of relativity theory and quantum mechanics—and the legend of Einstein's genius—only reinforced the notion of science as alien and inaccessible.

Novels exploring scientific knowledge, processes, settings, characters, and societal fallout are now quite common. This scientific turn in literature began in the late 1990s, when I was coming of age as a novelist, and I found myself writing in its vanguard, alongside a handful of more prominent writers. Two decades on, scholars began to take note, and there's been a lively academic exchange about contemporary science novels in recent years. Though I've contributed to that exchange, I've never been comfortable with its academic milieu, and the story I want to tell now is based more on personal experience than scholarly observation. This story tracks novelists' growing engagement with science alongside scientists' emerging realization that humanity has engendered a new geologic epoch. These events span the turn of the millennium, but my story about them is rooted in a relationship to the natural world that was forged in the ignorance of earlier decades.

I was studying at a state college in California's northernmost hinterlands, surrounded by redwood forests, when the molecules seduced me. I'd chosen a major that listed "forest ranger" as a job option ("novelist" wasn't on offer, but had the vague idea that if I just kept reading and writing stories in my spare time, I would magically turn into one). I encountered the glorious, multitalented chlorophyll molecule in a class about forest ecology and nutrient cycles. Then I took my first chemistry classes. When I got to organic chemistry, I changed my major.

Chemistry was irresistibly elusive. One couldn't *see* molecules, couldn't even conceptualize them without special instruments, the language of mathematics, and the iconography of organic chemistry. And yet they had a remarkable power to elucidate anything from the tiniest alga to the history of the Earth. Forget the job options, this was a more exotic, sophisticated intellectual love affair than any I had imagined. It was also extremely demanding, and by my second year of grad school, the relationship had become all-consuming.

I had a fellowship at the Scripps Institution of Oceanography, with the wide horizon of the Pacific just outside my door, but the world contracted to the hermetic confines of my lab and the experiments at hand. I hadn't read a novel, let alone written a story, in years. I was so focused on generating new knowledge about one tiny chemical process, that even the larger narratives of science—products of decades of accreting knowledge across laboratories and institutions— receded into the distance.

This obsession and claustrophobia, this contraction of one's intellectual life when one most expects it to be expanding, are beautifully captured in Brandon Taylor's Booker Prize shortlisted novel *Real Life*, Weike Wang's *Chemistry*, and Allegra Goodman's *Intuition*, all of which tell stories of struggling young researchers—and none of which existed in the 1980s, when I myself was one. Though being a woman and lacking an ivy league pedigree weren't without problems, I didn't have to cope with racism, homophobia, and a viciously competitive—ironically, all female—lab group, like Wallace did in *Real Life*, which is set in the 2010s. I didn't have a nervous breakdown like the narrator of *Chemistry*, or work in the competitive, backstabbing environment of commercial pharmaceutics like Robin in *Intuition*.

Unlike these fictional characters, I never doubted my inherent love for science. But their impatience with the tedious day-to-day and narrow focus of their research is all too familiar.

Though I was proud of my small discoveries, writing scientific journal articles was deeply frustrating. The norms of formal scientific communication precluded the accoutrements of narrative, which, according to accepted wisdom, would compromise the report's objectivity.

There was no plot, no point of view, no music in the words I so carefully assembled in the passive voice. The beauty of the chemical interactions I'd elucidated was absent from the page. So too, my speculations about their roles in the ocean's cycles of life and decay.

There were plenty of grounds for my divorce from chemistry, including a disconnect from the very nature I was trying to understand—for all my long hours, I knew little of my findings' significance in the natural world—and from the "real life" beyond the lab that the young scientists in Taylor's novel see passing them by. But at the top of my list of irreconcilable differences was a long-festering need to read, and dream, and write beyond the tight strictures of objectivity. I was unaware of the "two-culture" divide between the arts and sciences that the British chemist-turned-novelist C. P. Snow made infamous in the 1950s, when he claimed that Western intellectual culture had split into mutually exclusive realms of inquiry. The rift had widened in the ensuing years, generating academic battles about the truth and use value of different kinds of knowledge, but my problem was more prosaic. Art and science were battling it out in my personal life, but it was my time and creative energy, not my soul, that was at stake.

