

Fiction Meets Science: Background and Concept

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August, 2013

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Science in Society, Science in Culture

Scientific knowledge is the fabric of the post-industrial knowledge society (Bell 1973; Stehr 1994). Our economies are based on the technology it generates, and our collective future depends on how we employ it to manage our species and the earth's resources. Nevertheless, the production of scientific knowledge takes place in what has, since the late 19th century, been a relatively isolated and opaque sphere of society—one that requires many years of ever-more-focused education and training to enter. The number of individuals directly involved in scientific work has grown dramatically in the past half century, but they remain a relatively small portion of the labor force (de Solla Price 1963; Ziman 1994). The vast majority of the population has little direct experience with science and sees only its applications, the black box technology and products of daily life. Public funding for research and an increasing number of important policy decisions presume trust in science as an institution and an appreciation of the knowledge it produces, and yet relatively small sectors of the population have any insight into how it operates or the tools to understand its products (*cf.* NSB 2012; EC 2011; BSA 2011; Stocklmayer 2001). This is a precarious situation for democratic societies challenged by resource depletion, environmental deterioration, and climate change, or faced with decisions about how to regulate genetic engineering.

The past few decades have seen an avalanche of measures designed to gain public trust in science—from science "popularization" and PR campaigns to new efforts at "science communication"—and a surge in narrative or "popular science" literature penned by scientists and journalists. But both the results and the goals of such didactic efforts remain in question (Bauer et al. 2007; Broks 2006). Scientific literacy is not achieved through a simple one-way flow of information, but through the construction of meaning—not by an uncritical public *sympathy* for science, but by comprehension and *empathy*, in its broadest sense. And this is

where the arts, and in particular the novel, may fulfill a need that is not met by reportage or PR.

In recent years, there have been signs that science, having eluded serious literary scrutiny for much of the 20th century, has finally come under the lens of one of our more powerful, malleable, and popular tools of explication and reflection on the human condition—that familiar purveyor of empathy, the novel (Keene 2010). In a 2001 essay in *Nature*, Gaines called attention to a handful of "literary explorations of scientific culture" that seemed to elude classification, but were united in their implications: "[They] are not attempts to disseminate scientific knowledge, to popularize science or to sensitize scientists . . . But implicit in this small body of literature is the assumption—the presumption—that science is approachable. 'See,' these novels seem to tell us, 'science is common knowledge, science is the stuff of life and literature.'" What was a handful of novels in 2001 is now a modest but significant body of literature that may mark the advent of a new cultural discourse on science.

Science, Fiction, and the "Two Cultures."

Insights into the workings of nature have been met with awe and fear since antiquity, and the individuals who revealed them were both admired and distrusted. They were devils or gods, villains or heroes—tampering with nature, selling their souls, transforming matter, creating life—and they were secretive, marginalized, and powerful. Such reactions are manifest in a persistent set of cultural images and stereotypes that have accompanied the development of modern science from the time of the first medieval alchemists through most of the 20th century—from Faust to Frankenstein to Brecht's noble Galileo. Even as scientific work became professionalized and an explosion of scientific knowledge transformed Western society, permutations of these old images continued to inform cultural representations of science and its agents (*e.g.* Haynes 1994; Turney 2000; Hüppauf and Weingart 2007).

In the literary realm, modern and postmodern authors were subtly influenced by the rise of modern science, which may have informed textual structures and metaphors (*cf.* Thiher 2005; Whitworth 2001; Vanderbeke 2011; Maillard and Titzmann 2002), and science fiction writers speculated about the possibility of time travel and the dystopian threats of molecular genetics and nuclear physics. But though twentieth century novels dealt with every imaginable realm of human experience—war, class, love, sex, hate, friendship—and their stories were informed by knowledge in history, politics, economics, religion, philosophy, psychology, and sociology, the burgeoning knowledge in the natural sciences and the sphere of society in

which it was generated were rarely taken as major themes for serious fiction (Millhauser 1973; Russell 2010).

