

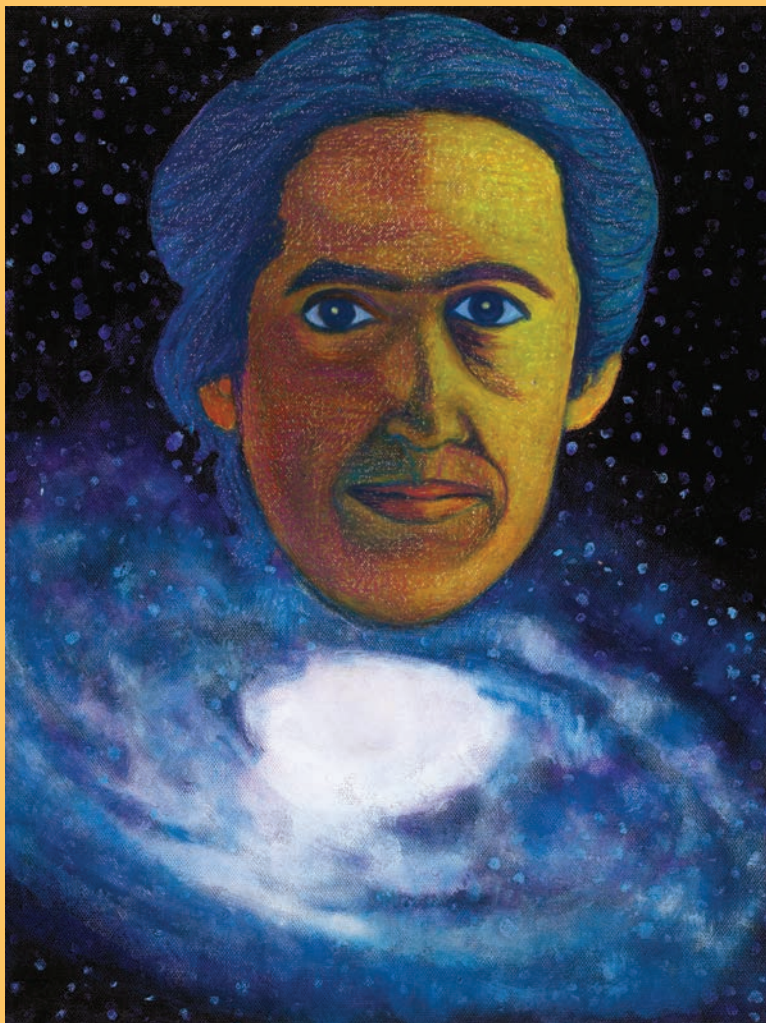
The

# Cascadia Subduction Zone

A LITERARY  
QUARTERLY

October 2011 ☉ Vol. 1. No. 4

## Special Focus on Women and Science



☉ Jennifer Mondfrans

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*The Highest Frontier*  
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## FEATURED ARTIST

Jennifer Mondfrans

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# Gender, Science, and Narrative Inversion

by Ann Hibner Koblitz

Recently, *The New York Times* science writer Gina Kolata interviewed four prominent women scientists on their opinions of what it takes to succeed. Columbia neuroscientist Joy Hirsch averred that “you have to be made of steel.” Her Columbia colleague, physicist Elena Aprile, interjected that “Titanium is better,” and Hirsch immediately agreed.<sup>1</sup> To be fair, the other two women scientists, University of Washington medical geneticist Mary-Claire King and IBM computer scientist Tal Rabin, did not go along with Hirsch’s and Aprile’s tough-as-nails stereotyping and self-aggrandizing martyr mythos. But the overall impression given by the interviews was that successful women scientists are rare-as-hen’s-teeth superwomen who would prefer that their daughters not follow their oh-so-difficult path.

That this image of women scientists is a common one in the US and other western countries is undeniable. That the image reflects the experiences or opinions of most women scientists is, however, doubtful. In fact, it might be said that this characterization is a good example of “narrative inversion”—the tendency to create, develop, and embellish a story that has a superficial appeal yet diverges dramatically from reality.<sup>2</sup>

For over thirty years I have been studying the careers of women scientists in a wide variety of historical and cultural contexts, and for more than twenty-five years I have directed a small nonprofit foundation, the Kovalevskaia Fund, which supports women in science, technology, and medicine in the Third World.<sup>3</sup> I have met women scientists and science students from many countries and fields of specialization and have learned that their circumstances are complex and do not fit popular stereotypes.

At the beginning of my career, I was fascinated with the story of the Russian women scientists of the “generation of the [18]60s.” These women included Sofia Kovalevskaia (the first woman to receive a doctorate in mathematics anywhere in the world), Iulia Lermontova (the first woman to obtain a doctorate in chemistry), Nadezhda Suslova (the first woman to obtain a doctorate in medicine), and many others in physiology, zoology, geology, and other scientific and technical fields.<sup>4</sup> In the second half of the 19th century, male scientists (at least in Europe) were far more welcoming to women

than scholars in the humanities. For example, an 1896 survey of the German professoriate revealed that mathematicians were unanimously in favor of admitting women students (presumably in part because of the success of Kovalevskaia), and physicists were almost as strongly agreeable as the mathematicians. Historians and philologists, on the other hand, were categorically opposed to the entry of women. The anti-women attitudes of German humanists were shared by many of their counterparts in other European countries. Consequently, even women who might have preferred to study literature or philosophy found themselves pursuing careers in science or medicine because those were the only doors open to them.

Kovalevskaia and her peers, male as well as female, viewed the sciences as fruitful, creative, and nurturing, the natural allies of progressive intellectuals committed to social and political change. For them, the sciences were beautiful and welcoming, and any woman who studied them was striking an active blow against backwardness, superstition, and patriarchy. Moreover, far from believing that they had to sacrifice everything else to their scientific careers—or had to be “made of titanium”—many of the Russian “women of the ’60s” engaged in lifestyle experimentation, wrote essays and fiction, promoted educational opportunities for the disadvantaged, participated in literary salons, and became political activists. In other words, their scientific work, although extremely important to them, was only one facet of their fascinating and fulfilling lives.

Work for the Kovalevskaia Fund has afforded me with numerous contemporary examples of similar attitudes toward the sciences held by women in many parts of the world; let me give just one here. Together with the Vietnam Women’s Union (VWU), for over fifteen years our Fund has been cosponsoring informal get-togethers of promising undergraduates and successful scientists. Hanoi University Professor of Microbiology Pham Thi Tran Chau is an eminent scientist and former Kovalevskaia Prizewinner who combines her own research work with a position as a Vice President of the VWU and member of the Kovalevskaia Prize committee. Professor Chau, like several former prizewinners, takes an active part in

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Gender, Science,  
and Narrative  
Inversion  
(cont. from p. 3)

*“Narrative inversion can become an unconscious reflex in many circumstances.”*

the get-togethers. Young women come to Hanoi from all over Vietnam. They tour scientific laboratories and institutes, speak with women graduate students and professors, and attend events such as the symposia connected with the awarding of our Fund’s Kovalevskaia Prizes. The young women visit Professor Chau’s laboratory and speak with her graduate students, many of whom are involved in the women in science organization she started.

Last year I attended the meeting of the students with high officials of the Vietnamese Academy of Sciences, of which Professor Chau is a member. She emphasized the joys of doing scientific work, the satisfaction of making discoveries, the excitement of traveling and meeting one’s colleagues from other countries.<sup>5</sup> The story told by Chau and her colleagues was an uplifting one. Yes, one needed to work hard—but the intellectual and emotional rewards were immense. Professor Chau regretted nothing about her career choice, and she invited the young women to join her. No hint of martyrdom or self-denial colored her speech. In fact, I suspect that if I were to show her the “woman of steel/titanium” statements of Hirsch and Aprile, she would be incredulous. After all, the circumstances in which scientists of both sexes work in Vietnam are far more difficult than those confronting Columbia University professors. And Aprile’s and Hirsch’s implication that their profession is more stressful than, say, those of a firefighter, police officer, nurse, or school teacher would have struck Professor Chau (as, indeed, it does me) as absurd.

Narrative inversion can become an unconscious reflex in many circumstances. Recently I served on the doctoral committee of Paula Guerrero in mathematics education at Arizona State University, where I teach. Her dissertation featured interviews with first-generation Latina eighth-grade girls enrolled in a special math program. Among other things, she asked them and their parents about the differences they perceived between the US and Mexico. A persistent theme in the girls’ narratives was that they were extremely lucky to be in the US, because now they had access to good math education as well as the opportunity to do something with their lives other than become housewives. The girls’ parents were not nearly so impressed with the quality of US education and maintained that they had been taught more mathematics in Mexico than their children were being taught in the US. But

since the younger generation clearly paid more attention to the ethnocentric views of their US teachers, friends, and media than to those of their parents, the young women remained smugly convinced of the superiority of their education to that of their cousins in Mexico. And they saw their interest in math as essentially a rejection of their cultural heritage.

As far as I was concerned, the delusions of the girls were bad enough. Worse, however, was the reaction to the young people’s narratives on the part of the four other members of Paula’s committee, all of whom were professors of math education. To a person, they accepted without question the arrogant assumption that mathematics in Mexico is in a primitive state and that Mexican women’s access to scientific careers is drastically circumscribed. I objected strongly. I have attended five of the past seven annual meetings of the Mexican Mathematical Society, and have met women math students from universities all across Mexico, including some of quite modest economic resources and a few from indigenous peoples such as the highland Maya. Women comprise between 40% and 60% of math majors, and virtually all of them intend to pursue a career in math, math education, or a related field. Moreover, 40% of recent Mexican doctorates in mathematics have gone to women. This is significantly higher than in the US (where in 2010 women were 30% of math PhDs), and vastly higher than in northern Europe and the United Kingdom, where women receive under 20% of math doctorates. And incidentally, none of the Mexican women mathematicians and math students with whom I have interacted thinks they need to be made of titanium in order to succeed.

This is not to say that women mathematicians in Mexico have an ideal situation, or that they never face gender discrimination. But the assumption on the part of Paula’s committee members that the narratives of her young interviewees reflected the reality of women in mathematics in the US as opposed to Mexico was ludicrous. Paula, who is Uruguayan, noted that the conditions for women in mathematics in her country resembled those that I had described for Mexico. But she remarked sadly that her young interviewees no more believed her stories of women’s opportunities in Uruguay than they did their own parents’ claims of good mathematics education in Mexico. They remained convinced that they lived in the best of all possible worlds

*“The girls’ parents were not nearly so impressed with the quality of US education and maintained that they had been taught more mathematics in Mexico than their children were being taught in the US.”*



and that their education and career possibilities in the US were unparalleled.

I'd like to give another example of this type of Eurocentric bias. For two years I have been supervising independent study projects of Monica Khan, a first generation Bangladeshi-American Biology and Society major/Women and Gender Studies minor who will be going to medical school next year. More than once she has come to me practically in tears after encounters with fellow students and even professors whose ignorance and arrogance about her culture are appalling. When she says that she is studying science and medicine in the medieval Muslim world, people bring out the old canard (which until talking to her I had thought died forty years ago or more) that all Islamic scholars did was translate and transmit to Europe the accomplishments of ancient Greece. They were imitators rather than originators of knowledge, Monica is told, and even after she informs them about the great physicians Ibn Sina (Avicenna) and Al Rhazes, or the prominent mathematicians Omar Khayyam and Al Khorezm, they remain firm in their conviction that Muslims have never done science. As for the notion that Muslim *women* could now or at any time in the past have been involved in science or medicine—that strikes her interlocutors as unimaginable. They are ignorant of the existence of Bibi Khanim, astronomer and patroness of the sciences in 16th-century Samarkand, and they flatly reject Monica's claim that Muslim women of the Indian subcontinent entered formal medical education at approximately the same time (second half of the 19th century) as did women of Great Britain. In fact, most people assume that she herself had to break with her family to go to college, let alone study medicine, and they are frankly disbelieving of her assertion that she will be the third generation of women doctors among her relatives in Bangladesh.<sup>6</sup>

Since a good part of the propaganda blitz promoting war in the Mideast posits a veiled, silent, uneducated woman as the putative object of a US mission of mercy and enlightenment, it is perhaps not surprising that Monica encounters so much resistance to her narratives of Muslim women as scientists and physicians now and historically. Certainly, on the first day of my Gender, Science, and Technology class when I ask people to guess which countries have the highest rates of female participation in the sciences, technology, and medicine, none

of the students suggest a Muslim country even though they rightly surmise from how I word the question that the answer is likely to be surprising. When I say that Turkey and Kuwait have some of the highest percentages of women in scientific and technical fields, while the Netherlands, Great Britain, and the Scandinavian countries have among the lowest, my students can't contain their amazement—even disbelief.