Domineering though it was, chemistry had paid the rent since I was a student, and my divorce left me broke and scrambling for day jobs. But as I immersed myself in the literary realm and honed my craft, I relished my newfound intellectual freedom, not to mention the day-to-day of a "real life." I read voraciously, wrote in the predawn hours, attended workshops, and assembled the small writers' group that would critique everything I wrote for the next thirty years. I'd placed some half dozen stories in literary magazines, garnered the requisite Pushcart Prize nominations, and relegated a 350-page novel to the Graveyard of Unpublished First Novels before I allowed chemistry to come creeping back into my life.

I started imagining a character who views nature through a molecular lens, a geochemist who begins, in the early 1980s, to wonder what the human-induced greenhouse effect means for her very concept of Earth. I created a plot around her research, basing it on published scientific literature, which I now read more broadly and impulsively than I'd ever done as a graduate student. Extrapolating into the realm of plausible but untested hypothesis, I could allow my story free rein. Gone were the tunnel vision and tedium of lab work: As a novelist, I could take a wide-angle view and telescope time. I could weave a tale that was at once personal and grand, a story not of war and peace, but of oceans and arth history, the carbon cycle and climate—and politics. Not least, I could capture the mystique and beauty of science in my prose.

As I was conceiving the book in the 1990s, I found my models in novels where the characters' relationships to abstract knowledge were center stage: Norm Rush's brilliant *Mating*, about American anthropologists conducting a utopian social experiment in rural Africa; A. S. Byatt's *Possession*, about literary scholars untangling the correspondence between two nineteenth-century poets; and James Gardner's *Mickelsson's Ghosts*, about a philosophy professor whose life is unraveling. These novels helped expand my idea of what literary fiction could do with its subject matter. They immersed readers in recondite worlds of knowledge and generated both emotional *and* intellectual empathy for their characters. Still, the book I was writing felt like an experiment.

I thought a lot about my readers. I wanted the novel to be both scientifically and literarily interesting, but not so challenging that a reader unschooled in chemistry couldn't enjoy it. My writers' group critiqued draft after draft, as I walked the line between accessibility and verisimilitude, honing the scientific plot to allow for a layered reading: the scientifically inclined should take pleasure in puzzling out its every twist and turn, while more impatient readers could skate happily across its surface and still find meaning in the story.

When *Carbon Dreams* went to press in late 2000, science was still a rare subject for literary fiction and anti-science attitudes were on the rise. But only as my novel made its way to readers did I understand both how excluded most people felt from the world of science, and how starved scientists themselves were for cultural comprehension.

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I was gratified to hear that readers had enjoyed their excursion into my protagonist's chemical world, despite having little experience with science. Some said it was the first time they'd given serious thought to climate change. Many were inspired by the portrayal of women working in a male-dominated field. Reviewers claimed the novel made science "sexy," that the scientist heroine was "beguiling," that it heralded a new genre of science in fiction. And, to my surprise, college instructors started assigning the novel in humanities courses designed to encourage critical thinking about science and climate change.

If science had been a rare subject for literary fiction, climate change had been a nearly nonexistent theme. T. C. Boyle's near-future tragicomedy, *A Friend of the Earth*, was released in 2000, and a handful of sci-fi novels had portrayed dystopian futures on a planet ravaged by anthropogenic climate change.[1] But literary explorations of Anthropocene problems—already in full swing, but yet to be defined as such—had been just as limited as political attention had been. The newspaper and literary media reviews of *Carbon Dreams* hardly mentioned the story's exposition of climate change, the oil industry, and media

1 Notable examples include J. G. Ballard's *The Drowned World*, David Brin's *Earth*, Octavia Butler's *Parable of the Sower*, and Bruce Sterling's *Heavy Weather*.

misinformation. The reviews in science magazines, however, highlighted these themes.

Fan mail and invitations trickled in from scientists who, unlike my obsessed grad-student self, did find time to read fiction. They said the novel humanized their work and articulated their anxieties about being misunderstood, ignored, demonized, or idealized by the culture at large.

