Old Woman and the Sea:
Evolution and the Feminine Aquatic

*by Erika Lorraine Milam**

ABSTRACT

A curious sympathy between second-wave feminism and evolutionary theory forged a powerful connection between women and the sea. Speculative nonfiction by Elaine Morgan rewrote humanity's evolutionary past to be more fluid and more feminist in her *Descent of Woman* (1972). Later fiction—including Kurt Vonnegut's *Galápagos* (1985) and biologist Joan Slonczewski's *A Door into Ocean* (1986)—posited alternative futures in which long association with the ocean resulted in the evolution of new forms of biological and social order. The elusive boundary between science and fiction in these narratives highlights both the moral authority of nature and the subversive connotations of the aquatic.

> Anthropology, like the best science fiction, celebrates cultural difference as productive tension between the culture-specific and the universally human.
>
> —Regna Darnell, 2001[1]

INTRODUCTION

It was the dawning of the Age of Aquarius.[2] Women poured into professional anthropology, as graduate students and established faculty members alike questioned the necessity of conceptualizing the evolution of humanity as driven primarily by men on the hunt.[3] Rigorous scientific work in cultural anthropology and primatology allowed "Woman the Gatherer" to take her place alongside "Man the Hunter."[4] Elaine

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[1] Regna Darnell, *Invisible Genealogies: A History of American Anthropology* (Lincoln, Nebr., 2001), 322.

[2] James Rado and Gerome Ragni, lyrics; Galt MacDermot, music, *Hair: The American Tribal Love-Rock Musical* (1967). In the original off-Broadway release of *Hair*, the character Claude was a space alien.

[3] Donna Jeanne Haraway, *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (New York, N.Y., 1989).

[4] Richard B. Lee and Irven DeVore, eds., *Man the Hunter* (Chicago, Ill., 1968); Sally Linton, "Woman the Gatherer: Male Bias in Anthropology," in *Women in Cross-cultural Perspective*, ed. S. E. Jacobs (Urbana, Ill., 1971), 9–21; Nancy Tanner and Adrienne Zihlman, "Women in Evolution, Part 1, Innovation and Selection in Human Origins," *Signs* 1 (1976): 585–608.

Morgan, a writer of radio shows for BBC Wales, provided one of the first pop-evolutionary alternatives to the "Tarzanist" assumptions of many tales of human evolution. She noted: "Everything depends on context. A knife is a weapon or a tool according to whether you use it for disemboweling your enemy or for chopping parsley."[5] Morgan imbued agency in humanity's female ancestors by adding a controversial aquatic phase to the narrative of human evolution.[6] Living at the water's edge, she suggested, may have protected early humans during a time of Pleistocene drought and provided them with plenty of food. Substantial time in the water, she reasoned, would have left indelible marks on our bodies, which she identified in our layer of subcutaneous fat, the swirled patterns of hair on the backs of men, or the breasts of women that provide babies with a firm grip on their mothers' bodies.

Whether based in the ocean, the desert, or the forest, ecological interpretations of human evolution played a crucial role in postwar evolutionary epics of humanity's past.[7] Scientists suggested our ancestors' transition from forest-dwelling apes to hunters on the open savannah depended crucially on this same shift in ecological environment. Forest-dwelling vegetarian gorillas and peaceful chimpanzees provided powerful alternative primate models to the hierarchical baboons that roamed far beyond the protection of the trees.[8] Cross-cultural anthropological comparisons appeared to echo assumptions that members of human communities who dwelled in the forests should be more pacific than those who lived in the open savannahs.[9] The forest, in each of these examples, provided analogical evidence for an irenic Edenic past before our ancestors' profound transformation into hunters in the crucible of the African savannah. These narratives also spoke to ecology's functional centrality to reconstructions of humanity's past after the Second World War. In the mid-1970s, this easy contrast between forest and savannah met with a crucial difficulty when Jane Goodall's research group at Gombe realized chimpanzees killed each other too. According to *National Geographic*, they were capable of war.[10]

In imagining alternative possible futures for humanity, writers of speculative science and science fiction thus found in the aquatic a realm of conceptual possibility

[5] Elaine Morgan, *The Descent of Woman* (1972; repr., London, 1985), 156. On the opening of the ocean to humanity's gaze in the 1950s, see Helen Rozwadowski, "From Danger Zone to World of Wonder: The 1950s Transformation of the Ocean's Depths," *Coriolis* 4 (2013): 1–20.

[6] Morgan first came across this idea in Desmond Morris, *The Naked Ape: A Zoologist's Study of the Human Animal* (New York, N.Y., 1967), 43–5, as Morris discussed Sir Alister Hardy's proposal that humanity might have had a heretofore unrecognized aquatic past; Alister Hardy, "Was Man More Aquatic in the Past?" *New Scientist*, 17 March 1960, 642–5. On the narrative conventions of evolutionary histories as heroic tales, see Misia Landau, "Human Evolution as Narrative," *Amer. Scient*. 72 (1984): 262–8; and Landau, *Narratives of Human Evolution* (New Haven, Conn., 1991).

[7] Nasser Zakariya, *A Final Story: Science, Myth, and Beginnings* (Chicago, Ill., 2017); Erika Lorraine Milam, *Creatures of Cain: The Hunt for Human Nature in Cold War America* (Princeton, N.J., 2019).

[8] Donna Haraway, "The Politics of Being Female: Primatology Is a Genre of Feminist Theory," part 3 in *Primate Visions* (cit. n. 3), 279–382; Susan Sperling, "The Troop Trope: Baboon Behavior as a Model System in the Postwar Period," in *Science without Laws: Model Systems, Cases, Exemplary Narratives*, ed. Angela Creager, Elizabeth Lunbeck, and Norton Wise (Durham, N.C., 2007), 73–89.

[9] Julian Steward, *Theory of Culture Change: The Methodology of Multilinear Evolution* (Urbana, Ill., 1955); Marston Bates, *The Forest and the Sea: A Look at the Economy of Nature and the Ecology of Man* (New York, N.Y., 1960). In anthropology, see, for example, Colin M. Turnbull, *The Forest People* (New York, N.Y., 1962); and Turnbull, *The Mountain People* (New York, N.Y., 1972).

[10] Jane Goodall, "Life and Death at Gombe," *National Geographic*, May 1979, 592–621.

that potentially avoided the violence of terrestrial landscapes.[11] The US Navy had certainly tried to militarize the oceans, even going so far as to call their depths "inner" space, a direct parallel to the involvement of the air force with the exploration of "outer" space. In 1963, Vice Admiral William F. Radborn suggested that in a decade, the navy would operate submarines that could conduct research at a depth of 20,000 feet and atomic-powered transponders to communicate under sea ice, and officers would work at depths of 1800 feet for a month at a time. An editor of the *Boston Globe* added, "were it not for the author . . . the description of what the United States fleet will be like 10 years from now would seem like a page out of science fiction."[12] Yet the promise of the oceans as a limitless frontier eventually paled in comparison to the vastness of space and excitement over the Apollo missions.[13]

In deep evolutionary time, our most distant ancestors had crawled out of the salty brine that spawned all planetary life, long before they encountered the arid savannah.[14] Even without the aquatic ape, oceans thus offered a reminder of humanity's epic primordial past. As Rachel Carson wrote in her immensely popular *The Sea Around Us*, "as life itself began in the sea, so each of us begins his individual life in a miniature ocean within his mother's womb, and in the stages of his embryonic development repeats the steps by which his race evolved, from gill-breathing inhabitants of a water world to creatures able to live on land."[15] Although the far distant ancestors of the human lineage had left the ocean millions of years ago, Carson noted, humanity had slowly been finding its way back to the sea. Humans "could not physically re-enter the ocean as the seals and whales had done," but using their ingenuity and reason, they could "re-enter it mentally and imaginatively."[16] Carson wrote with a sure pen about the charismatic wonders of the ocean, including the origins of life itself in the murky, wet past; "the unending darkness" of the deep abyss; and the "inverted 'timber line'" below which vegetation cannot grow.[17] Throughout the book, she also wove a message of hope and cyclical renewal. Even "the very iciness of the winter sea" promised a new spring, just as particles of material were "used over and over again, first by one creature, then by another."[18]

[11] On the long fascination with forests as a wild precursor to civilization in Western thought, see Robert Pogue Harrison, *Forests: The Shadow of Civilization* (Chicago, Ill., 1992). On the role of oceanic cetaceans in Cold War imagination, see D. Graham Burnett, *The Sounding of the Whale: Science and Cetaceans in the Twentieth Century* (Chicago, Ill., 2012).