We can identify a number of reasons for the notable absence of science as a topic for serious consideration in fiction. The definitive goal of science (and the basis for its methods) was to provide society with a systematic description of the natural world that was divorced from subjective human perspectives, an ideal of absolute objectivity that seemed to close the enterprise to literary inquiry. The formal protocols established for scientific publications were designed to focus exclusively on the object of study, but by eliminating the subjective elements of language and minimizing the role of narrative they rendered those publications inaccessible and unattractive to anyone but the professional scientist. At the same time, the 20th century explosion in scientific knowledge and proliferation of new disciplines led to ever more specialized education programs and produced a deeply bifurcated educated class (*cf.* Bensaude-Vincent 2001). In Britain, the late 19th century debates between the biologist T.H. Huxley and the poet and social commentator Matthew Arnold already presaged this bifurcation, setting scientific literacy at odds with moral and aesthetic literacy (Huxley 1901; Arnold 1885; *cf.* Collini 1998). By the mid-20th century, the days of an educated class of individuals who might engage equally with *Origin of Species* or *Anna Karenina* were long over, as the heroine of A.S. Byatt's novel, *A Whistling Woman*, observes in 1960s Britain:

[Frederica] had grown up in the narrow British educational system which divides like a branching tree, and predestines all thirteen-year-olds to be either illiterate or innumerate (if not both). She had grown up with the assumption that to be literary is to be quick, perceptive, and subtle. Whereas scientists were dull, and also—in the nuclear age—quite possibly dangerous and destructive. (2002: 269)

In the 1950s and 60s, the incendiary "two cultures debate" between chemist-turned-novelist, C.P. Snow, and Cambridge literary critic F.R. Leavis marked the growing schism between scientists and practitioners of the arts and humanities, with adherents of both groups claiming a monopoly on knowledge, truth, and social relevance (Snow 1959; Leavis 1962). In the Anglophone world, the popular literary genre now known as "science fiction" developed hand-in-hand with these two-culture debates, as well as with the inexorable spread of industrialization and new fears about its effects on society (*cf.* Russell 2010). These writers and their publishers saw the future in technological innovation, for better and worse, and set about imagining what those innovations might be, paying little heed to the literary aesthetics or emotional and psychological themes that were fashionable among leading writers of the

time. Their stories about space ships and extraterrestrial civilizations, alternative physical universes and future alien worlds, were typically more concerned with the potential applications of new scientific concepts than with understanding nature and the process of discovery. Author Arthur C. Clarke summarized this perspective when he observed, "any sufficiently advanced technology is indistinguishable from magic" (1962: 2).¹ In the U.S., science fiction became linked to a mass market publishing industry that required authors to follow certain formulas, earning the genre a reputation as low-grade entertainment. Though definitions are hotly debated by authors, fans, and scholars, almost any novel that deals with technological innovation or speculates about alien or future worlds tends to be classified as science fiction and its intellectual or artistic value downplayed by literary critics (*cf.* Aldis 2007). In recent decades, however, science has moved toward center stage in a number of novels that elude classification as science fiction, even by the broadest definitions. The recognition, both within and beyond the scientific community, that the objective framework of science must function within individual, social, economic, and political spheres, and that our collective well-being and future relies on understanding *how* it functions, may have opened the door to literary innovation.

A New Kind of Science Novel?

Can science really be the "stuff of literature and life?" Can a work of fiction make readers feel at home in a chemistry lab, or help them comprehend the inherent imperfections and self-correcting trajectory of the scientific method? Can narrative help us to understand the human and societal context of the knowledge produced by reductionism? Shine a light on the oft-neglected ethical challenges of scientific work, or reveal the opaque connections between the production of scientific knowledge and its societal impacts? Since the early 1990s, a body of literature has accrued that attempts all this and more. Early examples include *Einstein's Dreams*, a poetic imagining of Einstein's process of discovery (Lightman 1993); *Mrs. Einstein* (McGrail 1998), which recounts the drama of early 20th century physics through the eyes of his fictional mathematician daughter; *Mendel's Dwarf*, which weaves together the stories of a contemporary molecular biologist afflicted with a genetic disability and the 19th century father of genetics, looking both forward and backward at the unintended consequences of scientific discovery (Mawer 1997); and *Carbon Dreams* (Gaines 2001) which tells the story of a young geochemist caught up in the early controversies over global warming research. These novels