They reviewed it in their journals, pressed it on their students and nonscientist spouses, and called for more such novels. *Nature* magazine solicited an essay on science in fiction, and I wrote about the novels I'd discovered since beginning work on *Carbon Dreams*, including Richard Powers's *The Gold Bug Variations*, about a molecular biologist; William Boyd's *Brazzaville Beach*, about a primatologist; Simon Mawer's *Mendel's Dwarf*, about a geneticist; Rick Bass's *Where the Sea Used to Be*, about petroleum geologists; and Rebecca Goldstein's *Properties of Light*, about theoretical physicists.

I was conceiving a new novel and had followed its fledgling characters to Uruguay, when I received a fan mail from Geoff Eglinton, whose scientific papers had served as the foundation for Tina's research in *Carbon Dreams*. I hadn't consulted him—indeed, I knew nothing about him—so I was gratified to hear he'd read and enjoyed the novel. He invited me to give a public talk at the Woods Hole Oceanographic Institution, where he was a visiting professor.

I'm in Uruguay, I wrote back.

They would, of course, pay.

In my world of low-wage day jobs and small press publication, there was nothing "of course" about being paid to travel halfway across the globe to give a talk, so of course I said yes.

When I visited Woods Hole in October of 2001, the events of 9/11 seemed to have rendered all other public dialogue profane. It was a hard time to be talking about something as diffuse as human-induced climate change, especially in the context of a novel about scientific creativity and love. But the scientists gathered there were hungry for such discussions. Like Tina, they'd been trained to stay out of the public eye, but they were demoralized by the media's misconstrual of their reports of collapsing Earth systems. The novel allowed them to voice their feelings and frustration, to acknowledge a political stance. More importantly, they said, it brought the ever-evolving truths and ambiguities of their work to life for nonscientists.

Geoff Eglinton wanted me to write a sequel.

I told him I was researching another novel, but it wasn't about science. It was a family saga. About politics. And birds. It was set in the rice farms and wetlands of northeastern Uruguay.

What about a nonfiction book? he wondered. A popular science book about fossil molecules. Geoff, I'd learned, was an internationally celebrated British chemist, famous for having pioneered the study of biological fossil molecules—and for his dogged persistence.

I told him I'd left chemistry over a decade before.

We could coauthor it, he offered, exuding enthusiasm.

I tried to explain the paradox of my vocation. *Carbon Dreams* took five years to write. The royalties to date had paid rent for four months. There'd be no advance money for a new book, no guarantee of publication, until I finished a draft . . . But at the moment, I spent most of my time teaching English to Uruguayan businessmen.

I forgot about the exchange until six months later, when I received another piece of fan mail, this time from a German geochemist. He loved *Carbon Dreams* and had heard from Geoff Eglinton that I'd agreed to write a popular science book about fossil molecules. Would I be interested in a fellowship at the Hanse Institute for Advanced Study in Germany?

I'd just put down roots in Uruguay and was deeply immersed in the experience of my returning-emigrant characters. I had no desire whatsoever to go to Germany or write a nonfiction book, which, I knew, would require more than a one-year fellowship. But I was broke and uninsured, and the stipend was generous. And, I was honored. And, in spite of myself, intrigued . . . by the molecules.

* * *

The book I hadn't wanted to write yanked me hook, line, and sinker back into the scientific world I thought I'd abandoned, leaving my Uruguay novel simmering on the back burner. More rigorous than popular science and more entertaining than an academic text, *Echoes of Life* also turned out to be more demanding to research and write than my illustrious coauthors and I imagined. By the time we finished and I turned up the fire under the novel that would eventually become *Accidentals*, I was desperate to break free of the constraints of writing precisely about science, hungry for the imaginative storytelling of literary fiction. My fellowship and publisher's advance were long history, and I'd been juggling day jobs for years. I was also, despite a couple trips back to Uruguay, ensconced in Bremen, Germany. (There is, I must admit, more to this love story than molecules and books.) I'd acquired a new language and was earning my keep translating German academic texts, a job I found intellectually and linguistically exhausting, especially as I tried to reclaim the Spanish-tinged English prose of my novel's Uruguayan-American narrator.

I yearned for another idyllic, job-free fellowship at the Hanse Institute—this time to write the book I'd really wanted to write. Though the Hanse's mandate was to support scientific work, there'd been a lot of talk about cross-fertilization between arts and sciences when I was there, with *Carbon Dreams* as exemplar. I hadn't thought of my Uruguayan-American family saga in this vein, but the book was turning out to be almost as steeped in science—ornithology, agronomy, microbial ecology—as *Carbon Dreams*. I contacted the director.