[12] Vice Admiral William F. Raborn, "The Navy's Role in Nuclear Age: Exploring 'Inner' Space," *Boston Globe*, 25 February 1963, 10.

[13] Helen Rozwadowski, "Arthur C. Clarke and the Limitations of the Ocean as a Frontier," *Environ. Hist.* 17 (2012): 578–602; Neil Maher, *Apollo in the Age of Aquarius* (Cambridge, Mass., 2017); Michael J. Neufeld, ed., *Spacefarers: Images of Astronauts and Cosmonauts in the Heroic Age Era of Spaceflight* (Washington, DC, 2013); Kelly Moore, *Disrupting Science: Social Movements, American Scientists, and the Politics of the Military, 1945–1975* (Princeton, N.J., 2008).

[14] Stefan Helmreich, *Alien Ocean: Anthropological Voyages in Microbial Seas* (Berkeley, Calif., 2009). These associations continue to reverberate through recent science fiction narratives. In *Gravity*, directed by Alfonso Cuarón (2013; Burbank, Calif.: Warner Bros. Entertainment, 2014), DVD, Sandra Bullock is reborn to a new life as she staggers out of the ocean after her harrowing space incubation and splashdown into the watery depths.

[15] Rachel Carson, *The Sea Around Us* (1951; repr., London, 2014), 20.

[16] Ibid., 21.

[17] Ibid., 65, 81. See also Jacques-Yves Cousteau, with Frédéric Dumas, *The Silent World* (New York, N.Y., 1953).

[18] Carson, *The Sea* (cit. n. 15), 46, 38.

Countercultural associations of the oceans added to their draw as an alternative to normative terrestrial conceptions of intelligence and sexuality.[19] Dolphins entered the public spotlight as the aquatic equivalent of primates—an intelligent species capable of recognizing themselves in mirrors and communicating through sound.[20] Connections between women and water have a long history, from mermaids to synchronized swimming.[21] More important for Morgan may have been local folkloric transformative traditions that featured female selkies, who could take both human and seal forms.[22] Building on these tropes, Morgan crafted a feminist, aquatic account of humanity's evolutionary past as an antidote to stories about the transformative power of men on the savannah. She wrote of a past in which the key characteristics that made us human—our bipedal posture, our capacity for spoken language and facility with tools, our ability to cooperate with others—arose when our human ancestors partially adapted to life in the intertidal zone. With the added buoyancy of water, Morgan suggested, they learned to wade in search of food after the plentiful supplies of the forest vanished. They wielded rocks to crack open shellfish. With most of their bodies surrounded by water, they lost their fur, gained subcutaneous fat to protect against hypothermia, and over time developed the capacity to communicate verbally. Morgan's aquatic apes were more cooperative than the savannah beasts of anthropological tomes, as their ecology required gathering proteinaceous creatures rather than hunting them. Even if readers enjoyed her sarcastic rejoinder to life on the savannah, however, most assumed her reconstruction of humanity's past was mere conjecture. In *The Descent of Woman*, Morgan suggestively reinterpreted existing paleoanthropological data but supplied no new evidence of her own beyond appeals to readers' common sense experience of their own bodies. Practicing evolutionists deemed her aquatic theory the worst kind of pseudoscience (fig. 1).[23]

For authors of science fiction, however, oceans continued to provide an ecologically plausible alternative to humanity's own past and a fruitful space for speculation about its future. This essay examines two American science fiction novels—Kurt Vonnegut's *Galápagos* and Joan Slonczewski's *A Door into Ocean*, both published in the mid-1980s—that create a distant future for humanity defined by water.[24] Von-

[19] D. Graham Burnett, "A Mind in the Water," *Orion Magazine*, May–June 2010, 38–51; John C. Lilly, *Man and Dolphin* (New York, N.Y., 1961).

[20] D. Graham Burnett, "Shots Across the Bow," chap. 6 in *The Sounding* (cit. n. 11), 517–645; see also Leo Slizard, *The Voice of the Dolphins, and Other Stories* (New York, N.Y., 1961); Arthur C. Clarke, *Dolphin Island: A Story of the People of the Sea* (New York, N.Y., 1963); Douglas Adams, *The Hitchhiker's Guide to the Galaxy* (1979; repr., New York, N.Y., 1981); and Alexander Jablokov, *A Deeper Sea* (New York, N.Y., 1992). In Stanisław Lem's *Solaris* (1961; repr., New York, N.Y., 1970), the planetary ocean itself is a self-aware, intelligent entity.

[21] Astrida Neimanis, "Hydrofeminism: Or, On Becoming a Body of Water," in *Undutiful Daughters: New Directions in Feminist Thought and Practice*, ed. Henriette Gunkel, Chrysanthi Nigianni, and Fanny Söderbäck (New York, N.Y., 2012), 85–99.

[22] See, for example, Rosalie K. Fry, *Child of the Western Isles* (London, 1957), a fantasy novel for children that John Sayles would later use as the basis for his film *The Secret of Roan Inish* (1994; Culver City, Calif.: Sony Pictures Home Entertainment, 2000), DVD.

[23] Erika Lorraine Milam, "Dunking the Tarzanists: Elaine Morgan and the Aquatic Ape Theory," in *Outsider Scientists: Routes to Innovation in Biology*, ed. Oren Harman and Michael R. Dietrich (Chicago, Ill., 2013), 223–47; Jerold Lowenstein and Adrienne Zihlman, "The Wading Ape: A Watered-Down Version of Human Evolution," *Oceans* 13 (1980): 3–6; Ian Tattersall and Niles Eldredge, "Fact, Theory, and Fantasy in Human Paleontology," *Amer. Scient.* 65 (1977): 204–11, on 207.

[24] Kurt Vonnegut, *Galápagos* (1985; repr., New York, N.Y., 1999); Joan Slonczewski, *A Door into Ocean* (1985; repr., New York, N.Y., 1986).

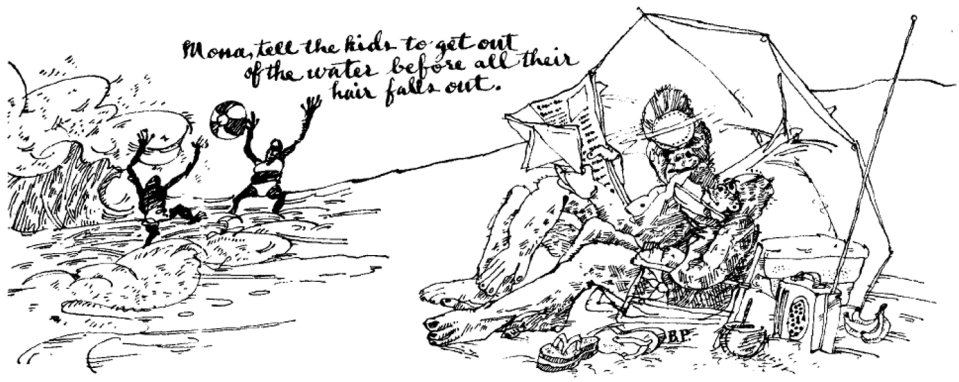

Figure 1. *Elaine Morgan reasoned in* Descent of Woman *(1972) that extended exposure to water over generations would have caused human ancestors to lose their body hair, learn to walk upright thanks to the added buoyancy of the water, and gain a layer of subcutaneous fat to help regulate internal body temperatures. This cartoon accompanied a thoroughgoing critique of Morgan's arguments and her evidence cowritten by a paleoanthropologist and a physician: Lowenstein and Zihlman, "Watered Down Version"* (cit. n. 23). *(Illustration by Bill Prochnow.)*

negut and Slonczewski grounded their narratives in current biological theory, paleobiological and microbiological, respectively. Both imagined life after an apocalypse of human causation. In Vonnegut's darkly humorous account, human evolution continues but only when people are stripped of weapons and other forms of technology. Slonczewski maintained a fierce optimism in her writing as she forged a link between women and nature to envision a future in which (some) humans learned to live in harmony with the ocean rather than seeking to conquer it. Both books served to warn readers of the hubris inherent to capitalism run amok.