The reasons for the high rates of women's participation in the sciences in Turkey, which go back to the time of Kemal Ataturk in the first half of the 20th century, are complex.<sup>7</sup> Ataturk and his followers were determined not to see Turkey colonized and swallowed up by the victorious western European nations after Turkey's defeat in World War I. They conceived of the sciences as part of a modernizing agenda, and progressive elites saw the education of their daughters (particularly in technical fields) as part of the same agenda. When Turkey greatly expanded its institutions of higher education during the middle third of the 20th century, women benefited hugely. The resurgence of Muslim fundamentalism has curtailed women's gains somewhat in provincial universities, but to this day Turkish women can be found in large numbers in the professorial ranks in many supposedly non-feminine fields from mathematics to engineering, especially in the prestigious urban universities.

The situation of contemporary Turkish women in science illustrates another point about gender and science. Namely, attitudes toward study of the sciences vary tremendously over time and from one region to another. In 20th-century Kemalist Turkey, elite women entered the sciences in great numbers; in 19th-century Russia also, the class background of the first generation of women scientists was noble or gentry, though this status did not always carry wealth with it. In some parts of Africa, too, elite women are disproportionately represented among women scientists. A career in the natural sciences appears to be regarded as a kind of cultural capital—affluent businessmen are willing to subsidize and are proud of their wives who work for a pittance in the science departments of the national universities. The woman scientist position conveys social status despite the negligible monetary reward.<sup>8</sup>

While at first glance one might be tempted to say that *of course* scientists always come from elite backgrounds, this is far from being the case. In fact, in Peru many scientists and

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*"While at first glance one might be tempted to say that of course scientists always come from elite backgrounds, this is far from being the case."*

*Cont. on p. 20*





# Women in Science and Science Fiction: A Mutual Relationship?

by Helen Merrick

*“What brings women to science fiction—as readers or writers—and does that have any relation to the reasons women study science?”*

A few years ago, sitting with a group of women at a local fannish gathering, it struck me what an insanely educated bunch we were: nine of us, out of maybe twenty, had advanced degrees, more than half in the sciences or engineering. This got me to thinking. What brings women to science fiction—as readers or writers—and does that have any relation to the reasons women study science? Does the certain “geeky” trait that characterizes a willingness to engage with sf as a teenage girl predispose girls to being more open to the sciences? Would more girls be interested in science if they were exposed to sf? (Certainly NASA seems to agree that there is some link between reading sf and choosing a career in science, as seen in their recent partnership with Tor-Forge to produce NASA themed sf books).<sup>1</sup>

In Australia, as in the US and EU, the need to attract more women to science continues to be a pressing issue. Despite enormous advances over the last fifty years, women’s place in the sciences remains analogous to that of women in science fiction—they are not as numerous, visible, lauded, or well-paid. A persistent subtext in both the women in sf and women in science issues is the notion that women are just not as interested in (or as good at) science as men. Certainly this assumption is common in debates about why we have so few female writers of “hard” science fiction (and may well feed into recent online discussions about why women might choose to write science fiction under a pseudonym).

While data from the US and EU on the under-representation of women in science would seem to support these notions, the issue becomes more complex if we take a global perspective. The Unesco Science Report 2010 shows that while the US and Western Europe continue to be pre-eminent in terms of research output and expenditure, they are outperformed by other countries in terms of gender equity. Women form close to (or above) 50% of science researchers in a number of countries in Latin America, Eastern Europe, and Southern Asia.<sup>2</sup> In contrast, while US women’s share of undergraduate degrees has soared in some areas (such as biomedical and agricultural sciences) across

most of the sciences women are less likely to continue on to advanced degrees or scientific careers.<sup>3</sup> So why do US women continue to fall foul of the “leaky pipeline”? The example of countries that have achieved gender parity suggests that it is not lack of interest that keeps women out of science, but rather a complex mix of social, cultural, economic, and political factors. According to a recent (US) National Academy of Sciences report, one of the biggest factors is what they call “implicit bias.” In other words, there are persistent stereotypes about girls and science that infuse popular culture, education, and peer and family influence (resulting in the phenomenon known as “stereotype threat”).<sup>4</sup>

One way to counter implicit bias and stereotypes is to provide more positive role models, particularly through the media. The most influential images are likely to be fictional scientists shown on TV and film, but many of these images continue to rely on stereotypes of normative femininity. While it is nowhere near as popular, print sf offers a much greater range of positive, non-stereotypical, and even feminist depictions of women in science.<sup>5</sup>

One of the few critics to focus on the issue of women scientists in sf is Jane Donawerth. In her 1997 book *Frankenstein’s Daughters*, Donawerth provides examples dating back to 19th century utopias, reflecting the long history of the struggle for women’s place in the sciences. Coterminous with the first wave of women’s campaigns for the vote and the right to education, Mary Bradley Lane’s *Mizora* (1881) and Charlotte Perkins Gilman’s *Herland* (1915), for instance, feature imagined societies where women hold important roles in scientific research and education.<sup>6</sup> Continuing into the 1920s and ’30s, “The Menace of Mars” (1928) and “The Ape Cycle” (1930) by Clare Winger Harris, and Louise Rice and Tonjoroff-Roberts’ “The Astounding Enemy” (1930) depict women as scientists and engineers.

Another cluster of texts appeared in the 1950s, a time of increased interest in science education generally. The most (in)famous science-fictional female scientist, Dr Susan Calvin, debuted in Isaac Asimov’s story “I Robot” (1950). John Wyndham offered

*“So why do US women continue to fall foul of the ‘leaky pipeline’? The example of countries that have achieved gender parity suggests that it is not lack of interest that keeps women out of science, but rather a complex mix of social, cultural, economic, and political factors.”*



more complex representations in “Consider her ways” (1961), as did Philip Wylie in *The Disappearance* (1951), where each sex effectively “disappears” as far as the other is concerned, and women are shown performing all the roles left vacant by the men. Katherine MacLean also published a number of stories from the 1950s that routinely feature female scientists working capably alongside their male counterparts, including “And be Merry...” (1950) and “Contagion” (1950). The early 1960s brought two very different but significant texts featuring female scientists. In *Memoirs of a Spacewoman* (1962), British writer Naomi Mitchison imagines a future where women (including women of color) participate equally with men in both scientific research and expeditions to other worlds. The imagined society of *Memoirs* displays radically altered attitudes to motherhood, childcare, and partnering, resulting in an environment where women routinely take on the dual roles of scientist and mother. The children’s book *A Wrinkle in Time* by Madeleine L’Engle (1962) also features a scientist mother, who does her lab work at home so she can continue to look after her children.

From the late 1960s, the growing body of work by feminist authors in sf along with a broadening of the genre’s themes and concerns have produced abundant images of female scientists. Even texts that do not directly represent scientists are often engaged in explorations and re-imaginings of the sorts of cultural, political, and economic institutions that contextualize and underpin contemporary science, with obvious consequences for women’s involvement in science. Feminist sf utopias of the early ’70s offer the most prominent examples of texts whose transformed futures include radical changes in the practice and culture of science. Female scientists are an accepted part of the society of Anarres in Ursula Le Guin’s *The Dispossessed* (1974), even if they do not figure as central characters. Joanna Russ’s “When it Changed” (1972) and *The Female Man* (1975) and Marge Piercy’s *Woman on the Edge of Time* (1976) depict societies where understandings of work, education, technology, and knowledge have been so re-imagined that it is easy to overlook the scientific work carried out by women as a routine part of everyday life. In quite a different example, the post-apocalyptic, tribe-like society of the Riding Women in Suzy McKee Charnas’ *Motherlines* (1978) appears to possess no ad-

vanced science or technology. However the very existence and continued reproduction of the Riding Women has been made possible by their female ancestors’ experiments with cloning and parthenogenesis.

Building on this history, the contemporary scene offers many positive examples of female scientists, from both male and female authors. Current sf engages with the “women in science” question on a number of levels, from critiquing “science as usual” to providing visions of more egalitarian or even gender-free science. Many women-authored and feminist sf texts offer explicit critiques of the practice of contemporary western science, some through envisioning radical alternatives, some by emphasizing the problems faced by working female scientists. An early example is the intriguing short story by East German writer Christa Wolf, “Self Experiment: Treatise on a Report” (1973), in which a female scientist, Anders, successfully undergoes a sex-change experiment. Unusual both for its realistic representation of a female scientist at work and its interrogation of scientific practice and language, the story illuminates the conflicts and contradictions characterizing women’s place in the sciences. The struggle to carve out an identity as a female scientist is made overt as Anders quite literally becomes a man.

The notion of the woman scientist as “female man” is critiqued in a number of texts dramatizing the problems faced by female scientists. In one powerful example, Kate Wilhelm’s *The Clewiston Test* (1977), Anne Clewiston, a brilliant medical research scientist falls victim to gendered prejudices and power struggles in her work, social circle, and marriage. In the beginning of the novel, Clewiston is represented as an admired, well-funded research scientist heading an important project working on pain management. As complications arise with the project and her personal life, the issue of her gender is used as an excuse to characterize her behavior as irrational and dangerous.

More recently, Gwyneth Jones’ novel *Life* (2004) provides a contemporary portrait of the difficulties of a woman working in science. Reflecting the present-day environment of much improved educational and career prospects for women, the novel follows the ups and downs of Anna Senoz’s career as a biologist. Set within a broader critical examination of the cultural and methodological operations of modern corporate science,

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Cont. on p. 20





# Bad Science: The Flawed Research into Gender Differences in the Brain

by Nancy Jane Moore

*"The idea that men and women might not be all that different frightens most people."*

*Vive la difference!*

You don't need to have studied French to recognize that phrase: men and women are different, and that's a wonderful thing. Except that in my experience, men and women aren't all that different, other than their reproductive equipment. And exaggerating differences between the sexes isn't wonderful; rather, it leads to discrimination against women who follow traditionally male paths and upholds the ongoing effort to force people into behaviors and roles they find wrong and uncomfortable.

In every society boys are raised differently from girls, which produces differences in abundance. I have only to examine the television commercials aimed at children to see the different roles and expectations US society associates with males and females. But cultural differences are mutable. In spite of the princess phenomenon marketed to girls and macho images to boys, young people in the US are growing up with increasingly egalitarian views about what men and women should do with their lives. Older people have shifted their opinions, too.

Work like Deborah Tannen's *You Just Don't Understand* scrutinizes the cultural differences we have created between men and women and offers ways to bridge those differences. Even better would be work that proposes ways for eliminating such differences altogether. Such work, though, is rare. Several books detailing the flaws in brain-difference research (discussed below) do point out how much the environment in which men and women are raised creates differences between us, but such books focus chiefly on the lack of scientific evidence for innate differences. Far too many books—the "Men are from Mars, Women from Venus" franchise is only one example—exploit rather than explore those cultural differences.

I began my martial arts study in 1979 with karate, and by the early 1980s I was training four nights a week, mostly with men and in a male-oriented environment. Despite that, I felt more at home in a karate dojo than I had ever felt any place else. One day, a senior male student asked another woman and myself why women study karate. He understood our training for self defense, but won-

dered why we kept it up. We said, "Why do *you* train? We train for the same reasons you do." It hadn't occurred to him that women might be motivated by the same yearning to understand the path of the warrior as a way of life. No one whose sole motivation for martial arts training is self defense stays with it for more than a few years, and most of those who start out with the urge to become the baddest person around tend to discover that they're actually looking for enlightenment.