I told him that novels about scientists and their work had been proliferating, citing my article in *Nature* and running through a litany of novels I'd read since: there was Jonathan Franzen's *Strong Motion*, in which a seismologist discovers earthquakes caused by industrial waste injection; A. S. Byatt's *Whistling Woman*, with its snail biology and cognitive science; Ann Patchett's *State of Wonder*, about pharmaceutical researchers in the Amazon; Amitav Ghosh's *The Hungry Tide*, about a biologist studying river dolphins in the Ganges Delta; Michael Byers's *Long for This World*, about a medical genetics researcher; Jim Lynch's *The Highest Tide*, about a youngster discovering the magic of marine biology; and, of course, there was the neuroscientist and his patient in Richard Powers's award-winning *The Echo Maker*.

I told the director about the scientific community's interest in science novels: the reviews in *Nature* and other scientific journals; the famous chemist Carl Djerassi's own attempts to write fiction about scientists' ethical dilemmas; the *LabLit* webzine, founded by cell biologist and writer Jennifer Rohn; and mathematics professor Alex Kasman's popular database of novels featuring mathematics problems and mathematicians. The idea that works of fiction could maintain artistic integrity while reflecting deeply, even informatively, on real scientific subjects and processes was beginning to gain traction. And the Hanse, I said, was uniquely positioned to contribute. If novelists writing about science were included among the yearly mix of fellows, they would gain access to a network of scientists and labs for their background research and get a feel for what it was like to *live* science. A first-of-its-kind writers' residency program! If I had a fellowship to work on *Accidentals*, I could also work on recruiting other novelists and get local scientists on board. We could call it "Fiction Meets Science."

The director, a neuroscientist who happened to be a Richard Powers fan, loved the idea. But, he told me, we'd need outside funding. And we'd have to involve professors at the local universities. And generate scholarly works, as well as novels.

Literary scholars? I offered, though I'd never even met a literary scholar and had no idea what they did. Sociologists?

A residency for me wasn't possible, the director said, because I now lived in the region. But the Hanse could pay an honorarium. Or maybe the university would hire me.

I could blame Stephan Leibfried, the German political science professor I'd fallen in love with, who'd thwarted my plans to return to Uruguay. Or Geoff Eglinton, or *Carbon Dreams*, or the molecules that infused it . . . But I soon found myself immersed in German academia, writing fifty-page grant proposals and coordinating a group of sociologists, English-literature scholars, and scientists—none of whom were accustomed to talking to each other (let alone to novelists), but all of whom were interested in the rising tide of science novels. The scholars identified narrative strategies used to convey scientific concepts, documented the transformation of age-old cultural stereotypes of scientists, extracted insights about the processes and institutions of scientific knowledge formation, and analyzed reading group and media responses to the novels. Local scientists formed book clubs to discuss the novels, and a steady trickle of writers arrived at the Hanse to labor over new books.

Implicit in the institutional support for Fiction Meets Science was the idea that science novels could encourage the thoughtful, informed engagement with scientific issues that has become so essential to democratic governance.

As novelists, we're both thrilled and nervous about this "learning" business. There's a natural tension between our responsibility to our subject matter and our mandates as storytellers and artists.

But even as we were writing grant proposals and singing the praises of this new literary trend, my science-trained self worried that we didn't have evidence to support such claims. We had a growing online database of hundreds of "science novels," but no systematic data on their reach and impact. Given the small audience for literary fiction, I wondered if one could talk about social impacts at all, let alone expect them to be "positive." And my novelist self rebelled against assigning such a didactic role to an art form whose attractions include its ability to camouflage its own intentions and subvert expectations, not to mention its purely aesthetic emphasis on the musicality and metaphoric imagery of language.