Although it hardly comes as a surprise that authors of science fiction, even evolutionary sci-fi, worked to make their narratives scientifically accurate, both books would have been classified in the 1980s as "soft" (rather than "hard") science fiction—a term often accompanied by a healthy dose of derision. Science fiction author and critic Charles Platt, for example, vilified the rise of such "New Wave" science fiction, lamenting that "the body of literature I love has been doped up and defiled, draped in fake finery and turned into a flabby old hooker smelling of festering lesions and cheap perfume."[25] He lamented the loss of the brash, rebellious feel of the science fiction he had read and fallen in love with as an adolescent boy in the 1950s. In its place, he suggested, came a "new 'soft' science fiction" that verged on fantasy. Due to the popularity of Richard Adams's *Watership Down* and J. R. R. Tolkien's three-volume *Lord of the Rings*, followed by novels by Robert Heinlein, Robert Howard, Frank Herbert, Terry Brooks, and others, Platt posited that fantasy had become a genre in its own

[25] Charles Platt, "The RAPE of Science Fiction," *Science Fiction Eye*, July 1989, 44–9, on 45. See also Pamela Sargent's response in her introduction to *Women of Wonder: The Contemporary Years: Science Fiction by Women from the 1970s to the 1990s*, ed. Sargent (Orlando, Fla., 1995), 3–6.

right.[26] At the same time, women had created a new strand of science fiction with an "admirable" "concern for human values," he wrote. The success of Joan Vinge, Vonda McIntyre, Ursula Le Guin, Joanna Russ, Kate Wilhelm, and Carol Emshwiller had helped erode "science fiction's one great strength that had distinguished it from all other fantastic literature: its implicit claim that events described *could actually come true*."[27] At the root of his jeremiad was a belief that the commercial success of science fiction starting in the 1960s produced a glut of mediocre writing, all of which sold brilliantly and made it difficult to discover any true emerging talent.[28] Too often, he deemed, authors invented the impossible, and bent the known rules of the physical world to save themselves from working out rigorously scientific mechanisms. (His complaints echoed those mounted by practicing anthropologists against Morgan's aquatic ape.)

Platt's historical taxonomy of the genre mirrored the rising currency of "soft science" as a term used to describe nonlaboratory social science research, from anthropology to human biology.[29] Yet, his characterization of some science fiction as "soft," and therefore unconcerned with plausibility, elided the careful attention many of these authors paid to contemporary social science. Platt's categories thus implicitly reflected the denigration of the social sciences as *science*, rather than a lack of engagement with their precepts or analytical methods.[30] For technological optimists in the 1980s, the progress of science and technology could and should exist outside the political realm. Good science—"real" science—they believed, was apolitical, especially when it came to theories of human nature.[31] With the benefit of hindsight, we can see more easily that authors of soft science fiction in the 1980s, like Vonnegut and Slonczewski, took world building to be serious scientific work impossible to separate from moral import.[32]

In their hands, aquatic landscapes provided a powerful means of challenging traditional accounts of human evolution that correlated arid savannahs with all-male hunting groups, while still adhering to the biological principle that through natural

[26] Richard Adams, *Watership Down* (New York, N.Y., 1972); J. R. R. Tolkien, *The Fellowship of the Ring* (Boston, Mass., 1954); Tolkien, *The Two Towers* (Boston, Mass., 1954); Tolkien, *The Return of the King* (Boston, Mass., 1955).

[27] Platt, "The RAPE," (cit. n. 25), 46 (emphasis in the original); Joan Vinge, *The Snow Queen* (New York, N.Y., 1980); Vonda McIntyre, *Dreamsnake* (New York, N.Y., 1978); Ursula Le Guin, *A Wizard of Earthsea* (Berkeley, Calif., 1968); Le Guin, *Left Hand of Darkness* (New York, N.Y., 1969); Le Guin, *The Dispossessed* (New York, N.Y., 1974), Le Guin, *The Word for World is Forest* (New York, N.Y., 1976), among many others; Joanna Russ, *The Female Man* (New York, N.Y., 1975); Kate Wilhelm, *Where Late the Sweet Birds Sang* (New York, N.Y., 1976).

[28] See also Amanda Rees, "From Technician's Extravaganza to Logical Fantasy: Science and Society in John Wyndham's Postwar Fiction, 1951–1960," in this volume.

[29] Based on searches in JSTOR and Ngram Viewer, both "hard science" and "soft science" existed in earlier decades, but they increased in frequency as analytical terms in the 1960s.

[30] Mark Solovey and Hamilton Cravens, eds., *Cold War Social Science: Knowledge Production, Liberal Democracy, and Human Nature* (New York, N.Y., 2012); Joel Isaac, *Working Knowledge: Making the Human Sciences from Parsons to Kuhn* (Cambridge, Mass., 2012).

[31] Ullica Segerstråle, *Defenders of the Truth: The Battle for Science in the Sociobiology Debate and Beyond* (New York, N.Y., 2000); Aaron Panofsky, *Misbehaving Science: Controversy and the Development of Behavior Genetics* (Chicago, Ill., 2014); David Kaiser and W. Patrick McCray, eds., *Groovy Science: Knowledge, Innovation, and American Counterculture* (Chicago, Ill., 2016).

[32] Despite the left-leaning politics of many academics, some "hard social science" fiction remained quite conservative in outlook; see many of the stories collected in Leon E. Stover and Harry Harrison, eds., *Apeman, Spaceman* (New York, N.Y., 1968); and Willis E. McNelly and Leon E. Stover, eds., *Above the Human Landscape: A Social Science Fiction Anthology* (Pacific Palisades, Calif., 1972).

selection physical environments inexorably shaped the creatures inhabiting them.[33] Alternatives to traditional evolutionary narratives took a variety of forms. Vonnegut used *Galápagos* to highlight the importance of contingency to the normal operation of evolution. In *A Door into Ocean*, Slonczewski took inspiration from the resonance between new-wave science fiction and second-wave feminism that allowed authors to explore alternatives to the techno-utopian worlds imagined for women by male visioneers.[34] (Ironically, although Platt lamented the demise of techno-utopian factualism, he—like Vonnegut and Slonczewski—feared the destructive potential of rampant capitalism, albeit in its short-term capacity to ruin the core of science fiction by catering too heavily to new audiences.) Alien ecological landscapes thus provided a plausible scientific mechanism for imagining a universal humanity governed by unconventional politics, genders, and economies. The power of the feminine aquatic stemmed not from its association with a single set of affective connotations, but from its generative intellectual slipperiness.

