

Current Comments®

EUGENE GARFIELD

INSTITUTE FOR SCIENTIFIC INFORMATION®
3501 MARKET ST. PHILADELPHIA PA 19104

Cantor's Dilemma by Carl Djerassi: Through Fiction, the Real World of Science

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With his first novel, distinguished scientist Carl Djerassi bridges the gap between the two cultures with a major contribution to science in fiction. Describing the quest for the Nobel Prize, he focuses on one of the key issues of the scientific community: trust and how it affects human relationships. Describing the process of science in exquisite detail, *Cantor's Dilemma* makes for an exciting read.

Probably no single theme, other than my specialty of citation analysis, has dominated these essays as has C.P. Snow's notion of the "two cultures."¹ Snow's work has become a metaphor for the alleged chasm between art and science. Personally, I have never believed in that dichotomy. Much of my work, therefore, has been dedicated to demonstrating the links and parallels between the two cultures.

I rarely make predictions. Even with respect to Nobel Prizes, I've always preferred the term *forecast*. However, in the case of Carl Djerassi's first novel, *Cantor's Dilemma*,² I predict success beyond the usual sense of a literary event; I also believe that this work will become not only a paradigm for science in fiction but also the modern metaphor for the marriage of the two cultures.

I will leave to professional book reviewers the task of assessing this work purely in terms of its literary merit. As this essay went to press, the book had already received excellent reviews in library sources such as *Publisher's Weekly*,³ as well as in newspapers, including the *Chicago Tribune*,⁴ the *San Francisco Chronicle*, and the *New York Times*.⁶ For my part, however, I can say in all honesty that I've never read a novel of its length so quickly—about four hours. To me, that is one of the best things I could

say about any book. In preparing these remarks, I've also spent several additional hours selecting the passages that are reprinted here with Djerassi's permission. Excerpts have also appeared recently in *THE SCIENTIST*.⁷

In discussing his novel, I cannot pretend to be unbiased. Readers of *Current Contents*® (CC®) know that Carl Djerassi is among that small group of great scientists I have been privileged to know. I believe our first encounter was at least 25 years ago.

A few months ago we reprinted Djerassi's memoir of his investigation into the origins of Alfred E. Neuman, mascot of *MAD* magazine.⁸ As noted in our introduction, Djerassi's emergence as a writer of fiction is only the latest turn in a remarkably accomplished life. The development of his literary career, as it happens, owes something to the influence of his wife, Diane Middlebrook, who is professor of English and Feminist Studies at Stanford University, California, where Djerassi is professor of chemistry.

Middlebrook and Djerassi met in 1977 and became a couple shortly afterward. In 1983 they separated. Djerassi began writing a novel in which Middlebrook and her daughter Leah appeared, thinly disguised. "This novel brought us back together," Middlebrook says. "Carl showed it to me

for comments. I was extremely annoyed by the way he represented Leah and me, but my professional eye couldn't help but be impressed. Carl had always been a marvelous storyteller. He had a lot to learn about writing novels, but the manuscript showed definite promise."⁹

When they married in 1985, Middlebrook made Djerassi pledge to burn this book. He continued to write fiction, however, and rapidly acquired expertise that warranted publication. Djerassi's new novel began life as a short story entitled "Castor's Dilemma," which appeared in the *Hudson Review*, a literary quarterly (1986),¹⁰ and was later republished in his first collection of fiction, *The Futurist and Other Stories* (1988).¹¹ *Cantor's Dilemma* is dedicated to the real-life Diane and Leah Middlebrook, along with Djerassi's editor Terrence Holt.

Required Reading?

By suggesting that this book will be required reading for every living scientist and all future scientists, I may be accused of hyperbole. Undoubtedly, a paperback edition will soon follow the first hardbound edition or will, at least, be adopted by science and other book clubs. Despite its relatively short length of 230 pages, *Cantor's Dilemma* expresses so well all of the human elements in science today that it is bound to achieve an immortality that might even outlast Carl's monumental scientific work.

My one criticism of *Cantor's Dilemma*, which will be considered by the publisher as irrelevant to a novel, concerns the book's lack of an index. I predict that future editions will need one as this work is subjected to even more microscopic analysis than I will attempt to provide here.

Rather than summarize the story line and deny you the pleasure of the suspense, let me say that the following topics, so often featured in *CC*, are covered in this highly engaging book: authorship, mentor relationships, eponymy, the alphabetic ordering of authors, scientific etiquette and one-upman-

ship, academic fiefdoms, priority in discovery, and women in science. Djerassi also offers a good deal of insight into publication practices and procedures, including a flattering, if slightly embarrassing (to me, at any rate), series of references to *CC* and the *Science Citation Index*[®].

All of the above is delightfully interwoven into a story about Professor Isidore Cantor, a distinguished cell biologist who covets the Nobel Prize; the other main characters include Cantor's postdoctoral assistant, Jerry Stafford; and two contrapuntal women chemists, Celestine Price and Jean Ardley.