The idea that men and women might not be all that different frightens most people. Gwyneth Jones, whose novel *Life* deals with a world in which gender differences are disappearing, thinks virtually all of us are afraid of this concept. "You can't have the goals of feminism if you want to keep the Great Divide. And we, we in the editorial and every other sense: everyone, including myself, we do not want to lose the Great Divide," Jones writes in her essay "Shora Revisited."<sup>1</sup> She isn't advocating against feminism, but rather making an effort to show us what it really means.

I, for one, am ready to lose the Great Divide. But both serious researchers and authors of pop science books persist in (mis)using research into the effect of hormones on human fetuses and studies of minor differences in the size and composition of male and female brains to argue that men and women are innately different. Recently, those invested in maintaining the Great Divide have turned their attention to brain research.

Such use of brain research is both popular and widespread. Take for instance the work of Louann Brizendine, a neuropsychiatrist who argues for vast differences.<sup>2</sup> Other scientists have found many errors in Brizendine's work. Cordelia Fine, for example, notes that at least one report Brizendine cites showing that women are better at empathizing than men came from a study that only looked at women.<sup>3</sup> Nevertheless while Brizendine's work on communication has been repeatedly taken apart on Language Log, a group blog by linguistics professors,<sup>4</sup> her books are bestsellers. Further, an article on WebMD<sup>5</sup> called "How Male and Female Brains Differ" states as fact many ideas that have not been proven, thus demonstrating just how widespread the adoption of belief in differences between the sexes is in both popular and scientific communities.

Whenever I listen to news reports on research purporting to show a difference between male and female brains, I hear: "Men and women are different, and that means you

*"...both serious researchers and authors of pop science books persist in (mis)using research into the effect of hormones on human fetuses and studies of minor differences in the size and composition of male and female brains to argue that men and women are innately different."*





cannot do X because you are a girl.” Most of the authors of such research would deny they mean any such thing and deny they have any agenda at all. But I foresee such studies being used to shove people into pre-ordained career paths, regardless of their personal interests or desires. What people choose to do with their lives should not be constrained by the presence of male or female reproductive organs. Arguments that biology is destiny undermine this core principle of feminism.

The legal profession is currently aflutter about why there aren't more women arguing at the US Supreme Court. Do women not relish the challenge? Are they afraid of the stress? And yet no one writing in legal journals on this subject addresses the barriers women face when trying to get the highest-status jobs in any profession. One particular barrier is lack of recognition and encouragement from teachers and mentors, a subject psychiatrist Anna Fels discusses in detail in her brilliant *Necessary Dreams*.<sup>6</sup> Fels argues that male students receive encouragement while women students often are ignored; women highly successful in male-dominated fields frequently point to a particular teacher who recognized their abilities at a critical moment. In the case of the Supreme Court bar, I suspect many women who dreamed of doing this work were ignored while their male colleagues were encouraged to pursue it. Thirty years ago we held the same discussion about women as trial lawyers. People worried that women weren't tough enough for trial work and argued that it was better for women to do more “feminine” law, like representing children in need of supervision or drafting wills. That discussion seems to have fallen by the wayside, perhaps because of the number of women doing trial work these days. The debate seems particularly ironic in light of the fact that all of the studies assigning inherent gender attributes claim that women have greater verbal ability than men. For all that the courtroom may resemble a battlefield, it's one in which verbal skill—saying the right words at the right time—is a crucial weapon.

But my reaction to reports that scientists have found gendered differences in human brains isn't scientific; it's personal and emotional. Fortunately, two recent books take on the task of analyzing this science and explaining where it fails to measure up: Cordelia Fine's *Delusions of Gender*<sup>7</sup> and Rebecca M. Jordan-Young's *Brain Storm*.<sup>8</sup> A third, Lise Eliot's *Pink Brain, Blue Brain*,<sup>9</sup> also pro-

vides useful critique. A careful analysis of the science of brain difference shows that many of the studies, particularly those focused on hormones, are based on a small number of participants. Some studies that supposedly add to earlier research were designed, in fact, with very different parameters from the initial project, making it impossible to compare them. Others lack observational neutrality. In short, much of the research showing vast gender differences in male and female brains is flawed. It is, in fact, bad science.

These three books provide a solid argument against the efforts of Brizendine, Simon Baron-Cohen (whose book, *The Essential Difference*,<sup>10</sup> uses his work on fetal testosterone to build an argument that the female brain is “hard-wired” for empathy and that men are better at systemizing tasks such as are found in math and science, according to Jordan-Young), and others to force us back into rigid gender roles. Perhaps the most important point, one made by all three books, is that credible studies that show differences between male and female brains demonstrate a wide variation in both sexes and only small measurable differences between sexes. As Jordan-Young points out, in tests of verbal fluency women score slightly higher than men, while in tests of spatial reasoning, men score slightly higher. But there is a great overlap in the range of scores for both men and women and, she adds, “For any given score, you would have a very hard time guessing whether it came from a man or a woman—you could not assign a gender to that score like you can assign a sex to genitals.” Pop science to the contrary, some men do score high on language use just as some women do on spatial reasoning.

The three books are quite different. *Pink Brain, Blue Brain*, which was first published in 2009 and is now available in paperback, is the perfect book to give friends who tell you about the vast differences they see between their daughters and sons. Subtitled *How Small Differences Grow into Troublesome Gaps—and What We Can Do About It*, it's a gentle book, repeating that yes, there are some differences, while supplying suggestions for giving your children a better chance at doing things they supposedly don't do well. For example, in her chapter on “Learning Through Play in the Preschool Years,” Eliot suggests high-quality preschool training that exposes boys to more language and fine motor skills while giving girls tools and building-toys and encouraging them to play sports.

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“...credible studies that show differences between male and female brains demonstrate a wide variation in both sexes and only small measurable differences between sexes.”

Cont. on p. 23





# Where the Juice Is: An Interview with Julie Czerneda

by Nisi Shawl

Canadian science fiction and fantasy writer Julie Czerneda is the author of over a dozen novels and twenty-five short stories. She has received four Prix Aurora Awards and a Golden Duck. Her graduate degree in biology and her years editing scientific texts make her a compelling advocate for science education. Czerneda designed her Wonder Zone series to promote inclusion of fantastic fiction in classroom syllabi. She edited the Wonder Zone anthologies and many others, including *Tesseract Fifteen*, reviewed elsewhere in this issue. Below she talks about science and its potent attractions, and the relationship between art and inquiry.

*"I love the way life constantly proves to be more complex and changeable than previously thought."*

CSZ: What is science? Can it be "hard" or "soft?"

JC: I feel any disciplined effort to further our understanding of the natural universe, with methodology that can itself be replicated and tested, is science.

That said, there are branches of scientific study where things fit in a test tube and produce nice, graphical data, and others, dealing with equally vital concepts such as sociology or the mind or cosmology, that contain a still-bewildering number of variables. Is the former "hard" and the latter "soft?" I don't think so. Either can be rigorous or sloppy.

I've never liked the hard vs. soft labels regarding science. Certainly as an educator, the last thing you want to implant in a student's mind is that one area of science is harder than another—or of greater worth. I'd love to see us use terms like "solid theory" and "speculative science" once in a while. I think it would help inform the public of the areas we scientists feel strongly have stood up to scrutiny versus areas of continuing (and exciting) exploration.

CSZ: What does science have to do with science fiction?

JC: Without it I'd have nothing to write. Science provides me with the ideas I explore in my stories.

I'd like to turn the question around: What does science fiction have to do with science? To me, science fiction thinking is a superb tool. The "what if" question is so important, it should be a trained reflex. It gives us the ability to run thought experiments as to possible consequences. Everyone should speculate about new science issues or technologies as they appear. Science itself benefits from imagination. Life rewards it.

CSZ: What attracted you to the study of biology?

JC: Everything! I love the way life constantly proves to be more complex and changeable than previously thought. What we know of animal behavior and communication, my particular passions, has taken huge leaps as we learn more about the oft-different ways certain organisms experience their world compared to us. We're still discovering new life forms. It's all quite gloriously messy.

CSZ: Evolutionary psychology and psychology: are they useful disciplines for you to draw on as a writer? What about sociology?

JC: E.O. Wilson's work on sociobiology came out when I was a grad student working on the evolution of animal behavior. What a sea change from the Skinner-box, animal-as-machine thinking prevalent at the time! I remember being floored by a university textbook's pronouncement that birds whose sexes looked the same to humans were forced to try and mate with other individuals until it worked. Really? Now we know birds have no trouble at all telling who is who. Some of them can even tell that about us.

I'm not a splitter of fields. The more you fine-tune your approach, the more likely—with living things—you are to miss what matters. I've been using some of the disciplines you're asking about, the parts that interest me. But it's the observations and raw data that compel me as a writer, rather than the summations of others—what's been found, what's been seen, what's being explored. That's where the juice is for me.

CSZ: What's your earliest memory of approaching something with a scientific attitude?

JC: I was three when I asked my parents to tell me what I'd scooped in my net from a local marsh. Some things wiggled. Some glistened. It was a fascinating mass of goop. They suggested I find out for myself and gave me a basement shelf and several jars of water. Doubtless my mother foresaw the mosquitoes and other flying insects soon to fill the house, but likely not the little tree frog that would climb the wall above the table

*"To me, science fiction thinking is a superb tool. The 'what if' question is so important, it should be a trained reflex.... Science itself benefits from imagination. Life rewards it."*



one morning, then leap into the yolk of her poached egg. My jars were moved into the garage.

Of course, there was no stopping me after that. I was raised to view it as the most natural thing in the world to exercise my curiosity and strive for my own answers. I was boggled when I learned one could actually do this for a living.

CSZ: Is there a best age to begin learning about science?

JC: In the womb? Kids arrive as scientists, supplied with boundless curiosity and questions. It's up to those around them to nurture that attitude and encourage the learning, letting them ask "why?" till it drives you batty. Answer each and every "why" to the best of your ability, even if it's only to say, "I don't know, let's find out."

Wonder's such a fragile, easily discouraged thing in us. As parents, educators, doting visiting friends, we have a responsibility to show we're curious and have questions too. The world's full of opportunities to experiment, starting right at home. Show them you test claims and assess what you see. Compare toilet paper brands to determine how long it takes each to dissolve in water and thus which might be better for the environment once flushed. What's the margin of error on blue jean sizes? What kind of light helps an older relative read most easily?

There's an age when the love of learning science can be lost, too. The early teens are fraught with tension as it is, including a natural and healthy drive to be different and distant from parents. It's time to tone back the over-enthusiasm for the science fair approach or documentaries. Watch the use of labels and criticism. The drive to explore must come from within. Admittedly, to the parent of a teen, sometimes it appears gone for good.

It'll come back, eventually, if the right seeds were planted.

CSZ: What was your education in science like? Did you experience any gender bias or other forms of discrimination, or did you encounter a basically level playing field?

JC: I honestly can't remember an instant of bias or discrimination. I was so excited by the chance to learn what I was learning, with people around me doing the same, that it would have to have been pretty blatant. Even

then, I'd likely have failed to take it seriously. I was told later our particular class year was exceptionally generous to one another and cheerful. Does joy spread?

So yes, a level playing field. About the only thing I noticed was that there weren't many in my class who had planned since Grade Three to be biologists. Most were heading to medicine or teaching or other careers, while I couldn't imagine doing anything else.

CSZ: Is the practice of science inherently egalitarian?

JC: Interesting question. I have to say I feel the practice of science should be inherently egalitarian and could be, but it isn't. Not yet.

What we need is a scientifically literate citizenship. Most of us won't practice science as scientists; all of us should understand how science is done and its value to society. We should be able to critically assess new information and speculate, as I've mentioned, on possible consequences before we vote or buy. And we should—we *must*—understand the workings of our own bodies.

In short, the practice of science should be a part of everyday thinking. For this to happen, however, good solid science—and scientific thinking—must be available, encouraged, and accessible to all.