KURT VONNEGUT'S FURRY FEMININE FUTURE

In Kurt Vonnegut's cynical guide to the evolution of humanity, *Galápagos*, 1985 marked the year when a global economic crisis would cripple the world's infrastructure. A devastating strain of bacteria that consumed human egg cells would render all but a handful of women infertile. Only a few humans would escape this fate, having been marooned on the Galápagos Islands by a series of unlikely events, beyond the reach of other people and therefore the spread of the disease. This small handful of women and a single man thus became the progenitors of all future humanity. The story is told from the perspective of the ghost of Leon Trout a million years in the future, having observed the fate of humanity in the meantime.[35] In retrospect, Trout deemed the twentieth century the "era of big brains." Our brains caused us endless amounts of trouble, he repeats throughout the book. As humans had adapted to life in the water, natural selection had shrunk our brains and transformed our hands, which had once been so dexterous, into flippers. Humans became pacific because we could neither conceptualize how to make weapons nor use them. Humanity's evolutionary fate as sleek, furry, "innocent fisherfolk," had been as much a matter of chance as of fitness.[36]

After the Second World War, Vonnegut spent five years studying anthropology at the University of Chicago. Although his anthropological musings often found their way into his fiction, he never published as an anthropologist. When Vonnegut and his second wife, Jill Krementz, visited the Galápagos in 1981, he reported being "fascinated by the island's natural life." He added: "I spent as much time there as Charles Darwin did—two weeks. We had advantages that Darwin didn't have. Our guides all had graduate

[33] Lee and DeVore, *Man the Hunter* (cit. n. 4); E. O. Wilson, *Sociobiology: The New Synthesis* (Cambridge, Mass., 1975); Richard Dawkins, *The Selfish Gene* (New York, N.Y., 1976).

[34] On the masculine precepts of science fiction as a genre, see N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago. Ill., 1999); and W. Patrick McCray, *The Visioneers: How a Group of Elite Scientists Pursued Space Colonies, Nanotechnologies, and a Limitless Future* (Princeton, N.J., 2012), 94–104.

[35] Leon Trout is the son of Kilgore Trout who makes an appearance in a variety of other Vonnegut novels, including *Breakfast of Champions, or Goodbye Blue Monday* (1973) and *Timequake* (1997).

[36] Gilbert McInnis, "Evolutionary Mythology in the Writings of Kurt Vonnegut, Jr.," *Critique: Studies in Contemporary Fiction* 46 (2005): 383–96, on 391; Sheila Pardee, "Drifting and Foundering: Evolutionary Theory in Kurt Vonnegut's *Galápagos*," *DQR Studies in Literature* 57 (2015): 249–65.

degrees in biology. We had motorboats to move us around the islands more easily than rowboats could when Darwin visited the Galapagos in the 1830s. And, most important, we knew Darwin's theory of evolution, and Darwin didn't when he was there."[37]

Soon after returning, Vonnegut gave a lecture in New York City at the Cathedral of St. John the Divine. (According to their online material, the cathedral is the length of six blue whales.) Vonnegut spoke about the strange creatures he had seen on the Galápagos Islands—especially the blue-footed boobies who in courtship iteratively and solemnly raised each beautiful, bright foot to show their prospective mates. He thought about the millions of years needed to create such natural intricacies; this was a span of time vast to us but a mere wink in nature's eye. However long it had taken for nature to craft humans, he feared we were running out of time. Death itself was old, he told his audience, but the scale of our destructive capacity threatened our very existence as a species. The previous night, Vonnegut reported, he had dreamed of meeting the descendants of humanity in a thousand years. In his dream, he asked these survivors how humanity had managed to persist for so long. Their reply? "By preferring life over death for themselves and others at every opportunity, even at the expense of being dishonored."[38]

Three years later, Vonnegut published *Galápagos*, a longer reflection on what would be required for humanity to survive for a million years—orders of magnitude longer than his earlier thought experiment. In Vonnegut's fantasy, an ill-fated celebrity cruise to the renowned islands strands a handful of lost souls on the entirely fictional Santa Rosalia. The members of this genetic bottleneck are rich, poor, likeable, insufferable, and ethnically diverse. Vonnegut took great care to establish the truly random circumstances that led each individual to a place on *Bahía de Darwin*, humanity's new ark to the future.

Vonnegut based his evolutionary theory in *Galápagos* on current trends in biological thought, especially those espoused by Stephen Jay Gould in the pages of *Natural History* magazine.[39] Evolution, for Vonnegut, was necessarily contingent and inconsistently progressive, and it changed its focus in fits and starts. As humanity regressed to a more animalistic state, we also became more peaceful, retreating to a small-brained primeval innocence.[40] (Leon Trout called this progress indeed.) The genetic bottleneck of humanity created by the small handful of survivors in turn creates substantial genetic drift, so that future generations of humans resemble those few individuals left to repopulate Earth. One of the survivors includes a young girl, the first

[37] Quote from Herbert Mitang, "Advantages Darwin Lacked," *New York Times*, 6 October 1985, BR7. See also, Lorrie Moore, "How Humans Got Flippers and Beaks," *New York Times*, 6 October 1985, BR7.

[38] Kurt Vonnegut, "Fates Worse than Death," *North American Review* 267 (1982): 46–9.

[39] Many of Gould's essays were then reprinted in paperback collections, also available when Vonnegut wrote: Stephen Jay Gould, *Ever Since Darwin: Reflections in Natural History* (New York, N.Y., 1977); *The Panda's Thumb: More Reflections in Natural History* (New York, N.Y., 1980); *Hen's Teeth and Horse's Toes* (New York, N.Y., 1983); and *The Flamingo's Smile: Reflections in Natural History* (New York, N.Y., 1985). On Vonnegut's reading of Gould prior to writing *Galápagos*, and his desire to make the novel "reputable scientifically," see his interview with Hank Nuwer, "A Skull Session with Kurt Vonnegut," *South Carolina Review* 19 (1987): 2–23.

[40] Leonard Mustazza, "A Darwinian Eden: Science and Myth in Kurt Vonnegut's 'Galápagos,'" *Journal of the Fantastic in the Arts* 3 (1991): 55–65; Donald Morse, "Thinking Intelligently about Science and Art: Kurt Vonnegut's *Galápagos* and *Bluebeard*," *Extrapolation* 38 (1997): 292–303. Mustazza claims this primeval innocence as ancestral, a contention most evolutionists in the 1980s would not have endorsed. In fact, most "regressions" of humanity in science fiction led to more violent behavior, not less. See David Kirby, "Darwin on the Cutting Room Floor: Evolution, Religion, and Film Censorship," in this volume.

child born on Santa Rosalia, who had a fine pelt of dark hair—a genetic consequence of her grandmother's survival of the atomic bomb in Hiroshima. Trout notes sagely that humans almost certainly would have become hairier eventually, but this happy circumstance speeded the process considerably. Contingency, as manifested in genetic drift as well as punctuated evolutionary changes, was key to paleobiologists' re-imagining of contemporary evolutionary theory in the 1980s, especially for Gould.[41]

Gould hoped to break down popular assumptions that evolutionary fitness somehow meant that the best or brightest individuals were necessarily those who left the most offspring. Sometimes, he reasoned, individuals survived and reproduced because they happened to be in the right place at the right time. Selection could favor, after all, ridiculous traits. The "Irish Elk" (so named despite the fact that it is neither an elk nor exclusively Irish) constituted one of Gould's favorite examples of this phenomenon.[42] Vonnegut discusses the Irish elk explicitly, linking the fate of their antlers to that of human brains. The large size of human brains, according to Vonnegut, had brought humans nothing but misery and had come to imperil our very existence. Building on long-standing tropes in the colloquial science literature of the day, Vonnegut suggested that humans' capacity to conceptualize, manufacture, and use nuclear weapons had outstripped our social savvy in maintaining peace once they existed.[43] "Can it be doubted," the ghostly narrator asks, "that three-kilogram brains were once nearly fatal defects in the evolution of the human race?"[44] He returns again and again to this theme—the very trait that assured our survival, on which humans judged their value and self-worth, was the very same trait that needed to be tamed to ensure the survival of the species. Vonnegut's satire feels especially dire in these moments. To survive biologically, we would need to sacrifice all literature and Beethoven's Ninth Symphony (a point that Vonnegut repeated eight times over the course of the novel).