One of the questions that nagged at me was if writing fiction about science was really so different than writing about other sorts of arcane knowledge. My writers' group buddy Jean Hegland was working on her novel *Still Time*, which immerses readers in the mind of a Shakespearean scholar, and facing craft challenges that seemed categorically different from those she'd dealt with in her other novels—but very similar to what I'd confronted writing about chemistry and ornithology. We realized that the narrative strategies used in science novels could be equally well applied to the treatment of literary scholarship Jean's *Still Time* and Byatt's *Possession*, to the musicology in Richard Powers's *The Time of our Singing*, and the theology in Marilynne Robinson's *Gilead* . . . These "nerd novels," as we dubbed them, rely on complex, generally unfamiliar knowledge that their authors have created nuanced ways of conveying—informing without explaining, and rendering expert jargon comprehensible without seeming to translate. Nerd novel authors take their scientific and scholarly subjects very seriously, often spending years to become, if not experts, accomplished dilettantes. Though they write for a general readership, they hope the real experts will also appreciate their stories.

Readers don't pick up a novel in the hope of learning how to interpret Shakespeare or classify a new species of bird—but one of the pleasures of nerd novels is that we may, in spite of ourselves, learn a thing or two about their subjects. Reading Powers's *The Time of Our Singing* and *Orpheus*, I learned enough about music theory to become intrigued and I revised my limited understanding of theoretical physics and molecular biology along the way. (If A. S. Byatt is the doyenne of nerd novels, Powers is surely doyen). Peter Mountford's *A Young Man's Guide to Late Capitalism* provided insight into the for-me mysterious logic of international finance. And though I'd always considered art history the most tedious of subjects, Michael Frayne's farcical *Headlong* had me laughing out loud *and* scouring Wikipedia for more information on sixteenth-century Dutch art.

As novelists, we're both thrilled and nervous about this "learning" business. There's a natural tension between our responsibility to our subject matter and our mandates as storytellers and artists. A novel, after all, is premised on the liberty to invent, and no matter how we negotiate the relationship between fact, plausibility, realism, and imagination, we trust readers to read it *as fiction*. Mawer's *Mendel's Dwarf* includes footnotes with the geneticist narrator's asides about genetic traits and references to scientific papers, leaving readers to decipher what's real (the genetics) and what is pure invention (the narrator)—and, if it matters. Some science novelists include nonfiction addenda that emphasize the traditional disclaimer of fiction, provide references, and disabuse their readers about the science. Barbara Kingsolver, who is a trained biologist, uses her acknowledgments section to tell readers explicitly which aspects of the novel's science she invented and which are based on actual research. Yaa Gyasi acknowledges the neuroscientists and research paper she relied on for *Transcendent Kingdom*, Nell Freudenberger recounts the physicists and popular science books that informed the quantum physics in *Lost and Wanted*, and so forth.

A decade of listening to Fiction Meets Science Book Club discussions has made me a fan of such addenda, which I might once have eschewed as unbefitting a literary novel. Readers enjoy parsing the real science from the fictional. They welcome references and reading suggestions about their newfound interests. And in an age where fiction is so oft conflated with nonfiction, news reportage compromised by falsehoods, and scientific consensus confused with opinion, a reminder to read the novel as fiction seems like an essential addendum. For all the literary commonalities Jean and I identified among nerd novels, it's this parsing of real from imagined or speculative knowledge—and the implicit pacts authors make with their readers— that may distinguish the science novel from other kinds of nerd novels.

For years, I resisted my German colleagues' translation of the German word *Wissenschaft*—which denotes any formal system of knowledge, from literature studies and history to biology and physics—as "science." Though we could argue all day (we did) about epistemology, the word *science*, as used in common parlance, connotes essential distinctions: in being predicated on the physical world, in the malleability of knowledge, the nature of evidence and fact, the requirements for verification, and, not least, in the impacts on both profit-oriented innovation and public policy making. Scientific knowledge is distinguished by societal expectations that it will remedy the world's problems, as well as by the perception that it has caused them. And such differences, I've decided, are important for writers and readers of fiction.

The premise of a novel is that it's not true, and yet it speaks to us like the truth. The mandate of science is to be verifiably true, and yet it may not speak to us at all. When the two get together, it can be both enlightening—fiction giving voice to science—and dangerous—fiction masquerading as or obfuscating scientific, evidence-based knowledge.