Through these vivid characters, and with well-chosen allusions to literature and music, Djerassi gives us a glimpse of the artistic world he knows so well. He also offers the social comedy implicit in Celestine's early affair with a professor 35 years her senior, and the tension between Stafford—a Baptist son—and his alienated, creationist father. Scientists everywhere—and nonscientists, for that matter—are certain to see familiar faces among the characters.

In a remarkable commentary on the generation gap, Professor Cantor advises the young Stafford in preparation for the major experiment that will test Cantor's theory of tumorigenesis:

"Better head for the library now—and look into who else has used that Maeda technique. It's the usual density-gradient differential centrifugation but with a clever twist: he alternates between a stepwise and a continuous gradient. It ought to help you locate our protein in cellular plasma membranes. If I were you, I'd start with the *Citation Index*. You should thank God for it. When I was your age, all we had was *Index Medicus* or *Chemical Abstracts*."

It was true, the *Citation Index* simplified life. In contrast to all of the other bibliographic aids that searched the literature backward, this one did it forward. Maeda's original paper had been published in 1983. The *Citation Index* would list all publications since 1983 citing the Maeda paper and thus would lead Stafford quickly to other workers who had used the same method. It would save Stafford hours, but he knew all that, and Cantor knew that Jer-

ry knew. Even though he suspected that the younger man would be irritated, Cantor could never resist the temptation to point out how much tougher research had been in the old days.² (p. 39-40)

Later, when the experiment designed by Cantor and performed by Stafford appears to be successful, the two men meet to discuss the best publication in which to announce their results. While *CC* readers will smile at Djerassi's explanation as to how one selects a journal for preliminary publication, the lay reader is given what is essentially a condensed sociology of communication in science.

As Stafford and Cantor mull over their publishing options, Cantor recalls the old European system of *pli cacheté*—the practice of presenting manuscripts to journal editors in sealed, dated envelopes. Cantor describes it as the method of choice for “people who really want to keep their results from other scientists, yet claim priority if the competition should publish first.”² (p. 61) The *pli cacheté* system having been abolished, Cantor and Stafford decide to submit their work to *Nature*.

Priority, of course, remains a highly provocative issue in science, as demonstrated by the recent report in *THE SCIENTIST* on university patent policies.¹² The topic of priority is deftly handled in *Cantor's Dilemma*. As Cantor himself explains to a non-scientist acquaintance:

“To be quite honest, most scientists suffer from some sort of dissociative personality; on one side, the rigorous believer in the experimental method with its set of rules and its ultimate objective of advancing knowledge; on the other, the fallible human being with all the accompanying emotional foibles. I'm now talking about the foibles. We all know that in contemporary science the greatest occupational hazard is simultaneous discovery. If my theory is right, then I'm absolutely certain that, sooner or later—and in a highly competitive field like mine, it's likely to be sooner—somebody will have the same idea. A scientist's drive, his self-esteem, are really based on a very simple desire:



Photograph by Margo Davis

Carl Djerassi

recognition by one's peers.... That recognition is bestowed only for originality, which, quite crassly, means that you must be first. No wonder that the push for priority is enormous. And the only way we—including me—establish priority is to ask who published first.”² (p. 113)

When the tumorigenesis article appears in *Nature*, prompting a deluge of reprint requests, Djerassi has occasion to mention *CC*, succinctly describing its role and its importance to the Third World:

After a temporary lull, when the table of contents of that particular *Nature* issue appeared in *Current Contents*, a second avalanche poured in. As journal subscription costs soar, *Current Contents*, which simply lists the titles of articles in other journals, along with the addresses of the authors, is God's gift to scientists from soft-currency countries. Cantor's secretary, whose brother was an avid stamp collector, was suddenly busy removing stamps from all the reprint request cards from Argentina, Bulgaria, India, and dozens of other countries.² (p. 81)

The “Soul and Baggage of Contemporary Science”

Even as Cantor and Stafford are facing the very highest recognition for their work, cir-

cumstances arise that cast doubt on the integrity of the experiment. Cantor must decide whether to confront his colleague—and thereby risk having to retract their paper—or to seek some other course of action. And he must grapple with this dilemma as the air of suspicion and mistrust between the two collaborators grows ever more pervasive. Indeed, perhaps the most crucial theme around which *Cantor's Dilemma* centers is the issue of trust. It is significant that the text is preceded by a 1983 quote on this matter from Arnold Relman, editor, the *New England Journal of Medicine*: "It seems paradoxical that science research, in many ways one of the most questioning and skeptical of human activities, should be dependent on personal trust. But the fact is that without trust the research enterprise could not function." And, of course, it is trust in human relationships as well that makes for health and happiness.