Yet if Vonnegut really had read Gould as closely as he claimed, he likely knew that evolutionists no longer propagated this mono-causal tale of the Irish elk's extinction. The exceedingly large Pleistocene deer exhibited giant antlers that were so big as to be functionally useless in battle. Gould had suggested they attracted female mates and so were useful in and of themselves, without having to be twisted or turned, much less bashed against the antlers of another male.[45] Despite modern folklore, Gould argued that the species later went extinct because of changing climatic conditions, not the size of the antlers. He also argued vociferously that if scientists were to replay the tape of life, it would never turn out the same.[46] Chance events would intercede. Life would turn out differently. This opens the possibility that for Vonnegut, humanity might not have been as doomed as the narrator—already reconciled to humanity's fate as fisherfolk—insisted.

[41] David Sepkoski, *Rereading the Fossil Record: The Growth of Paleobiology as an Evolutionary Discipline* (Chicago, Ill., 2012); Myrna Perez Sheldon, *Darwin's Heretic: Stephen Jay Gould, 1941–2002* (unpublished).

[42] Stephen Jay Gould, "The Misnamed, Mistreated, and Misunderstood Irish Elk," *Ever Since Darwin* (1979; repr., New York, N.Y., 2007), 79–90.

[43] See, for example, Charles Osgood, *An Alternative to War or Surrender* (Urbana, Ill., 1962), 19; Konrad Lorenz, *On Aggression*, trans. Marjorie Kerr (New York, N.Y., 1956). On colloquial science, see Milam, *Creatures of Cain* (cit. n. 7).

[44] Vonnegut, *Galápagos* (cit. n. 24), 9.

[45] Stephen Jay Gould, "The Origin and Function of 'Bizarre' Structures: Antler Size and Skull Size in the 'Irish Elk,' *Megaloceros giganteus*," *Evolution* 28 (1974): 191–220.

[46] David Sepkoski, "'Replaying Life's Tape': Simulations, Metaphors, and Historicity in Stephen Jay Gould's View of Life," *Stud. Hist. Phil. Biol. Biomed. Sci.* 58 (2016): 73–81.

That humanity had any future, furry or otherwise, looked rather bleak once the handful of remaining people had been marooned on Santa Rosalia. They included newborn Akiko Hiroguchi, her mother Hisako Hiroguchi, Selena MacIntosh, Mary Hepburn (age sixty-one), Captain Adolf Heist (age sixty-six), and six Kanka-bono women from the mountains of Ecuador who kept their names hidden from the rest of the group. As the captain was "a racist," Vonnegut wrote, he was "not at all drawn to Hisako or her furry daughter, and least of all to the Indian women."[47] It was Mary whose curiosity was piqued by her big brain and desire to know "whether a woman could be impregnated by another one on a desert island without any technical assistance."[48]

Leon Trout narrates the scene as if it took place in a movie: "Mary Hepburn, as though hypnotized, dips her right index finger into herself and then into an eighteen-year-old Kanka-bono woman, making her pregnant."[49] She then repeats this five more times, and all six women bore children. When Mary had first stepped foot on Santa Rosalia (150 pages earlier), she stumbled, abrading her knuckles. A small finch landed on that same finger and gently drank the droplets of blood that had appeared. In fact, this was how she had known they were marooned on Santa Rosalia—*Geospiza difficilis*, that queer, bloodsucking finch lived only there. (It seems fitting that finch speciation should play at least a bit part in any novel about evolution in the Galápagos, even if the species itself does not exist.[50])

Vonnegut's evolutionary vision could be read as darkly optimistic. Certainly, humanity at the end of his million-year glance into the future had managed to survive the ravages of natural selection, chance mutation, and extreme local conditions (albeit in newly aquatic form). By returning to the sea and abandoning military adventurism, humanity might yet survive enlarged, three-kilogram brains.[51] But at what cost? Humans had reverted to their animalistic, primordial past. Any attempt to escape back to a terrestrial existence was met by those ravenous egg-eating bacteria.

Shortly after publication, Gould read *Galápagos* quickly, over one weekend. He wrote to Vonnegut the following Monday, praising the novel as "beautifully accurate" in its depiction of evolution's quirkiness and punctuated progress. Gould approved of the novel's emphasis on contingency as inherent to the process of evolution and would on occasion assign it in his courses. Elsewhere, Gould would suggest, "In Vonnegut's novel, the pathways of history may be broadly constrained by such general principles as natural selection, but contingency has so much maneuvering room within these boundaries that any particular outcome owes more to a quirky series of antecedent events than to channels set by nature's laws."[52] Vonnegut replied immediately, admitting that Gould had been constantly on his mind as he wrote.[53] Like Gould, he had sought to undermine sociobiological arguments that implied the most

[47] Vonnegut, *Galápagos* (cit. n. 24), 289.
[48] Ibid., 292.
[49] Ibid.
[50] On Charles Darwin's voyage to the Galápagos and the role of finches in his theory of natural selection, see Janet Browne, *Charles Darwin: Voyaging* (New York, N.Y., 1995).
[51] Pardee, "Drifting and Foundering" (cit. n. 36), 265.
[52] Stephen Jay Gould, *Wonderful Life: The Burgess Shale and the Nature of History* (New York, N.Y., 1989), 286.
[53] Letter from Stephen Jay Gould to Jill Krementz and Kurt Vonnegut, 7 October 1985, Box 111, Folder 6; letter from Kurt Vonnegut to Stephen Jay Gould, 10 October 1985, Box 698, Folder 3; M1437 Stephen Jay Gould Papers, 1899–2004, Department of Special Collections & University Archives, Stanford University Libraries, Stanford, California.

successful members of society had attained their positions because they were smarter or more attractive.[54] In *Galápagos*, people had not survived because they were more fit than their neighbors; instead, they survived thanks to sheer chance.

Reflecting on his science fiction writing, Vonnegut later claimed he found it difficult because he needed to attend to two things at once—he sought to both "hold the reader emotionally" and "make sense scientifically." Vonnegut ensured that *Galápagos* was "responsible" in its presentation of evolution and natural selection. Good science fiction, for Vonnegut, made people rethink the capacity of science to solve some kinds of questions but not others. He added quickly, "It's a lot easier if you're not funny."[55]

JOAN SLONCZEWSKI'S SYMBIOTIC SHARERS OF SHORA

When Joan Slonczewski read Frank Herbert's *Dune*, she was inspired to write her own ecological science fiction—she believed she could do better, scientifically and politically.[56] Slonczewski trained as a microbiologist and began teaching at Kenyon College in Gambier, Ohio, in 1984. She published *A Door into Ocean* a year later, although she had been working on it for some time. The students who worked in her laboratory would come to refer to her, with affection and awe, as "The Sloncz," and appreciated her use of science fiction in her science classes. Slonczewski set *A Door into Ocean* in the watery world of Shora, home to an aquatic, decentralized, nonviolent, all-female Sharer society. Shora was the antithesis of Herbert's desert planet where harsh environmental conditions bred a race of natural warriors. Slonczewski's ecofeminist approach fit well into an established genre populated by authors like Margaret Atwood, Ursula Le Guin, and Marge Piercy, who combined second-wave feminism with environmental concerns.[57] Similar trends characterized contemporaneous scholarship in the humanities, where deep ecology and feminism combined in Carolyn Merchant's *Death of Nature*.[58] Whereas Merchant sought to document the early modern slaughter of nature in feminine guise at the hands of machines and masculine reductionism, Slonczewski resurrected feminine nature in futuristic form on an alien planet. Like Merchant, Slonczewski mobilized femininity as a foil to the extractive violence she saw as characterizing contemporary political and economic arrangements in "the West."