¹ Examples of SF authors from the period include J.G. Ballard, Ray Bradbury, Brian Aldiss, Robert Heinlein, Isaac Asimov, and Ursula K. Le Guin; contemporary authors include Philipp K. Dick, Michael Crichton, and Kim Stanley Robinson.

do not shy away from the scientific concepts at the heart of their stories: using various devices, they invite us to consider the implications of relativity for the perception of time, provide a refresher in Newtonian physics or classical genetics, or give a taste of the interdisciplinary delights of biogeochemistry. Nor are these lone, random creations, as it seemed when they started appearing in the 1990s: biology and ecology inform both the character of the heroine and the sociological and historical themes of the story in *The Hungry Tide* (Ghosh 2005). In *Intuition* (Goodman 2006) and *The Honest Look* (Rohn 2010), the pressures and fast pace of biomedical research collide with the gray zones of professional ethics. Examples in the German language realm include *Schilf* (Zeh 2007), a harrowing tale of scientific passion and the dangerous but seductive leap from theoretical physics to metaphysics, *Ein Tiefer Fall*, about ambition and ethics gone awry in the hot field of evolutionary biology (Kegel 2012), and *Die Vermessung der Welt*, Daniel Kehlmann's (2006) sardonic tale of two Enlightenment era scientists from opposite ends of the scientific and social spectrum.

Science is a visceral part of character in these novels, as we see in this passage from Rick Bass's *Where the Sea Used to Be*:

... the young geologist's pure desire to reach, again and again, those craggy lands below [...] reminded Old Dudley of some model of the very workings that so fascinated him: the earth's volcanic strainings and belchings, as one continental plate drifted over another like massive fire-breathing animals procreating: fissures and clefts channeling magma to the surface and giving birth to islands, new stone, then soil, then life . . . To go down into that battleground and find the oil [...] this was as close to love as Dudley could get (1995: 5)

The complex interplay of human urges and reactions that drive scientific work and discovery are a central concern: idealism or greed, yearnings for fame or power, intuition and creativity, curiosity or obsessive precision, or, as we see when a disillusioned biochemist in *The Goldbug Variations* explains to a friend why he is not interested in genetic engineering, a sense of wonder:

It's not science. Science is not about control. It is about cultivating a perpetual condition of wonder in the face of something that forever grows one step richer and subtler than our latest theory about it. It is about reverence, not mastery.... (Powers 1991: 411)

The uneasy marriage between science and industry is apparent in *Carbon Dreams*, when a young geochemist tries to explain to her environmentalist boyfriend why oil companies are offering to fund her academic research:

He was never going to see her hydrocarbon project outside of its technological context. She wasn't even sure he appreciated the difference between science and technology, between the compulsion to *know* the universe and technology's compulsion to *use* it. What would he make, she suddenly wondered, of Garrett's lifelong attempt to understand how life had come to exist, an unarguably benign quest? (Gaines 2001: 217)

But the messages in these novels are as varied as their scientist characters. For the geneticists in Powers' *Generosity. An Enhancement* (2009) and Michael Byers' *Long for this World* (2003), or the cynical aging physicist in Ian McEwan's black comedy, *Solar* (2010), science is indeed about control and mastery, and the technological context is its *raison d'être*—to master a horrible childhood disease, or predetermine the emotional well-being of one's offspring, or harvest energy from an inexhaustible source.

This new fictional discourse on science varies in style, theme, and quality. It includes "novels of ideas" that contain scientific as well as philosophical concepts, love stories, family dramas, thrillers, and mysteries, and its authors are as likely to be educated in the sciences as in the humanities. What these novels have in common, what appears to be new in terms of science in fiction, is a direct concern with the complex relationships between scientific knowledge and the individuals who produce, use, and are affected by it.