Alas, we aren't there yet. There are significant disparities in the quality of science education, both in delivery and content, whether you look within a country or consider the world as a whole. There are people who have learned to distrust or avoid science, when they could be empowered to ask and answer their own questions. There are those with questions, but unable to access quality information, be it from a lack of community facilities or the understanding of how to do so.

I'm optimistic, if for a desperate reason. If our world is to continue to be a livable, beautiful home, we must step up and care for it. Science has not only sounded the call to action, it has provided concepts and goals used by scientists and non-scientists alike. When we work together, we humans accomplish fantastic stuff. Science may well prove to be what lets that happen.

CSZ: You've won the Prix Aurora multiple times: twice for Best Editor (*Under Cover of Darkness* in 2008 and *Space, Inc.* in 2004), once for Best Short Form in English ("Left Foot on a Blind Man" in 2002), and once for

*"Kids arrive as scientists, supplied with boundless curiosity and questions."*

*"...the practice of science should be inherently egalitarian and could be, but it isn't. Not yet."*





## Heretical Connectedness: An Appreciative Look at *Symbiotic Planet* by Lynn Margulis

by Andrea Hairston

“Scientists too are creatures of their social, cultural moment. Hidden assumptions affect their theorizing.”

I first read *Symbiotic Planet* [*A New Look At Evolution*] by Lynn Margulis in 1998. I should say I inhaled it. Margulis’s intellectual fierceness appealed to me. Her work as an iconoclastic scientist was invaluable inspiration for my first novel, *Mindscape*.

Margulis insists on scientific research that questions our culture’s sacred norms. She sees science as a liberal art, more epistemology than technology. Cosmic questions engage her: How do stars bring forth life? How does biological novelty arise? For Margulis novelty is not just trivial variation in beak size, skin color, wing span, but novel species whose wondrous differences and varied repertoires allow life to populate every environment on Earth.

Margulis’s inquiries range from the microscopic to the global. Bacterial mats, mitochondria, chloroplasts, undulipodia, and spirochetes fill her with a sense of wonder, and she has relentlessly pursued their deep symbiotic secrets. Undulipodia—isn’t that a great mouthful of a word?—are flagella or cilia that propel a cell. Spirochetes are spiral bacteria that wiggle through any slimy, viscous substance. Margulis believes similar wrigglers invaded other ancient bacteria or got swallowed by them, but not digested. Nucleated cells evolved from this sort of symbiotic truce. There is robust, largely undisputed evidence that mitochondria and chloroplasts arose from bacterial symbiosis. However, Margulis holds that *all* life, *all* novel species, developed from bacterial symbiosis rather than through the accumulation of random mutations in DNA. Neo-Darwinists strongly disagree with her radical symbiotic theory. Her views are unpopular, and she is labeled combative, unfair, and aggressive.

Not satisfied with just one unpopular perspective, Margulis also supports James Lovelock’s Gaia Hypothesis, the controversial idea that the Earth’s biosphere—life, water, air, and land—form a self-regulating ecosystem. Powered by the Sun, Gaia is an emergent, self-sustaining entity. In *Symbiotic Planet* she brings together the two major scientific adventures of her life: Gaia is symbiosis as seen from space.

Margulis concedes that her radical symbiotic theory could be wrong. She is prepared to be wrong. She points out that we all see what we expect to see, what we have learned to see. Scientists too are creatures of their social, cultural moment. Hidden assumptions affect their theorizing.

Margulis rejects Neo-Darwinist reductionism and offers new principles for evolutionary history. She passionately works to decenter human discourse. The Copernican revolution removed the Earth from the center of the Universe. European encounters with other cultures destabilized European ethnocentrism. Margulis argues that human beings do not hold a special, central position in the middle of a great chain of being. *Homo sapiens sapiens* are not the center of the universe, the center of creation; humanity is not the dominant, “higher” species, but just one of many symbionts on a symbiotic planet.

This agenda is heretical.

Bacteria, since their discovery, have been seen as mortal enemies to be conquered and vanquished. In this widespread ideological fantasy, bacteria engage in a dirty war with superior humans, the rightful lords of the earthly realm. In Fall 2010, I had the good fortune to participate in a lively symposium on the Singularity—an intellectual event horizon fast approaching, when technology will (allegedly) allow for greater-than-human intelligence and a society so advanced we current humans cannot comprehend or imagine it. One of the esteemed conveners of the symposium proposed exterminating all bacteria if they interfered with our evolution into sentient supercomputers. Stunned by the casual call for such annihilation (and our colleague’s delusional hubris), several of us pointed out that we *are* bacteria. No biologists were present. I longed for Margulis’s elegance and clarity of expression as this man insisted on the conqueror’s rights to annihilate inferiors, disdaining any notion of Earth as a symbiotic planet.

We might want to eat others, but it is also in our self-interest to cooperate with others. This cooperation leads to ecosystems or new emergent beings—individuals wildly different from their component parts. Com-



plex “individuals” such as trees, slime molds, mammals, reptiles, and insects are a collection of cooperating cells whose ancestors were once “individual” bacteria, but who are now a tapestry of tissue, leaf, root, bone, blood, sap, light and sound sensors, energy and waste treatment depots, and the egg, pollen, sperm, spore progenitors of the future. According to Margulis, symbiosis isn’t a rare oddity but the ubiquitous norm. We take little note of our symbiotic reality because our cultural frames train us to ignore it.

Bacteria and indeed the entire planet are too often viewed as enemy or exploitable resources. Gaia theory advocates for the interconnectedness of all life, resulting in a living planet. Bacteria made the atmosphere and continue to regulate the flow of earthly fluids. Life modulates Earth’s temperature as the Sun heats up. Despite rich evidence, many scientists ridicule Gaia theory as goddess worship, non-science. Margulis fiercely defends it as a scientific enterprise and not new age, woo-woo nonsense. Often scientists who, like Margulis, are accomplished liberal artists and/or writers (Carl Sagan, Stephen J. Gould, for example) are accused of poetry. Rather than maintain rigorous scientific discourse (in their popular texts), these (bad) scientists resort to lush metaphors and ingenious analogies in order to persuade an ignorant lay public of their scientific theories. Lovelock and Margulis are also accused of resorting to poetry, to goddess worship, of gaining acceptance in popular culture for a theory that has flimsy scientific support. But “My Gaia is no vague, quaint notion of a Mother Earth who nurtures us. The Gaia hypothesis is science,” says Margulis.

Of course, critiquing Margulis’s poetry is not the same as critiquing her science. Symbiosis doesn’t jibe with mainstream rugged individualist, great chain of being notions of the cosmos and human progress. Margulis spends little time speculating on which hidden assumptions, ideologies, and worldviews, scientific or otherwise, prevent many scientists from taking Gaia or her radical symbiotic theory seriously. She does, however, mention that Gaia is tainted in scientists’ minds by association with anti-science views exhibited by creationists, believers in intelligent design, or confused puritanical feminists with their “discourse on the dangers of ‘rape’ and destruction of the sunlit earth.”

Margulis’s Gaia is a tough, disinterested bitch who can take all the polluted foolishness this newcomer mammalian weed (human-

ity) dishes out. Her Gaia will thrive long past our human species’ suicidal demise, if it comes to that. Margulis’s insistence on typically “masculine” toughness and rigor for her work rather than the softness of religion, feminism, and artistic discourse reveals her patriarchal context even if she fails to mention it. But as she points out, we’re unable to escape the dominant metaphors of our age. We must wrestle with our sacred norms, incorporate new ways of seeing in order to evolve.

Like the tiny life forms that Lynn Margulis has spent her scientific career investigating, *Symbiotic Planet* is a slim volume of complex wonders. With microbial efficiency she offers up billions of years of natural history in elegant formulations. Evolution is cosmic history. Life is continuous. We are at once 3.5 billion years old and newborns reaching into tomorrow. The living planet is in no danger from the big-brained mammalian weed, but we are perhaps a danger to ourselves.

Of course, given that humans are marvelous creative life forms, possessing 3.5 billion years of evolutionary experience, we also have the capacity to evolve with the rest of Gaia...at least until the Sun winks out.

*“Symbiotic Planet is a slim volume of complex wonders. With microbial efficiency she offers up billions of years of natural history in elegant formulations.”*

*“Margulis’s Gaia is a tough, disinterested bitch who can take all the polluted foolishness this newcomer mammalian weed (humanity) dishes out. Her Gaia will thrive long past our human species...”*

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**Andrea Hairston** was a math/physics major in college until she did special effects for a show, and then she ran off to the theatre and became an artist. She is author of two novels published by Aqueduct Press: *Redwood and Wildfire* (2011) and *Mindscape* (2006), shortlisted for the Phillip K Dick and Tiptree Awards, and winner of the Carl Brandon Parallax Award. Andrea is also a professor, performer, and playwright, and the artistic director of Chrysalis Theatre.





## Learning the World

*Tesseract Fifteen: A Case of Quite Curious Tales*, edited by Julie Czerneda and Susan MacGregor, Edge, September 2011, 280 pages, US \$15.95.

Reviewed by Nic Clarke

"It's not every day you come to school to find that your photo-double has somehow taken over your life," says Rayna, narrator of Virginia Modugno's excellent and disconcerting "Every You, Every Me." Speaking with the studied insouciance of the cooler-than-thou outsider, Rayna is a vivid and instantly recognizable character, which makes the appearance of her too-good-to-be-true doppelganger all the more creepy: "A new and improved me, now with less angst. A me with a flawless outer shell— all sparkly teacher-bait..." It makes for a highly effective adolescent nightmare; Rayna's encounter with this "upgrade" self, who performs her social roles—attentive student, dutiful daughter, polished and feminine girl—better than she ever could, strikes at the heart of the way she sees herself, most devastatingly when she goes home to find her parents eagerly awaiting their beloved Daughter 2.0.

Identity formation and its intersection with technology are at the heart of several of the best stories in this young-adult-centered installment of the *Tesseracts* anthology series. In "A Safety of Crowds," E.L. Chen builds a feedback loop of allusive prose, smartphones, and flash mobbing, as a scarred, reclusive girl and an internet celebrity seek to move anonymously through an information-saturated city: one finding privacy by hiding in crowds, the other by isolating herself within "an artifact of a life."

More lighthearted, but no less thoughtful, is Katrina Nicholson's "A+ Brain," whose splendidly shiftless narrator, faced with a choice over how to improve his C- grade average ("1. work harder, 2. brain replacement surgery") goes for the apparent quick-fix of option two. He is unimpressed with the results, as his "brand new A+ brain" nags him to stop playing computer games and get studying. A lively battle of wills ensues, and Nicholson does a marvellous job of evoking slapstick:

I read much faster now. Maybe it's my new brain. Maybe it's because I get a lot more practice. I blew through the issue in a single day, and now I don't know what to do. But of course my brain does. I lurch like a zombie

out of the house and down the street. I've never been up this way before. I round the corner, and there it is: the library. I beg my brain to think of another way.

The new brain appears to work as much by altering habits as intelligence; by the end of the tale the narrator regards "the disembodied voice in my cranium" as "Me." Yet this quiet triumph is undercut by the recognition that while his new, nerdier friends "have A+ brains, too," they "were born with them;" his success, in other words, is in part due to the advantages afforded by parental money.

Kate Boorman's "The Memory Junkies" extends the theme to family relationships. Her teen protagonists plot an arson attack on Life Keep, a corporation promising "Immersion in Life's Happiest Memories." Their parents have become addicted to reliving their pasts, neglecting their offspring in the present. The key to the story's success is its simple structure; we follow a single conversation, with backstory interjections from our narrator, watching the characters move from fervor to alarm as they realize that the objects of their parents' addiction are moments with their children in happier—that is, less sullen and teenaged—times. It produces the uncanny sensation of seeing someone grow up, just a little, within the space of a few paragraphs.

In "Split Decision" Robert Runte plays elaborate games with structure, letting his narrator's breathless excitement about aliens landing at her school spill over into the way she recounts the story: jumping into the middle, recalling details out of order, and not bothering to explain allusions ("So anyway, we're inside and right away it's just like that movie—the original, I mean, not the remake—because everything is this kind of gloomy black and white"). As well as offering one of the most interesting, and convincingly young, voices of the anthology, this nonlinear technique resonates perfectly with the plot; the aliens, it turns out, allow you to see choices and the parallel realities that they create.