In her work as a microbiologist, Slonczewski explored the interior workings of the gram-negative bacteria *Escherichia coli*, commonly found in the intestines of mammals. Human digestive health symbiotically depends on some strains of *E. coli*, although other strains can cause major foodborne illnesses. Her research at the time of *A Door into Ocean*'s publication explored how these common bacteria maintain a consistent in-

[54] Sheldon, *Darwin's Heretic* (cit. n. 41).

[55] Zoltán Abády-Nagi, "'Serenity,' 'Courage,' 'Wisdom': A Talk with Kurt Vonnegut," *Hungarian Studies in English* 22 (1991): 23–37.

[56] Author interview with Joan Slonczewski, 8 March 2017; Frank Herbert, *Dune* (Philadelphia, Penn., 1965).

[57] See also Naomi Mitchison, *Memoirs of a Spacewoman* (London, 1962); Le Guin, The Word (cit. n. 27); and Marge Piercy, *Woman on the Edge of Time* (New York, N.Y., 1976).

[58] Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (San Francisco, Calif., 1980); Joan Cadden, "Introduction" (485–6), and editor of Focus section, "Getting Back to the *Death of Nature*: Rereading Carolyn Merchant," *Isis* 97 (2006): 485–533, including essays by Katharine Park, Gregg Mitman, Charis Thompson, and a response by Carolyn Merchant.

ternal environment, especially pH levels.[59] The idea that symbiotic relationships existed between organisms with radically different evolutionary origins was hardly new in the 1980s, but the importance of symbiosis as a process in the history of life on Earth was steadily gaining traction among both biologists and colloquial science readers.[60]

Slonczewski used *A Door into Ocean* to address questions of diversity and cooperation in the living world. Herbert had created an ecologically distinct desert planet in which to base his epic story. Yet no living ecology could exist with such paltry species diversity, she insisted. (When David Lynch directed his recounting of the *Dune* story, released in 1984, he ventured to the quartz fields of the Samalayuca Desert in Mexico, known for its spectacular sandscapes, and lying only an hour south of El Paso. Lynch deemed the area insufficiently "pristine" to represent the desolate world Herbert had envisioned and hired 300 men to remove all rocks, shrubs, and cacti from the 25 square miles where he would be filming.[61]) Slonczewski bridled, too, at Herbert's normalization of aggression in his depiction of humans as born warriors, hardened by circumstance and environment. At the other end of the political spectrum, she found herself equally disappointed by Le Guin's *Word for World is Forest*, where the peaceful, idyllic creechies, a far distant descendent of human space travelers, were able to repel their colonial invaders (another species of humans) only after adopting the violence of their oppressors.[62] Slonczewski saw in the history of colonialism a similar tragedy, where local leaders had to become westernized to emerge as national heroes.[63]

In search of an alternative to *Dune*'s dry vistas, Slonczewski chose an aquatic environment.[64] She had read Morgan's *Descent of Woman* and was impressed with the notion that fish have excellent protein composition for human brain development.[65] Ad-

[59] Publications contemporary with *A Door into Ocean* include J. L. Slonczewski, M. W. Wilde, and S. H. Zigmond, "Phosphorylase a Activity as an Indicator of Neutrophil Activation by Chemotactic Peptides," *Journal of Cell Biology* 101 (1985): 1191–7; J. L. Slonczewski et al., "Effects of pH and Repellent Tactic Stimuli on Protein Methylation Levels in *Escherichia coli*," *Journal of Bacteriology* 152 (1982): 384–99; and J. L. Slonczewski et al., "pH Homeostasis in *Escherichia coli*: Measurement by P31 Nuclear Magnetic Resonance of Methylphosphonate and Phosphate," *Proceedings of the National Academy of Sciences USA* 78 (1981): 6271–5.

[60] On the importance of symbiosis to the history of life on Earth, see Lynn Margulis, *The Origin of Eukaryotic Cells* (New Haven, Conn., 1970), 45–68; and James Lovelock, *Gaia: A New Look at Life on Earth* (New York, N.Y., 1979). See also Jan Sapp, *Evolution by Association: A History of Symbiosis* (New York, N.Y., 1994); Rachel Mason Dentinger, "The Nature of Defense: Coevolutionary Studies, Ecological Interaction, and the Evolution of 'Natural Insecticides,' 1959–1983" (PhD diss., Univ. of Minnesota, 2009); and Michael Ruse, *The Gaia Hypothesis: Science on a Pagan Planet* (Chicago, Ill., 2013).

[61] *Dune*, directed by David Lynch (1984; Hollywood, Calif.: Universal Studios Home Entertainment, 1984), DVD. In 2009 the Mexican government created the Área Natural Protegida Médanos de Samalayuca, although tourism still allows sand-boarding, 4 × 4 dune tours, and other activities.

[62] Le Guin, *The Word* (cit. n. 27). The progressive politics of several of Le Guin's earlier novels may account for Slonczewski's disappointment with *The Word*; see, for example, *Left Hand*, and *Dispossessed* (both cit. n. 27).

[63] In my interview with Slonczewski, she mentioned the life of Mahatma Gandhi as an example of this process, although Frantz Fanon would seem an equally natural parallel; Frantz Fanon, *Wretched of the Earth*, trans. Constance Farrington (New York, N.Y., 1963).

[64] Slonczewski provides a study guide for the book on her website and believes science fiction, when constructed well, can provide students with an introduction to biological concepts: "*A Door into Ocean* Study Guide," last updated 4 January 2001, http://biology.kenyon.edu/slonc/books/adoor_art/adoor_study.htm.

[65] See also Betty Meehan, "Hunters by the Seashore," *Journal of Human Evolution* 6 (1977): 363–70; Meehan, "Man Does Not Live by Calories Alone: The Roles of Shellfish in a Coastal Cuisine," in *Sunda and Sahul: Prehistoric Studies in Southeast Asia, Melanesia and Australia*, ed. J. Allen, J. Golson, and R. Jones (Cambridge, Mass., 1977): 493–531.

ditionally, her imagination had been sparked by the pages of *National Geographic*, where she read about the Ama of Japan, women who dove without SCUBA gear in search of mollusks.[66] In *A Door into Ocean*, readers first meet the Sharers who live on an aquatic moon called Shora, through the eyes of another culture, the Valans who occupy the terrestrial planet Valedon, around which Shora orbits. Whereas the Valans are miners, stone shapers, capitalist, and militaristic, the Sharers are aquaculturalists, nonviolent, and all female. Regarded by the Valans as "pre-stone age," the Sharers are marked, too, by their lavender or deep violet skin color. Sharers live on floating rafts that sit atop the ocean, shaping their dwelling structures from sea silk, and diving to great depths to find and cultivate food. The purple color of the Sharers' skin derives from a symbiotic relationship with "breath microbes." In the novel, Slonczewski detailed how these breath microbes possessed a color-changing molecule shaped like a "ring of dots." And "when this molecule held oxygen, it turned purple, like a light switch."[67] When it gave up its oxygen, however, it turned white. Embedded in the skin of Sharers, these molecules released oxygen at times when their host was deprived of sufficient air, allowing them to dive for up to fifteen minutes on a single breath—when they surfaced, their skin was quite pale. Initial impressions thus paint a picture of two cultures: one white, technologically advanced colonizer trading small baubles for boatloads of sea silk; and one purple, living in symbiotic harmony with their world, and in danger of extermination.

As a teenager, Slonczewski had read Margaret Mead's *Coming of Age in Samoa*, and her books reflect Mead's commitment to fluid sexual identity, especially for women.[68] She has described her characters as "pansexual." (The transgressive erotics of mermaids held greater social relevance in the early modern period, although the subversive connotations of the aquatic have never fully dissipated.[69]) The gendered and racialized tropes that open *A Door into Ocean* slowly erode over the course of the novel. Valan visitors to Shora find themselves changing color; at first the hollows of their cheeks look a little lavender, and then even in bright sunlight their skin gains a vibrant violet hue as the breath microbes integrate themselves into their physiologies. Visitors could choose to remedy this situation with a phalanx of antibiotics. Other physical differences are far more ingrained in each population. With the centuries of their separation, Sharers possess inner eyelids that act as natural goggles when they dive. They also can no longer copulate with males, reproducing instead through the fusion of ova from two women bonded as partners. These processes, the novel makes clear, had been accelerated with the guidance of "life-shapers" and provide an early clue that the Shorans' lack of technological prowess might not be as straightforward as it first appears.