As a phenomenon, the new science novels seem to have captured more attention in the scientific media than in literary circles. The chemist Carl Djerassi first used the expression "science *in* fiction" to describe his own, unabashedly didactic novels (Djerassi 1998), and commentators in the scientific media have since adopted the term for novels about science that do not fit in the science fiction genre (*e.g.* Wilson 2001; Gaines 2001; Appleyard 2007). Jennifer Rohn coined the term "lab lit" to describe books that "focus on the intricacies of scientific work and scientists as people" (Rohn 2006). Her webzine *Lablit.com: the culture of science in fiction and fact*, whose core readership comprises working scientists and amateur science aficionados, has been featuring a list and reviews of such novels since 2001. The term is catching on, as we note from a recent essay in the science section of the *New York Times*, inspired by bestselling literary author Barbara Kingsolver's latest novel (Bouton 2012). But do these works actually constitute an emerging new genre of fiction? Or is this new attention to science in fiction part of some more diffuse cultural trend?

Science and Literature Studies.

Over the past twenty years, there has been an increasing interest in the relationships between literature and science, with the establishment of scholarly societies dedicated to their study (www.litsciarts.org; www.slsa-europe.eu; www.bsls.ac.uk), journals (*e.g.* *Configurations* or *Epistémocritique*), and anthologies and texts (*e.g.* Clark 2011; Gossin 2002; Sleigh 2010; Smith 2000). Studies in the new field range widely: They include attempts to identify shared aesthetics and epistemologies; track the influences that new ideas in medicine, evolution, astronomy, and physics had on writers of the 19th century (*e.g.* Caldwell 2004; Otis 2002; Richter Schönert, et.al. 1997); read scientific texts as literature (*e.g.* Locke 1992; Beer 2000); emulate scientific methods in the analysis of literary texts (Gottschall 2008); trace the evolutionary basis of storytelling (*e.g.* Boyd 2009); and identify the impact informatics is having on cognition and writing (Hayles 2012). But though an emerging science-in-theater movement has received quite a bit of attention (*e.g.* Ball 2002; Shepherd-Barr 2006; Glaser 2003) and the recent wave of science novels has not gone unnoticed (Clayton 2002; Freese 2004), there have been few concerted scholarly efforts to characterize the recent discourse on science emanating from the literary realm, or examine its social and literary implications. Any attempt to review the literature on the topic raises more questions than it answers.

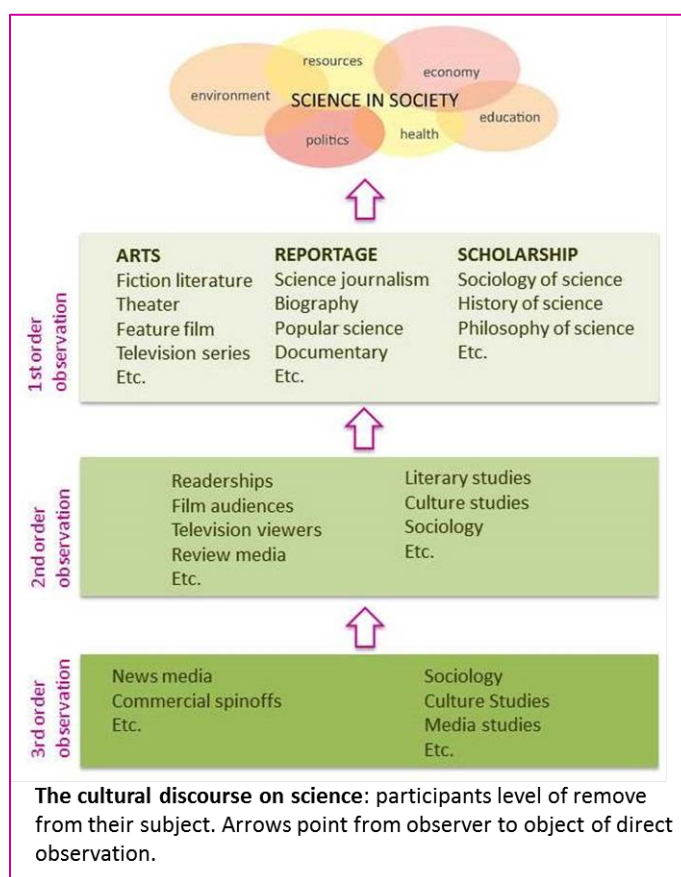
What distinguishes this new literary engagement with the sciences from that of the mid-20th century, and what is behind the change? Are the writers responsible for it educated in the sciences, or have they gained access to the scientific sphere? Do the new literary representations differ from those of the past in terms of how they represent science and its practitioners and place in society, and how do they compare to real world models as understood by sociologists and interpreted by working scientists? Do we see comparable developments in theater and film? How are scientific concepts represented in fiction, and does this differ from the representation of other forms of knowledge? Are we seeing the emergence of new forms of fiction, and what are their implications for the forms of literacy expected of a reading public and required by reviewers and critics? Can fiction generate a generalist dialogue in a fragmented world of specialists—between atmospheric physicist and organic chemist, geneticist and medical doctor, cell biologist and pharmacist... between scientist and non-scientist? And, finally, what are the potential effects of the discourse emanating from the literary arts on public perceptions and understanding of science and on discourses within the scientific community?