If I think about contemporary novels having "impacts" on public discourse about science, I invariably stumble over Michael Crichton's popular mass-market thrillers, which both feed and feed on public distrust of science. Unlike most of the novels that Fiction Meets Science scholars have studied, Crichton's novels feature one-dimensional characters—including the old stereotypes of power-hungry rogue scientists—and action-packed plots about frightening technologies and unintended consequences of scientific research. But he was a master of verisimilitude when it came to representing the science and technology that drive his plots.

Fantastical as Crichton's stories are, credulous readers tended to assimilate their "scientific" premises—a concoction of real and invented knowledge, plausible speculation, and pseudoscience—as real, and Crichton made no attempt to disabuse them. The most pernicious example is *State of Fear*, a story about environmentalists and corrupt scientists conspiring to terrorize the public about climate change. The novel includes charts, graphs, and footnotes that frame its science as fact-based. The nonfiction addenda—a long bibliography, a bizarre essay about the history of eugenics as an analog for climate science, and an author's message—reinforce this perception. In the author's message, Crichton announces that he doesn't have "an agenda," while detailing his own purportedly well-researched conclusions that human-induced climate change is not a problem, scientific climate predictions are just "guesses," and all government-funded scientific studies are suspect.

Crichton did, in fact, have an agenda, and *State of Fear* reads more like a polemic than an entertaining thriller. Many fans were disappointed, but the novel influenced the understanding of climate change science for millions of readers, including then-president George W. Bush and senator Jeff Inhofe. It functioned, in effect, as a falsification rather than a fictionalization of science. Though the scientific community was quick to point out the fallacies, Crichton, who had no training in Earth sciences, was invited to the White House and to Congress, where he testified about the unreliability of climate science.

By 2020, when *Accidentals* was published, anti-intellectual populism, political manipulation of ignorance, obfuscation of facts, and the demonization of scientists had risen to a fevered pitch. The effects of human-induced extinctions and climate change—drought, fire, floods, extreme heat waves, rising sea level, and shrinking ice sheets and glaciers—were making themselves felt around the globe. Desperate Earth scientists had reinvented themselves as science communicators, media pundits, and, finally, political activists—roles that would have seemed an unconscionable transgression of the scientific creed to the protagonist of *Carbon Dreams* in the 1980s. In the literary world, Amitav Ghosh had taken his fellow novelists to task for neglecting the existential theme of anthropogenic climate change. Other high-profile writers like Ian McEwan, Barbara Kingsolver, Margaret Atwood, and Kim Stanley Robinson were already on the beat, and by 2020, the problems of the Anthropocene—and the science that illuminates them—were common enough subjects that pundits were tossing around genre monikers like climate fiction, cli-fi, and eco-fiction.

More and more novelists were writing about science not because they wanted to educate their publics or further a political agenda, but because in thinking about the human condition in the twenty-first century, science is almost unavoidable. On the one hand, the seemingly impenetrable black box where knowledge is generated has become more transparent, exposing a fecund extravagance of metaphor, language, moral complexity, and page-turning stories of discovery. And on the other, the crises of the Anthropocene make it difficult for novelists, and their characters, to avoid entanglement with the other-than-human dimensions of life on Earth—other organisms, ecosystems, climate, even geologic processes and timescales—and scientific perspectives are key to recognizing and exploring such entanglements.

Richard Powers said he initially wanted *The Overstory* to focus entirely on trees, but soon realized that it was really the relationship between trees and people that he was writing about.

He conveys the trees' stories from a mix of perspectives that rely—both directly, through a scientist character, and indirectly, in the expository text—on dendrologic and ecologic knowledge. In Kingsolver's *Flight Behavior*, about the roles of poverty, education, and religion in our response to climate change, an entomologist character's knowledge generates empathy for threatened monarch butterflies. In Ash Davidson's *Damnation Creek*, a logging community's relationship to the redwood forest comes into focus when a biologist returns home to sample the creek waters for herbicides. In William J. Cobb's *The Bird Saviors*, an ornithologist monitoring species decline broadens the lens beyond the story of a young girl's survival in a dystopian world.

In *Accidentals*, empathy for the wetland habitat and its avian characters is enhanced by microbiological and ornithological knowledge, even as the limits of that empathy in the face of human hardship are explored and tested. Ironically, a few days after I arrived in California from Germany for the book launch, the world's attention pivoted en masse to the all-too-human grief and mayhem wreaked by a deadly new virus.