Several stories offer less urgent and inventive voices, and it is here that a common problem for anthologies afflicts *Tesseract 15*: certain narrative modes and moods dominate, and dull the reader's senses to what might be perfectly enjoyable stories in isolation. The hormone rush of first lust, for example, is the topic of only six of the book's twenty-three stories and three poems. But in most cases



it is approached with an interchangeably earnest and sentimental narrative voice, and cumulatively the effect is wearing. Thus the geek wish fulfilment of Kevin Cockle's "The Bridge Builder"—loner boy discovers he's so special that his roleplaying game brings fantasy beings to life, not least a hot elf chick with mad fighting skills whose sole purpose is, well, him—ends up overwhelming the quieter, insightful points the story has to make about intense adolescent friendship.

Amanda Sun's sweet but slight "Fragile Things" starts well, with the taciturn son of a working-class family struggling against the unexpected media attraction that is the "unicorn" in his father's barn (he calls it "Frankengoat"), but then the prettiest girl in school pays him some attention and it's all soulful gazing from there on out. This might not be a problem were it not followed immediately by the rather ponderous "Feral;"

Nicole Luiken's star-crossed lovers go some way towards tackling the gender binary of much of werewolf lore, but the demands of the romantic plot blunt the tale's edges.

The earnestness is offset, however, by bursts of surprising inventiveness; Elise Moser had me laughing aloud with "Darwin's Vampire," Rebecca M. Senese put me off hide-and-seek for life with the brilliantly scary "Hide," and in "The Weirdo Adventures of Steve Rand" Claude Lalumiere does comic-book action with a psychological twist in the tail. A collection well worth dipping into, then, but perhaps not for gobbling down whole.

*"A collection well worth dipping into, then, but perhaps not for gobbling down whole."*

*"Identity formation and its intersection with technology are at the heart of several of the best stories in this young-adult-centered installment of the Tesseracts anthology series."*

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**Nic Clarke** lives in Oxford, UK, where she researches and teaches medieval Islamic history. A revised version of her doctoral thesis, "The Muslim Conquest of Iberia: Medieval Arabic Narratives," will be published by Routledge in 2012. She also reviews fiction for *Strange Horizons*, *SFX*, and *Vector*, and blogs at *Eve's Alexandria*.



## Doctor and Monster Revisited

*Frankenstein's Monster: A Novel* by Susan Heyboer O'Keefe, Three Rivers Press, October 2010, 352 pages, \$15.

Reviewed by Siobhan Carroll

Mary Shelley's *Frankenstein* ends with Victor Frankenstein's monstrous Creature fleeing into the depths of an arctic night, while Captain Walton, a failed polar explorer, looks on in horror. The Creature has vowed to kill itself; Walton has turned his ship towards home, having learned from Frankenstein's fate that even the worthiest ends do not justify sacrificing lives. The gloomy novel thus seems to offer a "happy ending": many people have died, but both the Creature and Walton have learned their lessons.

Or have they? The ominous final words of the novel describe the Creature's form being lost in "darkness and distance." What if the Creature doesn't kill itself as it has promised? What if Walton doesn't abandon his mad quest for self-aggrandizement? What if *Frankenstein's* world, instead of being restored to order, falls further into chaos?

This is the premise of O'Keefe's thoughtful sequel to Shelley's classic. As with the original novel, *Frankenstein's Monster* begins in the epistolary style: excerpts from Walton's log and from the Creature's journal reveal that not only did the Creature abandon its plans for suicide but also that Walton has transferred his ambition from conquering the North Pole to killing the Creature.

The Creature is no innocent victim: torn between desire for human company and fury

over its treatment, it murders people as frequently as it seeks them out. Yet as the increasingly mad Walton pursues the Creature across Europe, we realize that the "monster" of the title could refer to either of these characters: by asking Walton to take up his quest to destroy his creation, Victor Frankenstein has created a second abomination.

The first third of *Frankenstein's Monster*, depicting the Creature's attempts to build a life for itself in Venice, bogs down in the Creature's self-pity and the author's need to recap *Frankenstein's* plot. Moreover, despite the first-person insights we gain into Walton's psyche, he's not that interesting a character. His insanity is sketched in broad strokes; his dark secret is easy to guess, and he serves primarily as a plot device.

Once the Creature tires of Walton's persecution and heads to England for some blood-thirsty revenge, the plot gains momentum. The vengeful Creature tracks down Walton's family, but its plans are derailed when Walton's niece, Lily, rather than fainting like a good Gothic heroine, invites the Creature home for tea. "I want to know what it's like to be hated," Lily explains in the first of many untrustworthy statements. The hapless Creature finds itself sucked into a wider, more disturbing Gothic plot than the story of its own creation. Walton's family members hide

*"Lily, rather than fainting like a good Gothic heroine, invites the Creature home for tea."*

*"The hapless Creature finds itself sucked into a wider, more disturbing Gothic plot than the story of its own creation."*





*The Highest Frontier* by Joan Slonczewski, Tor Books, September 2011, 448 pages, \$26.99, hardcover.

Reviewed by Karen Burnham

*“Slonczewski...respects our intelligence enough not to get bogged down in minutia, but holds our interest and leaves us curious.”*

*The Highest Frontier* is one of those rare sf books I look back at and think: “I could have used a little more info-dumping.” This speaks highly of Slonczewski’s immersive world-building and sympathetic characters. She respects our intelligence enough not to get bogged down in minutia, but holds our interest and leaves us curious. Jennifer Ramos Kennedy, her down-to-earth protagonist, is a big help. A young woman born of immense privilege and about to start life at one of the most rarefied colleges in the world (or rather, above it), she has every potential to be insufferable. If she had been angsty, melodramatic, or snobbish, this book would have been a depressing slog. Instead, she is matter-of-fact, practical, and as un-dramatic as they come. This lends an interesting air of tension between Jennifer and her very dramatic story.

Jennifer belongs to an intensely political family living a century in the future. The world is being devastated by global warming, with huge swaths of the southern United States declared “death zones.” Shortly before the book opens Jennifer’s twin brother Jordi drowned when a seawall broke near New York—he refused to evacuate and instead rescued the helpless. This tragedy makes the idea of going to an off-world college all the more appealing—no risk of drowning in space! So Jennifer heads up the space elevator to Frontera College, which occupies a satellite orbiting the Earth.

During the leisurely-paced first half of *Frontier*, Jennifer gets established in her new life. She is particularly obsessed with botany; her orchids are calming talismans, and she becomes anxious when separated from them. She jumps into a research program with one of the most demanding and quirky members of the biology department. She takes courses both onsite and through “ToyHarvard” (her father is one of the immensely wealthy senior execs of the VR company Toynet). She is a talented Slanball player (athletes use brain-wave enhancing caps to direct a floating ball around a court—a shout-out to diehard sf fans) and must keep up with the practice and competition schedules. She joins the satellite’s EMS team. She must also balance the social demands of her decidedly

odd new roommate, new friends, new potential love interest, and her family’s political demands—she has the misfortune to be starting college during an election year.

In the second half things begin to slowly converge towards the inevitable crisis—her roommate’s oddness, her professor’s biological experiments, the election cycle, and the potential for the satellite to actually flood all come to a head only at the very end of the book. Slonczewski is not writing a thriller here. Jennifer is a levelheaded young woman, not given to panic, and the narrative reflects her matter-of-fact style. I appreciated this, having read too many stories that take the hysterical, over-the-top, thriller approach. Likewise, Jennifer’s budding romance is handled in a low-key manner—a nice contrast to the angsty-emo-insecure romances so often depicted in school stories. Sometimes that works, but it’s nice to have something calmer to cleanse the palate.

However, at its core this novel’s strength is its world-building, which deftly manages both first- and second-order extrapolations. There’s the rough-and-tumble political process, plus a significant media presence. There’s global warming, advances in social networking and other computer tech, and lots of advances in bioengineering that have significant social consequences. For instance, many wealthy families choose to have twins, as did Jennifer’s parents. This has led to conjoined twins being more common than they were historically; Jennifer’s Aunt Meg is governor of California though conjoined to her more impulsive Aunt El. And of course no cutting-edge technology is perfect: despite being engineered to the preferences of her political family, Jennifer has an intense fear of public speaking as well as OCD tendencies—the resulting lawsuits helped pay her Frontera tuition. I also liked the fact that in this future gay marriage is completely normalized—Jennifer’s Uncles Dylan and Clare are the Chancellor and Chaplin of Frontera college respectively, and although the presidential candidates are male and female, the First Ladies debate features two women.

No future would be complete without an extrapolation of today’s conservative global warming-deniers—here in the form of intensely religious factions that reject the heliocentric model of the universe. Frankly, that was a little much for me, but it’s rarely front-and-center, and easy to forgive. Slightly harder to ignore is the book’s immersion in a world of wealth and privilege.

*“...at its core this novel’s strength is its world-building”*

*“...overall we get little sense of what day-to-day life is like for the less fortunate and probably displaced masses back on Earth, or much of any perspective from non-Western countries.”*





Although we meet some inhabitants of the satellite from poorer backgrounds, overall we get little sense of what day-to-day life is like for the less fortunate and probably displaced masses back on Earth, or much of any perspective from non-Western countries. Jennifer's new best friend, the OCD hacker Anouk, is from France—not from the Middle East, Indonesia, or Africa.

The places where I felt a dearth of info-dumping arose mainly from extrapolations of bioengineering. For instance, the space elevator runs up and down on “cords of anthrax bacteria,” and having spent much of my life reading about space beanstalks made of carbon nanotubes I wasn't sure how or why

anthrax bacteria would make a good construction material. Slonczewski is the chair of the biology department at Ohio's Kenyon College, so she no doubt knows whereof she speaks. But as someone whose background runs to physics rather than biology, I could have used more help. Still, the important thing is that I cared enough to even ask the questions—and any sf novel that inspires that level of thought and curiosity can be said to have done its job.

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## Doctor and Monster Revisited

(cont. from p. 15)

secrets of their own, and the manipulative, dangerous Lily has no qualms about using Frankenstein's monster for her own mysterious ends.

The relationship between the Creature and Lily forms the novel's core. “A free woman in an unfree society will be a monster,” wrote Angela Carter, and Lily, determined to free herself of all social constraints, embodies an extreme version of this monstrosity. Alternatively charming and cruel, coldly calculating and explosively erratic, Lily lets nothing restrain her relentless pursuit of her goals. The Creature is simultaneously fascinated and disturbed by Lily's behavior. “Was she so unnatural she would of her own volition lie with me?” the Creature asks. “Did that make her mad?”

Chafing against the restrictions of biology and culture, Lily claims spiritual kinship with the Creature's murdered bride and offers it an alliance of monsters. But morality still underpins the Creature's actions, and though it has declared itself evil, there are some crimes it cannot bring itself to commit. Ironically, the Creature, whose patchwork body assembles contradictory elements into a cohesive whole, can't come to terms with Lily's multifaceted nature. It would prefer the sanity and stability of a patriarchal society to Lily's wild, amoral individualism.

*Frankenstein's Monster* is an intriguing sequel to Shelley's classic. O'Keefe clearly knows the original well, and, in her characterization of Lily, seems interested in the possibilities suggested by Victor's abortive creation of a female monster. Sadly the

conclusion of the novel forecloses many of these possibilities via some very implausible plot developments. Another happy ending, of sorts, is reached, but it lacks the ominous overtones of Shelley's “darkness and distance.” *Frankenstein's Monster* is a respectful and provocative revisiting of *Frankenstein*. Like the Creature itself, though, its body is marred by the occasional mismatched limb: convenient plot developments and Walton's thin characterization detract from the beauty of the finished product.

*“Frankenstein's Monster is a respectful and provocative revisiting of Frankenstein. Like the Creature itself, though, its body is marred by the occasional mismatched limb...”*

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## Whose Revolution?

*Revolution World* by Katy Stauber,  
Night Shade Books, 2011, 232 pages, \$14.99.