Answering such questions effectively requires concerted efforts from disciplines that rarely collaborate with each other and lack common tools and languages—namely literary studies and sociology. It involves focusing on a discourse that emanates from fiction writers—creative individuals with a license to fabricate tall tales—but has as its subject science writ both small and large—how it is practiced by individuals, its social structures, the knowledge produced and its effects on society—depending on how one focuses the microscope. As humanities scholars join the discussion, it is essential to keep in mind the different perspectives and levels of remove from which participants observe their subject.

A sociologist of science who systematically studies how science operates by observing the daily life in a chemistry lab or conducting surveys of citizens' attitudes about science, or a historian examining scientific documents might be considered a direct or “first order” observers of science in society. So might a journalist producing a documentary, or a scientist writing an autobiography or popular account of discovery, or the novelist or playwright who must directly access and "inhabit" the

world they render into fiction. These first order observers are, of course, distinguished by their methods, motives, and perspectives. The scholar and the journalist work with different constraints on their time and methods, and different expectations for their products—but both *aim* to produce reports that are direct reflections of objective observation. Creators of fiction, on the other hand, are unconstrained in their methods, which can range from systematic surveys of scientific papers and observation of life in a research lab, to recording gossip and hearsay among the

geologists at the pub or observing science at the next remove, through documentary reports and popular science accounts. Fiction makes no claim to objectivity and doesn't attempt to *report* on “reality,” but rather, makes free use of point of view to provide a singular *experience* of it, a revelation. Its creators are constrained only by the need to tell a story with



some degree of aesthetic interest. At the next level of remove from the topic of interest—namely, science in society—we find the readers, film-goers, reviewers, and scholars of literature or culture who partake of and discuss or comment on the news reports, documentaries, novels, plays and films. At this second order of observation, the discussion encompasses the artistic products as well as their subjects. At the third order of observation, the discussion moves even farther afield as the news media reports on the exceptional popularity of a book or on a celebrity or politician's reaction, the market generates commercial spin-offs (films from books, computer games from movies, fan paraphernalia, and so forth), and the scholars study the discourse generated by the novels—that is what the reviewers, and book groups and media are saying about them.

Despite the increasing participation of high profile literary authors like Ian McEwan and Barbara Kingsolver, the discourse on science emerging from contemporary fiction has not generally been a mass-market, Jurassic-Park-scale affair. But it is a discourse that reaches across literary, public, and scientific spheres: if we are concerned about the ways that both literature and science function within our society, the transparency of the scientific sphere, and the public understanding of science, then it behooves us to pay attention.

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