I myself was just emerging from two dark, tormented years of personal grief and chaos after the sudden death of my beloved Stephan, looking forward to the meandering book tour my publisher had set up. Instead, I spent three months "sheltering in place" with my friend Jean and her husband at their home in a drought-plagued Northern California redwood forest. In between pandemic doomscrolling and fretting about the fate of *Accidentals*, I tried to write.

Sitting at my makeshift outdoor desk, with my friend working in her office across the clearing, I finally had enough time and, I thought, emotional equilibrium to immerse myself in a new novel, which hadn't fared well on German soil. But my imagination was as stalled and in limbo as the locked-down human world, and the novel, with the now-almost-cliché working title *Anthropocene Blues*, remained on hold—even as the climate crisis, mass extinction, and my own blues continued apace.

As the *Sixth International Panel on Climate Change Report*—released in 2022 and buried, yet again, among headlines of war and violence—made clear, human-induced climate change is upon us. Despite all the speculative eco-fiction novels my to-read piles have amassed since that first stalled pandemic summer, these are not problems of a dystopian future. With billions of human lives truncated and disrupted by climate change–exacerbated floods, hurricanes, drought, famine, heat waves, and fires, saving the Earth from humanity is no longer an altruistic act: it is, as Greta Thunberg and millions of young people have realized, an act of survival.

Only with decades of hindsight, have I recognized the inverted autobiographical relationship between my books and my real life, the way the books determine my life. Retiring from my job in Germany, I moved back to California and tried to inhabit my American characters, who now seemed so foreign, and the landscapes I love, which now seem so sad. Jean's forest home was now ashes, as were many of the ancient forests I roamed in my youth, their recovery slowed by the preternatural severity of the fires and drought. When I arrived, the golden hills I longed for were brown or black, the waters of our cherished mountain lakes dangerously low, the industrial rice fields that stood in for native marshes as habitat for migrating water birds—the "managed nature" the bird-watching protagonist of *Accidentals* abhors—dry fonts of contaminated dust. Whether the atmospheric rivers that pummeled the state since then—rains like none I've ever known—will save us from fire and drought, or simply flood rivers, uproot trees, and wash more coastline out to sea remains to be seen. Whatever the case, the concept of nature I came of age with—that inspired both my writing and my practice of science—is a figment of memory or imagination, of history.

As I work on the new novel, set in the early twenty-first century, my writing suffers this loss. The science in the story I've conceived is a means of documenting nature's degeneration and preserving a few relics, rather than revealing its mysteries. In search of inspiration, I try to immerse myself in the pre-Anthropocene world of the novel's historic subplot, the story within the story.

I think about the German philosopher Walter Benjamin's angel of history, which I learned of from Stephan, who had a passion for symbolic political imagery. Benjamin, writing shortly before his suicide while fleeing the Nazis, described the angel hovering above the wreckage of the past, trying to wake the dead and repair the ruins—only to be propelled into the future by a raging storm of human "progress."

Unlike Benjamin's angel, novelists get to choose their stories. As I hover above the end moraine of history, the storm of progress seems to have run its course, having destroyed everything it touched. There's just a light breeze blowing—not of progress, but of restraint and science-based mitigation—nudging us toward some uncertain future. I could ignore it, free my novel of science altogether, forgo its knowledge and turn my subplot with its pre-Anthropocene natural wonders into the main plot.

There's no silver-bullet technology to be found in this applied science of mitigation, no false hope of redemption or preservation. But I've been thinking about the microbial life that set Earth's system in motion and dominated most of its history, regulating its atmosphere and carbon cycle. About all the yet uncharted territory of modern microbial ecosystems, how we might harness their capacity for mitigation. And it's here, in these first and last frontiers of nature, that I find the inspiration to nudge my Anthropocene characters out of their despair, if not their grief, and send them off to reckon with the Earth system we've thrown off-kilter. To be sure, microbes are harder to write about than birds, certainly harder to love. But their multifarious schemes for harnessing energy and recycling their communities' waste depend on a glorious cornucopia of bizarre molecules . . . so that I am, yet again, seduced.

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