Reviewed by Thomas Foster

"...one of the few examples of articulating paranormal romance traditions with cyberpunk, and...unique in its emphasis on the themes of recent near-future fiction..."

I don't know if anyone has ever wondered what Charlaine Harris's *Sookie Stackhouse/True Blood* novels would be like if they'd been written under the massive influence of contemporary post-cyberpunks like Bruce Sterling, Cory Doctorow, or Paolo Bacigalupi. But if there are people like that, they'd be the perfect audience for Katy Stauber's first novel, *Revolution World*.

*Revolution World* fits a tradition of women writers revising the conventions of cyberpunk fiction by replacing cyberpunk's hard-boiled/film noir framework with a romance plot armature. *Revolution World* is one of the few examples of articulating *paranormal* romance traditions with cyberpunk, and it is unique in its emphasis on the themes of recent near-future fiction, especially the relation between high-tech surveillance, post-industrial network societies, and the post-9/11 war against terror, with its new bureaucracies and permanent states of emergency (for example, Cory Doctorow's *Little Brother*). On top of that, *Revolution World* cites and reworks the themes of environmental crisis most recently associated with Bacigalupi's fiction, as well as narratives about online gaming and social change (Doctorow, Walter Jon Williams, Ken Macleod). This play with genre boundaries and their gender codings is likely the book's main appeal.

*Revolution World* takes place around 2080, after "the Troubles," a combination of global warming, peak-oil resource wars, and disaster capitalism, in part resulting from the abuse of genetic engineering. There's both a greater emphasis on local, sustainable cultures (and therefore the regional focus on Texas) and a greater reliance on the "virtual world" (and therefore the focus on online gaming and computer hacking).

The main romance takes place between Clio Somata, a gene "splicer," and Seth Boucher, a computer programmer. Not only is Clio a genetics prodigy and Seth a super-hacker (he brags about controlling US military satellites and India's nuclear missiles), Seth is also a martial artist whose skills make Clio realize he's "a man, a man worth fighting for" and whose strong arms make her forget "pretty much everything."

The novel's science-fictional features impose a series of larger contexts on the more personal, romance plot. Clio and Seth's romance is contained within a narrative of the relationship between Clio and Seth's families and their respective businesses. Clio works for Floracopia, a woman-owned and operated coop specializing in gene splicing, founded by her mother, Harmony (one of the novel's minor pleasures is its menagerie of modified plants and animals). Seth works for Omerta, a computer security company located on an independent island nation in the Pacific Northwest. The novel opens as Floracopia's activities attract corporate espionage and increased government scrutiny, and Seth and his uncle Max come to town scouting locations for a solar-powered server farm. Seth and his relatives turn out to be vampires (scientifically explained as an inherited condition). The novel uses its science fictional setting to defamiliarize the conventions of paranormal romance. During a climactic scene in which Clio rescues Seth from the US military, Seth reveals his vampire heritage and retractable fangs. In the conversation that ensues, Seth offers a critique of traditions of sexualizing the vampire's bite, comparing it to becoming aroused by eating or taking medicine.

The conventionality of the romance plot is most interestingly qualified by the way regional cultural differences inflect gender norms. Stauber explores how Southern women inhabit gender roles and the kinds of agency for women that these roles might empower. Clio and Seth's relationship begins, in fact, when Clio catches Seth staring at her butt and stares right back. Clio's mother Harmony comes under suspicion as both a single mother and the founder of a "devilish gene business." The fact that Harmony had quadruplets (Clio has three identical sisters) suggests that she illegally manipulated her own body. At the same time, Harmony's biotech company, Floracopia, is a woman-dominated institution that employs all four of her daughters, and Floracopia is represented as epitomizing the norms of smalltown Texas, where women may be confined to traditional roles but are also respected as "elders." Floracopia employs almost the entire town, the citizens of which vote on company policies. The novel's message about too-quick dismissal of Southern culture as merely traditional or patriarchal explains the novel's attraction to romance conventions in the first place, as well as its turn to science fiction in

"This play with genre boundaries and their gender codings is likely the book's main appeal."



order to highlight the women characters' capacity for exceeding their roles.

Finally, all these subplots and characters become involved in a large-scale political conflict between Texas and the US government, culminating in Texas seceding. By far the most startling and original aspect of the novel is the way this emphasis on local autonomy results in a biting critique of US responses to 9/11 and the rhetoric of homeland security, which Stauber's novel directly characterizes in terms of "torture prisons" and the kidnapping or "extraordinary rendition" of American citizens as well as foreign nationals.

The book's critique of post-9/11 rhetorics about "terrorism" is wholly admirable and brave. However, this same aspect of the novel also raises its most disturbing questions, to the extent that much of its criticism is expressed through a doctrine of states' rights and anti-immigrant or nativist attitudes. In this respect, the novel is far more self-conscious about its use of gender conventions than it is about the racial histories it both invokes and represses.

The main form of resistance to US policy in the novel comes through the appropriation of an online game, *Revolution World*, for the purposes of organizing and training militias. *Revolution World* is described as a virtual "re-enactment of the Texas Revolution" or war for independence from Mexico. While the Texas revolution certainly involved resistance to centralized state power, it also had a much less attractive side. Part of Texans' outrage against the Mexican federal government derived from its having outlawed slavery. While the novel never mentions this, it does present a conversation between two of the game's players about the game's relevance to the tensions in the novel between Texas and the US federal government. That present moment of state/federal tension is contrasted not to the war with Mexico but to the "War of Northern Aggression," a phrase that is associated in the South with a critique of Northern motives for waging the Civil War and more problematically with a tendency to deny slavery as a justification for it. In the South of my youth, during the civil rights movement, the phrase was a codeword for resistance to desegregation. Clio in fact describes the goal of the militia movement that emerges from the online game as getting "rid of all the carpetbaggers." This near-future narrative of local autonomy against global business and

state power is clearly modeled on and fueled by a history of Southern resentment against "Yankee" interference in the Southern way of life.

The fact that slavery and segregation were among the most notable features of that way of life functions as a repressed subtext in this novel. The kidnappings attributed not to the US government but to local terrorists turn out to be what Clio describes as an "underground railroad" helping citizens escape "military detention." This pattern of the repression and reemergence, in displaced form, of racial histories is recurrent. Clio at one point reflects on the excessive paleness of Seth and his family. She reassures herself that this impression is simply an effect of her being "used to darker skin" since she lives in a "sun-drenched state where Caucasians were a minority." These darker skins, however, are exemplified only by Clio and her sisters' tans, since the novel contains no characters of color at any level. The novel's repression of the literal history of race in the Texas region means that race re-emerges as metaphor either displaced onto the genetically-modified animals or appropriated by white people.

*Revolution World* has some of the flaws of a first-time science fiction novel. Readers are offered infodumps on topics like the fight-or-flight response and genomics, while studiously avoiding ideas like germline modifications or computer cryptography. I often felt that the novel was therefore aimed at romance readers rather than science fiction fans, despite themes and reworkings of its sources, which seem primarily aimed at precisely such fans. Most importantly, the problem with race and Southern history seems to stem from an overly reductive critique of globalization and centralized authority, against which regionalism is celebrated as a mode of revolutionary resistance. But *Revolution World* is to be applauded for taking on topics as ambitious as this within its romance framework, regardless of whether readers agree with the results.

*"The book's critique of post-9/11 rhetorics about 'terrorism' is wholly admirable and brave."*

*"Revolution World is to be applauded for taking on topics as ambitious as this within its romance framework, regardless of whether readers agree with the results."*

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## Gender, Science, and Narrative Inversion (cont. from p. 5)

“...stereotypes and narrative inversion distort our perceptions of women in the sciences and prevent an in-depth analysis of the complexities of the interactions of gender and science, in which issues of race, ethnicity, class, and culture must be taken into account”

science students come from rural and indigenous families. Quechua youth, for example, often view study of the sciences as a road to social mobility and advancement. By contrast, upper class Peruvians are far more likely to see business or the humanities as the areas of study that fit their high economic and social status.

The above examples illustrate how stereotypes and narrative inversion distort our perceptions of women in the sciences and prevent an in-depth analysis of the complexities of the interactions of gender and science, in which issues of race, ethnicity, class, and culture must be taken into account.

### Notes

- 1 Gina Kolata, “Women Atop Their Fields Dissect the Scientific Life,” *The New York Times*, June 7, 2011.
- 2 This term is explained further in Ann Hibner Koblitz, Neal Koblitz, and Alfred Menezes, “Elliptic Curve Cryptography: The Serpentine Course of a Paradigm Shift,” *Journal of Number Theory* 131 (March 2011):781-814; or check out the video abstract at <http://www.youtube.com> ; search for “serpentine course.”
- 3 For information, see <http://kovfund.org> .
- 4 For information about these women, see Koblitz, *A Convergence of Lives. Sofia Kovalevskaia: Scientist, Writer, Revolutionary* (New Brunswick: Rutgers University Press, 1993, 2<sup>nd</sup> ed.) and Koblitz, *Science, Women and Revolution in Russia* (Amsterdam: Harwood/Routledge, 2000).
- 5 Tal Rabin made a similar comment in her *New York Times* interview with Gina Kolata.
- 6 As an aside, it is quite possible that Bangladesh had the first female Minister of Science and Technology in the world, although this has been impossible for me to verify even in this age of internet statistics. I do, however, recall being introduced to the Minister at the first meeting of the Third World Organization for Women in Science in Trieste, Italy, in 1988. At the time, all of us in attendance at the meeting were fairly sure that none of the industrialized countries had a woman in a similar post.
- 7 The following discussion is taken from Feride Acar, “Women in Academic Science Careers in Turkey,” in Veronica Stolte-Heiskanen et al., eds., *Women in Science: Token Women or Gender Equality?* (Oxford, UK: Berg Publishers, 1991), 147-71.
- 8 I discuss this further in “Gender and Science Where Science Is on the Margins,” *Bulletin of Science, Technology & Society* 25, no. 2 (2005): 107-14.

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**Ann Hibner Koblitz** is Professor of Women and Gender Studies at Arizona State University. She is author of *Science, Women, and Revolution in Russia* and is co-founder and director of the Kovalevskaia Fund which focuses on encouragement of women in science, technology, and medicine in Asia, Africa, and Latin America.

## Women in Science and Science Fiction (cont. from p. 7)

*Life* charts the difficulties Senoz faces in her career. The ingrained sexism still prevalent in many university and research environments is painstakingly drawn, as Senoz faces numerous challenges in both her professional and personal life.

Although Senoz is in many ways an inspirational figure, she is not so much a positive role model as a realistic and often troubling representation of a woman in science. Nevertheless, texts such as *Life* can be useful in thinking through the factors that have been identified as affecting girls’ and women’s success in the sciences. Research on girls’ performance in science emphasizes the detrimental impact of cultural assumptions that stereotype a particular group as unsuited to science. The complex rendering of Senoz’s experiences works to break down such stereotypes, as we are encouraged to see her marginalization as the consequence of cultural and institutional forces rather than individual failings. Thus, even less-than-positive representations of female scientists may provide powerful correctives to the notion that women *as a group* are inherently unsuited to science.

A more recognized way of countering stereotype threat is the portrayal of positive role models for women in science. The availability of such role models may improve girls’ ability to imagine themselves as scientists, as suggested by research on self-schemas and the “possible self as scientist” (see Stake & Nickens, 2-3). Numerous sf texts over the last decade have featured male and female scientists and engineers in equal roles. Here female scientists are taken for granted, hold positions of authority, perform their jobs capably, and enjoy the research they do. Many of these texts are set in the future, allowing for a shift in the cultures of science such that women are shown as equal participants in “gender-neutral” sciences. Sarah Zettel’s *The Quiet Invasion* (2000), set in a scientific research colony on Venus, is headed by the eighty-year-old Dr Helen Falia. Another key character, Dr Veronica (Vee) Hatch, has a PhD in planetary atmospherics and works as a holographic artist and science populariser. Set in a less-distant future, Greg Egan’s *Distress* (1995) also depicts a society in which women’s equal participation in science



is taken for granted. Here, however, other shifts in gendered roles are apparent, signaled by the cultural phenomenon of “gender migration,” which posits seven genders as the norm, including the neuter “a-sex.” Like Zettel, Mitchison, and others, Egan’s expanded vision of science is inclusive in terms of race and ethnicity as well as gender. The central scientist is a Black South African woman, Violet Mosala, who is a Nobel prize-winning quantum physicist. In terms of gender, race, and science, the society of *Distress* suggests there is nothing preventing all women from being competitive in science at the highest levels, including areas such as physics.