In an uncanny twist, and as further testament to the book's verisimilitude, some of the main issues in *Cantor's Dilemma* happened to prefigure the controversy surrounding the 1989 Nobel Prize in medicine. As in the novel, the 1989 prize recognized cell biologists in the cancer field. Furthermore, in the wake of claims by researcher Dominique Stehelin, Pasteur Institute, Lille, France—who worked as a postdoctoral fellow under laureates J. Michael Bishop and Harold E. Varmus at the University of California, San Francisco—there was much discussion about the matter of apportioning credit between those who provide the theoretical foundations for research and those who carry out the experimental work.¹³

Others may try to summarize the sociological message of *Cantor's Dilemma*, but nothing does it as well as Carl's own afterword, which is reprinted below:

Outright fraud in scientific research is rare. Moreover, in science there can be no perfect crime, no permanently unsolved murder, because there is no statute of limitations. If the subject is important enough, sooner or later the experiment will be repeated, the theory subjected to independent verification. *Cantor's Dilemma*, however, does not deal with such a black-

and-white issue; it maps out much grayer territory into which we scientists, deliberately or inadvertently, sometimes stray.

Original science—what Thomas Kuhn called "paradigmatic science"—usually involves the construction of a working hypothesis, which must then be substantiated experimentally. The hypothesis, when such arrives, seems so beautiful, so obvious, that it must be right. We design an experiment to test it; the results seem to bear us out. I say *seem*. At times a few inconsistent data show up: the two points out of eight that do not fall on a straight line, the one rat out of seven that did not survive. We ascribe them to experimental variability, to statistical aberration—these are the inescapable conditions of science. So we publish the massaged results, our paper causes a sensation, colleagues and competitors rush to repeat our work and to test it by other means. "Normal science" takes over, and our paradigm takes its place in the pantheon.

Suppose our insight was clairvoyant, our reasoning impeccable: what about the ethics of our data trimming? Such activity was noted and condemned a hundred and fifty years ago, by the inventor of the modern computer, the English mathematician Charles Babbage. Certainly it enjoys a long and glorious tradition: Gregor Mendel assuredly, Sir Isaac Newton probably—and no doubt Francis Bacon himself—smoothed their data with an eye toward something more than the truth. But what about our collaborators, our students? Have they been tainted? Have we been doubly tainted by ignoring the example we set our disciples? Science is both a disinterested pursuit of truth and a community, with its own customs, its own social contract. What harm is caused to its culture when the elite displays such occupational deviance?

Gray issues such as these are what I wanted to illuminate behind the scrim of fiction. Yet I could not start, and now cannot end, with the usual throat clearing of an author: a disclaimer that all characters are fictitious, any similarity to real events coincidental. Nor is this book science fiction. For instance, essentially every detail about insects is true: male scorpion flies really do display transvestite behavior; the female sweat bee's sexual behavior is indeed restricted by a chemical chastity belt;

believe it or not, *The Wall Street Journal* does prevent sexual maturation and causes early death in the bug *Pyrrhocoris apterus*, whereas *The Times* of London is innocuous—according to an experiment conducted before that paper was acquired by Rupert Murdoch.

Cantor's Dilemma deals with science in fiction and, with one exception, all of the science it describes is real. Professor I. Cantor, Dr. Jeremiah P. Stafford and Celestine Price, as well as many of the subsidiary characters like Professors Graham Lufkin, Kurt Krauss and Jean Ardley (nee Yardley), are creatures of my imagination. My Jean Ardley changed her name from Yardley to climb up the alphabetical ladder of authors. So did a scientific acquaintance of mine—jumping some twenty letters to move to the front by the stroke of a judge's pen. Can I guarantee that Cantor, Stafford and the rest never existed? In over four decades of research experience I have encountered them in many guises. Most of the other names are those of real people: the many Nobel laureates; the organic chemists on the Harvard University faculty; distinguished scientists like McConnell, Nakanishi, Roelofs, Roller, Stork and Williams; journal editors like *Science's* Koshland and *Nature's* Maddox. At one time or another I have met them all; some are my good friends. None are in any sense responsible for appearing in my book, except that I admire their work.

Publications, priorities, the order of the authors, the choice of the journal, the collegiality and the brutal competition, academic tenure, grantsmanship, the Nobel

Prize, *Schadenfreude*—these are soul and baggage of contemporary science. To illustrate them, I had Cantor and Stafford work on a totally fictitious theory of tumorigenesis. It is almost as improbable that convincing proof could be adduced by just one or two straightforward experiments lasting a few weeks or months as happened with Stafford and then Cantor. While their research is made up, their laboratory background, their ethics and their ambitions are not. Only by giving myself, the scientist-author, the assurance that *their* science is pure fiction could I write about behavior and attitudes surely more common than we like to admit.² (p. 228-30)

Finally, there is probably a novel or two lurking in the heart of every literary-minded individual. Carl Djerassi has written the novel that many of us involved in the sociology of science would have aspired to. Like the "obvious" experiment we all should have performed, Djerassi has said it all for us.

We'll be saying a lot more about science in fiction in the future, but it will be difficult to discuss that theme without making reference to *Cantor's Dilemma*.

Excerpts from *Cantor's Dilemma*, published by Doubleday,
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