[66] Luis Marden, "Ama: Sea Nymphs of Japan," *National Geographic*, July 1971. A grandmotherly character in the book is even named Ama.

[67] Slonczewski, *A Door* (cit. n. 24), 142.

[68] Margaret Mead, *Coming of Age in Samoa*, foreword by Franz Boas (1928; repr., New York, N.Y., 1961). Mead's classic was reprinted in the early 1960s thanks to a burgeoning interest in "intellectual paperbacks." See Hayward Cirker, "The Scientific Paperback Revolution: A Traditional Medium Assumes a New Role in Science and Education," *Science* 140 (1963): 591–4; and Melinda Gormley, "Pulp Science: Education and Communication in The Paperback Book Revolution," *Endeavour* 40 (2016): 24–37.

[69] See Tara Pedersen, *Mermaids and the Production of Knowledge in Early Modern England* (Farnham, UK, 2015). On the legacy of mermaids, see Harriet Ritvo, *The Platypus and the Mermaid and Other Figments of the Classifying Imagination* (Cambridge, Mass., 1997).

In vitro fertilization (IVF) had become more fact than dystopian speculative fiction with the 1978 birth of Louise Brown in Oldham Hospital in the United Kingdom. American researchers at the time had been hard at work on a similar process, but Doris Del-Zio had found her hopes dashed in 1973, when Dr. Vande Wiele let the test tube with her eggs and her husband's sperm stand out on a hospital counter, effectively stopping cell division and the procedure. She claimed that Vande Wiele had killed her baby and sued him, the hospital, and Columbia University, where the work had taken place; he in turn insisted he had stopped a dangerous procedure and that the concoction would have harmed and possibly killed her. Louise Brown was born just one week after the American trial began. Her birth made international news, not only for the success of the process but also because, despite earlier fears that IVF babies would likely be born in some way malformed, Louise was completely healthy. (Meanwhile, the jury found that Dr. Vande Wiele had been at fault, but awarded the Del-Zios only a small fraction of the damages they had demanded.) By September of 1982, 124 IVF babies had been born around the world.[70] In the intervening years, the media hubbub over IVF had died down considerably. Slonczewski raised the political stakes by imagining a world in which the cold metal of the laboratory was replaced by the botanical warmth of the Shorans' life-shaping chambers, where they could craft an embryo through the fusion of eggs.

Narratively, Slonczewski interwove two parallel stories throughout the novel—a love story between a Valan and a Sharer, and a chronicle of the fates of their respective cultures. Spinel and Lystra learn to respect each other's strengths and weaknesses. Valans and Sharers come to a mutually beneficial agreement regarding the resources of Shora. To counter the Valans' weapons, the Sharers offer passive resistance. Some Sharers take their own lives rather than remain captives. When the Valans imprison Sharer children, they let them remain captive. Sharer children also join their elders on hunger strikes in protest of the Valans' military presence on their planet. They get to know the Valan soldiers, successfully breaking their resolve to fire on unarmed Sharers. As events become more heated, they even offer themselves for execution, stepping in front of a firing squad bent on shooting imprisoned Sharers, and thus requiring the already hesitant Valan soldiers to kill even more people in carrying out their orders. Equally crucial to the plot, a handful of "life-sharers" alter the breath microbes rendering them resistant to antibiotics. The inevitable spread of purple through the soldiers' bodies leaves them visibly marked by their experiences in Shora. If the purple color of their skin served as an analogy for race, Slonczewski's narrative demonstrated the biological arbitrariness of any such physical marker. This physical transformation also reinforces the Valans' increasing belief that the Sharers possess far more scientific skill than they initially had thought.

A telling passage late in the book between Siderite, a Valan scientist who has lived on Shora for years to understand their life-shaping skills, and Realgar, head of the Valan military forces, explains a bit more about the history of the moon. "What sort of people are likely to develop methods of confrontation which exclude violence?" Siderite poses to Realgar, who responds: "People who have no weapons." Siderite waves his response away: "The first tools man invented were knives and arrows.

[70] For a thorough account of these two families and the politics of IVF in the 1970s, see Robin Marantz Henig, *Pandora's Baby: How the First Test Tube Babies Sparked the Reproductive Revolution* (Cold Spring Harbor, N.Y., 2004).

Think again. Who were the Sharers?" Realgar later replies, "A people whose weapons are too deadly to be used."[71] In this exchange, Slonczewski flips reader expectations (although to be fair, there are plenty of hints earlier in the book). The Shorans had become peaceful *because* they had been scientifically advanced.[72] In the words of one Valan who had spent considerable time on Shora, the residents were "post-metal age." For Slonczewski, radical pacifism could succeed only in a society committed to nonviolent resistance, where members refused to share a fate with others if they were unwilling to accept that fate for themselves, too. Writing during the Cold War, she lamented that Americans considered it unpatriotic to talk of peace and thought citizens too easily dismissed pacifism as a "fairy tale." She especially disapproved of narratives in which white saviors (*Dune* again) arrived to save the planet, or indeed even the universe.[73] The Shorans' strategy of passive resistance ultimately found sympathetic ears among the Valans. By the end of *A Door into Ocean*, not only had the Sharers scuttled Valan control, but key members of the Valan military had internalized their strategic disobedience.

Although the first settlers to Shora had the capacity to wreak death upon unwelcome visitors, their modern sisters no longer remember how to construct such bioweapons. For Slonczewski, then, the real power of passive resistance comes not from mutual fear but from the Valans' realization that Shora and Valedon shared the same fate. In a confrontation between Merwen, a Sharer, and her captor Realgar, she tells him, "When you come to see that your survival is inseparable and indistinguishable from mine, then we both will win." This strategy works because the Valans begin to see their own position as under the control of a much larger military power that is similar to what they have forced upon the Sharers. Their mutual survival is very much connected after all.

Slonczewski uses the watery world of Shora to demonstrate the potential sympathetic connections between pacifism, feminism, and environmentalism. Unlike Vonnegut, Slonczewski approached her Shoran subjects with sincere optimism, conceptualizing her novel as an existence proof for the kind of world she saw around her. Nonviolent resistance did work. Feminism was powerful. Thoughtful, collaborative science could lead to breakthroughs in humanity's capacity to live in greater harmony with the environment.

CONCLUSION

Read together, Vonnegut's *Galápagos* and Slonczewski's *A Door into Ocean* resist any neat separation of science from worldly affairs by pushing against narratives of biological determinism that circulated in the science and the fiction of the 1980s. Vonnegut savagely revealed the social assumptions behind an adaptationist perspective on human progress—the most "fit" either biologically or socially were not always the in-

[71] The idea that there are weapons, from gunpowder to nuclear arms, so deadly they can stop war has a long history; Osgood, *Alternative* (cit. n. 43).

[72] Gene Sharp, *The Politics of Nonviolent Action*, editorial assistance of Marina Finkelstein, 3 vols. (Boston, Mass., 1973).

[73] Slonczewski disapproved, too, of Herbert's invocation of a deep species-level memory and ESP among the Bene Gesserit and the Fremen; see Joan Slonczewski and Michael Levy, "Science Fiction and the Life Sciences," in *The Cambridge Companion to Science Fiction*, ed. Edward James (Cambridge, UK, 2003), 174–85.

dividuals who survived and reproduced. The future, for him, depended far more on chance than those in positions of power were liable to admit. Slonczewski built her commitment to diversity and her scientific fascination with symbiosis into her novel. In using fiction as a means of communicating both, she hoped to convince her readers that cooperation played a powerful role in shaping the social and natural worlds we inhabit.