Not all gender-equal sf visions are distanced from contemporary relations through a futurist setting. *Darwin’s Radio* by Greg Bear (1999), like Jones’s *Life*, depicts a near-future much like our present, but by contrast features a much improved atmosphere for women in science, for *Darwin’s Radio* not only focuses on Dr Kaye Lang, a molecular biologist whose research provides a breakthrough in understanding what appears to be a virus affecting women’s fertility, but also shows numerous other female scientists at work.<sup>7</sup> Kim Stanley Robinson’s near-contemporary *Forty Signs of Rain* (2004) features numerous female scientists. Anna Quibler is a statistician who works fulltime as a senior bureaucrat in the NSF while her husband takes on the bulk of childcare responsibilities for their sons. Unlike *Darwin’s Radio*, *Forty Signs of Rain* makes evident significant factors that support women’s work in science, from the Quibler’s domestic arrangements to the fact that the NSF director is a woman.

Representations of senior, capable female scientists who are not isolated geniuses obviously contribute to positive images of women in science. However, as Noonan (2005) points out in relation to ’50s film, presenting a gender-neutral ideal of science as a *fait accompli* is problematic, particularly when accompanied by relatively unchanged cultural mores and gendered relations. As a result, these texts beg the question of how such gender-balanced environments emerge. The subtext suggests that since there have been no significant changes in the ways science is taught, practiced, or communicated (or in general societal norms), the problem lies with the individual rather than the culture at large. That is, if the only difference between these visions and our society is the

number of successful women in science, then such texts seem to suggest that the only possible site of change is women themselves.

Given the continuing barriers in real-world scientific cultures, more satisfying representations of gender and science occur in stories where there have been obvious shifts in our culture and institutions. Some earlier examples situate their female scientists in totally re-imagined political and cultural contexts, as in Mitchison’s *Memoirs*, Joan Slonczewski’s *A Door into Ocean* (1987), and Vonda McIntyre’s *Starfarer* series (1989). McIntyre’s scientists work on a space station where scientific research is integrated into daily life, in a future where there have been significant shifts in social institutions such as the family and marriage. These texts also represent women of color as central scientist characters.

The capable MacKenzie (Mac) Connor, a marine biologist in Julie Czerneda’s *Species Imperative* series (2005), offers a more recent example. Mac could initially be mistaken for a “female man” type, since she disregards traditionally feminine attachments to appearance and romance and delights in her demanding outdoor fieldwork studying salmon. However, Czerneda achieves a balance through the complexity of Mac’s character and the portrayal of her more traditionally “feminine” colleague, Dr Emily Mamani, who is also a senior scientist and expert in her field. The novel’s representation of an egalitarian scientific context avoids the simplistic assumption of gender neutrality, due to the ways in which science is conducted and represented in the book. On Mac’s marine research station, graduate and postgraduate students work alongside their professors in an egalitarian, community-based and gender-balanced group that lives and works together, seemingly not hampered by excessive institutional hierarchies. Within such a setting, the equal participation of women and men and the fact that many of the senior researchers and administrators are women appear natural. Moreover, the characterization of Mac as a brilliant and committed scientist is lent verisimilitude by the detailed descriptions of her work, the discomforts of field research, demonstrations of support from her family, and reminiscences from her childhood, which speak of a life-long love of, and fascination for, science.

Mac’s passion is significant, I think. It is precisely a fascination for, and even love

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## Women in Science and Science Fiction (cont. from p. 21)

*"In this sense, sf may provide a uniquely valuable space for the kind of role models needed to encourage or enable girls' engagements with science."*

of, science that drives a variety of women's engagements with science, whether as scientists, sf writers, or sf readers. In this sense, sf may provide a uniquely valuable space for the kind of role models needed to encourage or enable girls' engagements with science. And perhaps the traffic need not just be one way. In 2006, the US National Academy of Sciences released a report on women in science that argued: "Neither our academic institutions nor our nation can afford such underuse of precious human capital in science and engineering" (1).

Now there's a lesson for the sf community.

### Further reading

Ceci, S.J. and W. M. Williams Eds., *Why Aren't More Women in Science? Top Researchers Debate the Evidence*. Washington, DC: American Psychological Association, 2007.

NAS. *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*. Washington, DC: National Academies Press, 2006.

National Science Foundation, Division of Science Resources Statistics. *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011*. Special Report NSF 11-309. Arlington, VA, 2011. Available at <http://www.nsf.gov/statistics/wmpd/>.

Noonan, B. *Women Scientists in Fifties Science Fiction Films*. Jefferson: McFarland & Company Publishers, 2005.

Stake, J. E., and S. D. Nickens. 2005. Adolescent Girls' and Boys' Science Peer Relationships and Perceptions of the Possible Self as Scientist. *Sex Roles*, 52(1/2), 1-11.

Steinke, J., 2005. Cultural Representations of Gender and Science: Portrayals of Female Scientists and Engineers in Popular Films. *Science Communication*, 27(1), 27-63.

Weingart, P., and P. Pansegrau. 2003. Introduction: Perception and Representation of Science in Literature and Fiction Film. *Public Understanding of Science*, 12(3), 227-28.

### Notes

- 1 [http://ipv6.nasa.gov/home/hqnews/2011/aug/HQ\\_11-273\\_NASA\\_TORFORGE\\_Books\\_Partner.html](http://ipv6.nasa.gov/home/hqnews/2011/aug/HQ_11-273_NASA_TORFORGE_Books_Partner.html).
- 2 For example, EU countries with leading percentages of women researchers are Lithuania (49%), Latvia (47%) Bulgaria (45%); in Cuba 53% of all S&T professionals are women. UNESCO Science Report, 2010; available at: [unesdoc.unesco.org/images/0018/001899/189958e.pdf](http://unesdoc.unesco.org/images/0018/001899/189958e.pdf).
- 3 A 2011 National Science Foundation report shows that while women in the US now account for well over half of undergraduate degrees in areas such as biological sciences (59.8%) and medical science (84.5%), they remain a minority in areas such as Engineering (18.5%) and Computer sciences (17.7%—down from 28% in 2000). Further, while women's share of graduate studies has improved in the last few years, these figures don't flow onto senior academic and career positions. Women's share of S&E occupations is roughly half that of their participation in the general workforce, with a much lower percentage of jobs in professions such as physical scientists (32%), math/computer scientists (25%), and engineers (11%): <http://www.nsf.gov/statistics/wmpd/>.
- 4 Stereotype threat refers to the negative impact on girl's performance when stereotypes about innate abilities are reinforced—for example, girls will not perform as well on tests when told boys are better than girls at math, but perform better when told both are equally as good at math.
- 5 There are, however, some useful sites and blogs that comment on science and sf: see Peggy Kolm's blogs on science and sf, and women in science: <http://sciencefictionbiology.blogspot.com/>; <http://sciencewomen.blogspot.com/>. Also of interest is a site I started a few years ago to try and track female scientists in fiction (and from which many of the examples herein are drawn): <https://projects.ivec.org/womeninscience/>. The site allows users to suggest further entries online.
- 6 Another interesting example from outside the Anglo-American tradition is a scientific utopia written by a Bengali woman, Rokeya Sakhawat Hossain, in 1905, *Sultana's Dream*.
- 7 The apparent success of Lang and many other minor female scientists in the book are, however, undercut by the fact that the broader system of gender politics remains untouched, with most powerful political and administrative roles occupied by men.

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## Bad Science

(cont. from p. 9)

*Delusions of Gender*, subtitled *How Our Minds, Society, and Neurosexism Create Difference*, is the ideal book for feminists who feel like lone voices in the wilderness. Fine uses a slightly sarcastic tone as she comments on the errors she finds in the research and the over-selling of small differences. She touches on all the important issues while relegating extensive detail to the footnotes, making it an easy read for the lay person. In addition to providing useful information, *Delusions of Gender* is great fun to read.

*Brain Storm*—subtitled *The Flaws in the Science of Sex Differences*—focuses on how far brain difference research has strayed from scientific method. Jordan-Young's work is not limited to the studies that purport to show differences between genders; she also looks at studies on the causes of homosexuality, many of which rely on the assumption that gay men must have been feminized and lesbians masculinized in the womb and try to tie those preconceptions to testosterone or its lack. A sociomedical scientist, Jordan-Young critiques the work of other scientists in a polite but devastating tone. In her introduction, she states, "we have enough information to eliminate the simplistic story of brain organization as it's currently understood," and her book does just that. This book requires taking the time to understand the research being done in order to comprehend her discussion of the flaws, but I found it the most rewarding.

Both Fine and Eliot point out the significant flaws in a study that is often cited as proving that baby boys and girls are different. Jennifer Connellan, a graduate student working with Baron-Cohen, did a study in which 102 newborns were given a choice of looking at a human face or a mobile. Boys, Connellan reported, looked at the mobile 52% of the time and at the face 46% of the time, while girls spent 41% of their time on the mobile and 49% on the face. These figures have been trumpeted by Brizendine and other researchers like psychologist Susan Pinker and her brother, linguist Steven Pinker. While these findings are statistically significant, both Fine and Eliot point to problems in the study, the most significant of which is that Connellan knew the sex of some of the babies. Studies of infant cognition by experts such as Elizabeth Spelke have failed to find any differences at all, while still others have found babies of both sexes more

interested in mobiles or that boys preferred faces more often than girls.

Fine devotes a good deal of space to debunking Brizendine. She quotes one review that says the book is "riddled with scientific errors" and mentions the work of Mark Liberman, a linguistics professor who has pointed out on the Language Log blog many of Brizendine's mistaken comments about the difference between male and female communication styles. Liberman has frequently noted on the blog that studies claiming women use 20,000 words a day to men's 7,000 is inaccurate.

Jordan-Young doesn't bother with Brizendine or the other pop-science writers; her work focuses on the flaws in serious scientific studies. I found her analysis of studies that purport to show the different effects on the brain of the steroid hormones fetuses receive in utero the most compelling part of her book. Jordan-Young points out that by labeling these steroids as sex hormones, we have developed exaggerated ideas tying estrogen to womanly behavior and testosterone to male. She also points out that studies of the effects of such hormones are quasi-experiments, based on work with people with such conditions as congenital androgen hyperplasia, which is sometimes the result of excess androgen, or androgen insensitivity syndrome, in which the fetus does not respond to androgen. Obviously it would be highly unethical to dose fetuses with different hormones to see how they turn out, so scientists can only deduce their effects from subjects whom they know have had unusual hormone exposure. The sample size for such studies is small, and the evidence in many cases shows that environmental and cultural factors affected the subjects as much as their hormonal abnormalities did, making the results less than compelling. One example concerns boys raised as girls when their penises are insufficient and surgery is performed to convert their external genitalia. Because the parents are aware that the child was originally male, their assumptions about their child's "true" sex influence their childrearing.

Jordan-Young's discussion of the science of hormones and human sexuality nails numerous examples of observer bias affecting results. Many of the studies she looked at were based on outdated assumptions about male and female sexuality. For example, researchers working through the 1960s apparently presumed that passivity is an appropriate characteristic of female

*"...the evidence in many cases shows that environmental and cultural factors affected the subjects as much as their hormonal abnormalities did"*

*"Jordan-Young's discussion of the science of hormones and human sexuality nails numerous examples of observer bias affecting results."*



## Bad Science (cont. from p. 23)

*"[S]cientists must keep their own cultural biases about gender out of their research if they hope to arrive at valid results."*

sexuality, while later studies allowed for a more active female interest in sex. Yet researchers often treat the studies as comparable, failing to notice that the characteristics described as inherently male or female are no longer the same.