Charles Platt's horror at "New Wave" science fiction recognized this tendency in what he deemed the social science fiction of the Cold War. In hindsight, we can see more easily that even the science fiction authors he had valorized, from Frederik Pohl to Harlan Ellison, embedded politics into their scientific speculations about the future. He wrote of falling helplessly in love with their technologically plausible futures, without recognizing that their visions secured this future for only a sliver of the modern world.[74] For a different set of readers, Vonnegut and Slonczewski embraced "rigorous plausibility" as a feature of their narratives, but swapped the inevitability of technological progress for the contingent messiness of the life and social sciences.

For Ursula Le Guin, an author Platt singled out for particular scorn, the point of speculative fiction had been to lie convincingly in order to help readers see more clearly the present in which they lived. In her 1976 introduction to *Left Hand of Darkness* she proffered this vision of what science fiction could, indeed should, be: "Science fiction is not predictive." All authors can tell you, she wrote, "is what they have seen and heard, in their time in this world, a third of it spent in sleep and dreaming, another third of it spent in telling lies." Platt's objections to social science fiction and Le Guin's embrace of the malleability of truth drew on existing tensions within the sciences that exploded in the "science wars" of the 1990s.[75]

Reading Platt's concern in this context, we can imagine his distress (even if his target was misplaced) over the blending of science fictions and facts as a new generation of authors used their narrative skills to support and popularize nonmainstream scientific theories. Peter Dickinson took inspiration for *A Bone from a Dry Sea*, for example, from Elaine Morgan's theory of the aquatic ape.[76] In the opening pages, "the child" (one of two at the center of the story) slowly comes into focus—with a "snapped off hoot," she warns her tribe of an approaching shark, and points with a "web-fingered hand." Readers also come to understand that this girl differs from the other members of her tribe; she can strategize about the future in a way they cannot, and she is aware of the difference. Dickinson avoided causal explanations of why this young girl was so much smarter than her companions, but his decision reflected an

[74] Platt, "RAPE" (cit. n. 25), 45. See De Witt Douglas Kilgore, "On Mars and Other Heterotopias: A Conclusion," in *Astrofuturism: Science, Race, and Visions of Utopia in Space* (Philadelphia, Penn., 2003), 222–38.

[75] Consider the controversial reception of Donna Haraway's *Primate Visions* (cit. n. 3); for example, Peter S. Rodman, "Flawed Vision: Deconstruction of Primatology and Primatologists," *Curr. Anthropol.* 31 (1990): 484–6; and the Sokal affair, starting with Alan Sokal, "Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity," *Social Text* 46–47 (1996): 217–52; Sokal, "A Physicist Experiments with Cultural Studies," *Lingua Franca* 6 (1996): 62–4; and Jennifer Ruark, "Bait and Switch," *Chronicle of Higher Education*, 1 January 2017. See also Ursula Le Guin and Margaret Atwood's delightful conversation about writing and science fiction in Portland, Oregon, 23 September 2010, 52 min., available online: Literary Arts, "Ursula Le Guin & Margaret Atwood," https://literary-arts.org/archive/ursula-le-guin-margaret-atwood/ (accessed 5 September 2018), which includes a brief dig at Desmond Morris's conceptualization of humans as naked apes.

[76] Peter Dickinson, *A Bone from a Dry Sea* (New York, N.Y., 1999).

embrace of quantum evolutionary change—one closer to Richard Goldschmidt's hopeful monsters than Stephen Jay Gould would have found comfortable.[77] In the second chapter, the narrative focus shifts to the present day, when another young girl is accompanying her father on a paleontological expedition in Africa. Vinny, like "the child" from the first chapter, excels at thinking through complex questions. Subsequent chapters oscillate between "THEN" and "NOW," iteratively telling the tale of these two girls whose fates are intertwined. (The omniscient narrator decides to call the prehistoric child "Li" for convenience at the expense of accuracy, for none of the members of her tribe used names, readers are told, as they were only "half-way towards words."[78])

In his young adult novel, Dickinson brought to life Morgan's aquatic ape at the same time that he championed the role females played in the success of the human species. Li, whose skin is a "very dark purply brown," invents a mesh with which she can more efficiently capture shrimp, learns to hunt fish collaboratively with dolphins, and devises a splint to help heal the broken leg of a tribe member. Vinny, for her part, seeks to convince the scientists on the dig that Elaine Morgan might have had a point. Most express deep skepticism, from her father's "she's not respectable" to another paleoanthropologist's "I think she's wrong, but not crazy wrong." In the end, Vinny (it will come as no surprise) plays a crucial role in uncovering and interpreting the bones of members of Li's tribe who had died millions of years earlier. In Dickinson's hands, at least, Elaine Morgan was vindicated.[79]

Today, new links are being built between oceans and climate change, in which displaced water serves as one of the primary mechanisms by which human lives are uprooted and forever altered.[80] In *The Sea Around Us*, Rachel Carson had already noticed the ocean's role as a regulator of global temperatures. "Day by day and season by season," she wrote, "the ocean dominates the world's climate." Oceans had necessarily played a significant role in past climatic shifts. In fact, she reasoned, they were involved again. Carson warned, "Now in our own lifetime we are witnessing a startling alteration of climate." The Arctic and sub-Arctic regions were warming and changing the habits and migration patterns of the nonhuman world. "The long trend," she cautioned, "is to a warmer earth."[81] These speculative futures warn once again that human

[77] Michael Dietrich, "Reinventing Richard Goldschmidt: Reputation, Memory, and Biography," *J. Hist. Biol.* 44 (2011): 693–712. See also Greg Bear's *Darwin's Radio* (New York, N.Y., 1999) for his vision of what quantum evolution might look like in the future, where the trigger for an event is a virus; the story is part Richard Preston's *Hot Zone* (New York, N.Y., 1994) and part evolutionary drama.

[78] Dickinson, *Bone* (cit. n. 76), 24.

[79] Morgan's feminist theory also makes a cameo appearance in Naomi Alderman's *The Power* (New York, N.Y., 2016), when an anthropologist suggests that girls' new ability to produce electricity from specialized organs by their collar bones "is proof positive of the aquatic ape hypothesis—that we are naked because we came from the oceans, not the jungle, where once we terrified the deeps like the electric eel, the electric ray" (22).

[80] Brian Fagan, *Attacking Ocean: The Past, Present, and Future of Rising Sea Levels* (London, 2013); Amitav Ghosh, *The Great Derangement: Climate Change and the Unthinkable* (Chicago, Ill., 2016); Elizabeth Deloughrey, "Submarine Futures of the Anthropocene," *Comparative Literature* 69 (2017): 32–44; Ursula Heise, *Imagining Extinction: The Cultural Meanings of Endangered Species* (Chicago, Ill., 2016). For fictional dramatizations, see Octavia Butler, *Parable of the Sower* (New York, N.Y., 1993); *Waterworld*, directed by Kevin Reynolds (1995; Universal City, Calif.: Universal Pictures Home Entertainment, 2016), DVD. More classically, see J. G. Ballard, *The Drowned World* (New York, N.Y., 1962); Ballard, *The Burning World* (New York, N.Y., 1964); and *Mad Max*, directed by George Miller (1979; Beverly Hills, Calif.: Twentieth Century Fox Home Entertainment, 2016), DVD.

[81] Carson, *The Sea* (cit. n. 15), 201, 208, 213.

survival depends on our capacity to conceptualize ourselves as part of the natural world rather than independent of it.

Even as the politics of earth and air appeared increasingly constrained, the generative openness of the water remained. Authors like Vonnegut, Slonczewski, and even Dickinson made use of this conceptual space to imagine alternatives to standard scientific narratives of our past and future. These novels suggested that humans could learn and could evolve—the future was not fixed, it was ours for the making.