Jordan-Young, Fine, and Eliot have done important work. It is certainly useful for those of us who are skeptical about major brain differences between the sexes to have data showing the research is flawed, though of course the fact that many of the studies were poorly done does not prove that there are no differences. Brain research is in its infancy, and it will take many more years of research before anyone can credibly say whether such differences exist and how significant they are, and produce solid evidence for their assertions.

And that is the second reason why this work—and particularly Jordan-Young's detailed dissection of existing research—is so important. Science progresses by critique. If, as it appears, so many brain researchers are approaching their work with unquestioned and inaccurate assumptions, criticism of their methods and assumptions may make them rethink their approach.

But there's a third reason for debunking the myth of brain difference: these ideas are prominent in popular culture. The professors who blog on Language Log frequently lament the poor coverage of scientific research by the mainstream media, which tends to spread more misinformation than fact. So-called educators are now involved, using the flawed research (and contributing some of their own) to argue for separate schools and separate approaches for girls and boys. It's probably just my own paranoia kicking in, but I'm sure some of them don't just want separate math classes (so boys can soar and girls can learn to do a little arithmetic), but also a revival of home economics classes limited to girls and shop classes for boys.

Research into the operations of the human brain is an important field of science, and examining how differences among humans are reflected in brain structure can certainly contribute to such research. But as with the study of primates—where observational bias based on assumptions about gender roles has been well-docu-

mented—scientists must keep their own cultural biases about gender out of their research if they hope to arrive at valid results. Since unquestioned assumptions about sex differences are so widespread, it is a difficult task to create a study free of their influence, but any research purporting to find a vast difference between male and female brains that has not allowed for observational bias will necessarily be flawed.

My own bias is clear: I don't think research will find significant gendered differences in our brains, any more than it will find significant raced differences. I suspect that brain research will eventually find a range of interesting differences among human beings in general, one that might contribute to an understanding of the different ways people learn, for example. But I'm willing to bet that instead of neatly breaking down along gender lines, those findings will show a continuum of difference across all human beings.

Meanwhile, we should take a closer look at the cultural influences on gendered behavior within societies. No one on this planet is currently being raised as gender-neutral: no matter how careful parents are, cultural ideas about what's "appropriate" will be adopted by children.

A serious discussion of the idea that there may not be much difference at all between men and women is a relatively new phenomenon, and most of the science in the field done before the mid-to-late 20th century is not merely flawed, but laughable. The notion that men and women are similar is not only new territory, it is also uncomfortable territory. In addition to making sure that scientific research into sex differences is properly done before using it to push people back into culturally more acceptable roles, we must also remember how new all this is and give up our illusion that because we have developed some measure of legal gender equality in the United States, we no longer need feminism.

*"A serious discussion of the idea that there may not be much difference at all between men and women is a relatively new phenomenon..."*

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Nancy Jane Moore has trained in martial arts for close to three decades. She holds a fourth-degree black belt in Aikido. Originally trained as a lawyer, she has published science fiction since the 90s including the novella *Changeling* (Aqueduct Press).





## Notes

- 1 Gwyneth Jones, *Imagination/Space* (Seattle: Aqueduct Press, 2010), 61.
- 2 Louann Brizendine, *The Female Brain* (New York: Broadway Books, 2006); *The Male Brain* (New York: Broadway Books, 2010).
- 3 Cordelia Fine, *Delusions of Gender* (New York: W.W. Norton & Co., 2010), location 2,760 (Kindle edition).
- 4 <http://languagelog.ldc.upenn.edu/nll>.
- 5 <http://www.webmd.com/balance/features/how-male-female-brains-differ>.
- 6 Anna Fels, *Necessary Dreams* (New York: Pantheon Books, 2004).
- 7 Cordelia Fine, *Delusions of Gender* (New York: W.W. Norton & Co., 2010).
- 8 Rebecca M. Jordan-Young, *Brain Storm* (Cambridge: Harvard University Press, 2010).
- 9 Lise Eliot, *Pink Brain, Blue Brain* (New York: Houghton Mifflin Harcourt, 2009).
- 10 Simon Baron-Cohen, *The essential difference: the truth about the male and female brain*. (New York: Basic Books, 2003).

## Where the Juice Is (cont. from p. 11)

Best Long Form in English (*In the Company of Others*, also in 2002). And you've won other major awards as well. Do you have any thoughts on what you've won?

JC: I love shiny things? Seriously, it is gratifying and always a delightful surprise to have a beloved project recognized. When it's a work of my fiction, or that of my authors, I'm thrilled. When it's for my work using science fiction to develop scientific literacy, I view it as a milestone and vastly encouraging.

CSZ: You teach as well as write fiction, and you've written on teaching. And you edit fiction, too. Of those three activities (teaching, writing fiction, and editing) which is the most fun? Which is the most rewarding?

JC: If I only did one thing, I'd quickly lose interest. Something in my hardwiring (or software?) demands novelty and change. I've a penchant for moving furniture around, if I can't do anything else. So having the chance

to switch from writing-brain to editing-brain to working-with-groups-of-people-brain is important to me.

I do love giving writing workshops. The sizzle of all that creativity is a great boost. Editing? That keeps me honest. I've had the privilege of working with authors who write much better than I do. Writing my own stories? I have to say that's closest to the heart. If it weren't fun and joyous and constantly fresh-feeling (we'll skip all the hard parts, shall we?), I wouldn't keep doing it.

The most rewarding? In a cash-on-the-table sense, it's what I no longer do, namely writing and editing nonfiction. That's an observation, not a complaint. For me, writing fiction, and all that goes with it, continues the frame of mind I had at three. I have questions. I want to find my own answers.

CSZ: Your first books were nonfiction: educational and academic titles. But if you could write a popular, mass market nonfiction book on one scientific topic, what would it be? Could you do it with the same passion you bring to fiction?

JC: Just one? Hmm. I'd like to write a natural history of our backyard, which would be about the edge of the boreal forest, meadows, and freshwater streams. I've seen quite a few over the years, and none seem, to me, to capture the whole of it. The interactions, seasonal changes, the amazing new discoveries about creatures we think we know, their ongoing evolution, how to encourage wildlife, how to become part of it...yes, I could do that in a heartbeat.

I'm also really interested in biodiversity. Communication systems. The oceans. Biofilms. Where we're going with artificial body parts. String theory. Science is like that, you know. Like dragging tinfoil past a kitten.

As for the passion? If you haven't guessed by now, ask anyone in my family. I've one gear: full speed ahead!

Perhaps that's something science has given me. Or something that led me to science. I immediately engage, heart and mind, wherever my curiosity leads me.

It's not, after all, the answers that matter.

It's asking the questions.

*"For me, writing fiction, and all that goes with it, continues the frame of mind I had at three. I have questions. I want to find my own answers."*

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In 2008 Nisi Shawl won the James Tiptree Jr. Award for *Filter House* (Aqueduct Press). She was Guest of Honor at WisCon 5. She is on the Clarion West Board of Directors. She also is Reviews Editor for *The Cascadia Subduction Zone*.



# Women Scientists in History

## Jennifer Mondfrans

When people ask me why I did a series of historical women scientists, I always tell them it was because no one thought there were any, besides Marie Curie. I remember a conversation I had with a friend of a friend, when I told him what I was working on, he said, "Well, they must not have done anything important, otherwise I would've heard about it." Such ignorance is prevalent mostly because history favors men. The truth is the efforts of women scientists have been a huge contribution from which many men a huge contribution, and many men scientists have benefited. Albert Einstein himself admitted he would not have understood relativity without the brilliant work of Emmy Nother. And Edwin Hubble built his theory on Henrietta Swan Leavitt's genius interpretation of Cepheid stars.

It took a great deal of time and searching through websites filled with bright blue hyperlinks to find these women. Then it took me time to understand what they did. Not to say that I really do; they were all geniuses in their fields. But I wanted to know what they did and how they did it so I could incorporate their work within the portraits. Most of these women only have one photo.

I set out to create a series of pop portraits that would look iconic. Each piece is framed with plaques that explain what the scientist did. It is truly astounding the accomplishments they achieved; so the accompanying text was a way to teach people about them in a positive light, without reference to the fact that they were overlooked. For each portrait the last line references her work as incorporated into her fashion—an allusion to how society trivializes women's accomplishments by focusing on her superficial appearance.

I used water-soluble wax pastel for their faces and acrylic for the clothes and background. The portraits are on canvas, which gives the wax pastel texture and the skin a luminescent look.

### Barbara McClintock

Geneticist 1902-1992

She received the Nobel Prize in medicine in 1983 for showing that genes could transpose (move around) within chromosomes. This so-called "jumping gene" taught her that stress and the genome's reaction to it underlie our evolution. Her revolutionary understanding came from studying simple grains of maize.

Barbara poses with her maize.

### Kathleen Yardley Lonsdale

Chemist 1903-1971

She solved a 64-year contention in chemistry by confirming experimentally the ring structure of benzene, the aromatic compound responsible for scent. She also gave the structure's precise molecular dimensions. In 1945, she was the first woman to be elected to fellowship in the Royal Society, which had excluded women for 285 years.

Kathleen looking clever in her benzene ring glasses.

### Lise Meitner

Physicist 1878-1968

She gave the first theoretical explanation of the fission process. While exiled in Stockholm during the second world war, she kept in constant collaboration with her partner in chemistry, Otto Hahn. Although the Nobel Committee overlooked her vital contribution, the element Meitnerium, a transuranian element, is named after her.

Lise basks in the sparks of fission..





**Emmy Noether**

Mathematician 1882-1936

Emmy Noether made fundamental contributions in abstract algebra, developing ideal theory, the basis of modern ring theory; and in theoretical physics, establishing relationships between symmetries of a system and conservation laws. At her death, Einstein wrote in her obituary: Fraulein Noether was the most significant creative mathematical genius thus far produced since the higher education of women began.

Emmy works her First Theorem as a bow tie.

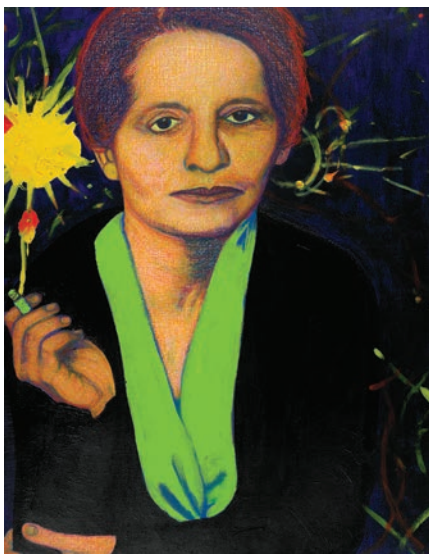


**Maria Mitchell**

Astronomer 1818-1889

She won the gold medal in a competition held by the King of Denmark to discover a new comet in 1847. Mitchell's comet is now identified as C/1847 tl. In 1848, she was the first woman elected to the American Academy of Arts and Sciences. She co-founded the Association for the Advancement of Women in 1873.

Maria's comet streaks through her hair.



**Marie Geoppert-Mayer**

Physicist 1906-1972

She won the Nobel Prize in physics in 1963 for her discoveries concerning the meaning of the magic numbers (nuclei with a special number of protons). She established mathematically that these numbers are the nuclear counterpart to the closed shells of electrons at the atomic level.

Marie on the move in her magic numbers hat.



See back cover for more portraits



### Chien Shing Wu

Physicist 1912-1997

In 1957, she devised the experiment which disproved the law of conservation of parity—an amazing feat in physics. She was the first woman to receive the Comstock Award from the National Academy of Sciences in 1964. After all this success, she moved into medical research to study sickle cell anemia.

Chien dresses up a sickle cell slide..



### Elizabeth Blackwell

Medical Doctor 1821-1910

She was the first woman awarded a medical degree in the United States. No hospital would employ her, so in 1853 she opened a dispensary in a tenement district of NYC, which later became the New York Infirmary of Women and Children. She was a visionary doctor who worked for those in the poorest conditions.

Elizabeth sports a 19th century travel stethoscope.

\$4.00

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