

Notes

Introduction: Stolonc Strategies

Epigraphs: Deleuze and Guattari 1987, 280; Kumar and Shivay 2008, 178.

- 1 Deleuze and Guattari 1987, 15.
- 2 Ibid., 15.
- 3 Kumar and Shivay 2008, 178.
- 4 Lorde 1984b.
- 5 Willey 2016.
- 6 This research took place in Denise D. Belsham's reproductive neuroendocrinology lab at the University of Toronto. I am grateful to Denise for her supervision, for sharing her expertise in molecular biology techniques, and for the cutting-edge research taking place in her lab.
- 7 See Roy 2007 and 2014.
- 8 Haraway 1991, 1997, 2004; Stengers 2000a, 2000b, 2005, 2010; Barad 2003, 2007.
- 9 Stengers 2010.
- 10 Hacking 1983, 150.
- 11 Myers 2015, xi.
- 12 Stengers 1997; Haraway 2008b.
- 13 Roy, Angelini, and Belsham 1999.
- 14 Yen 1991.
- 15 MacGillivray et al. 1998; Shevde et al. 2000; Baker et al. 2003.
- 16 Barakat et al. 2016.
- 17 Levine 1997; Roy, Angelini, and Belsham 1999; Belsham and Lovejoy 2005.
- 18 Shivers et al. 1983.
- 19 Kuiper et al. 1996.
- 20 Roy, Angelini, and Belsham 1999.
- 21 Leung et al. 2006.
- 22 Prossnitz, Arterburn, and Sklar 2007.
- 23 Terasawa and Kenealy 2012; Prossnitz, Arterburn, and Sklar 2007.

- 24 I first heard this term “scientist feminist” being used by my brilliant colleague Elizabeth Wilson, whose work has served as an important point of reflection in my own contributions to feminist STS.
- 25 D. Smith 1974; Rich 1976; Hartsock 1983; hooks 1984; Collins 1990; Haraway 1991; Code 1991; Harding 1991; Trinh 1991; Crenshaw 1993; Sandoval 2000, 2004; Alcoff 2006.
- 26 Grosz 1990, 337.
- 27 Ibid.
- 28 Ibid., 339.
- 29 Ibid.
- 30 For more information, see the Our Bodies Ourselves website at www.ourbodiesourselves.org/history/, the Feminist Women’s Health Center website at www.fwhc.org/selfhelp.htm, and the Black Women’s Health Imperative website at www.blackwomenshealth.org/.
- 31 The work of many different feminist scholars housed in several different disciplines came together to form these early interventions. For works by feminist philosophers during this era, see Harding 1986, 1987; Haraway 1988, 1990; Tuana 1989a, 1989b; Longino 1989, 1990; Hankinson Nelson 1990; Code 1991; Keller and Longino 1996; Rouse 1996, 2002; Wylie 2002, 2004; Potter 2001; Stengers 1997, 2000a, 2000b. For works by feminist historians of science, see Rossiter 1982; Keller 1983, 1985; Merchant 1990; Schiebinger 1991, 1994. For works by feminist sociologists and anthropologists of science, see Martin 1987; Star 1989; H. Rose 1994; Oudshoorn 1994; Clarke 1998, 2005. Also see Ehrenreich and English 1978; Gould 1981; Lewontin 1991.
- 32 Longino 1990; Rosser 1990; Harding 1993.
- 33 For more on these feminist scientists, refer to their earlier works, including Benston 1982; Keller 1983; Bleier 1984, 1986; Fausto-Sterling 1985; Birke 1986, 1994; Rosser 1986; Hubbard 1988, 1990, 1995; Haraway 1988; Rogers 1988; Franklin 1990; Messing and Mergler 1995; Spanier 1995; and Barad 1995.
- 34 van der Tuin 2015.
- 35 Roy 2004, 2008a.
- 36 Braidotti 2002, 2006; Grosz 1994, 2011; Kirby 1997; Wilson 1999, 2004; Hird 2004; Alaimo and Hekman 2008; Alaimo 2008; Coole and Frost 2010; Bennett 2010.
- 37 Benston 1982; Keller 1983.
- 38 Deleuze and Guattari as discussed in Holland 2013.
- 39 Deleuze and Guattari as quoted in Adkins 2015, 45.
- 40 Deleuze and Guattari 1987, 41.
- 41 Holland 2013, 63.
- 42 Braidotti 1994, 2002, 2006; Grosz 1993, 1994.
- 43 Grosz 1993, 176.
- 44 Grosz 1990.

- 45 Irigaray 1985.
- 46 Braidotti 2002, 84.
- 47 Spivak 1988b, 13–15.
- 48 Deleuze and Guattari 1987.
- 49 The “science wars” refers to a series of heated exchanges in the 1990s between scientific realists and postmodernist scholars.
- 50 Haraway 1988, 1990; Longino 1990, 1993; Harding 1991; Martin 1987; Subramaniam 2000b.
- 51 Spanier 1995.
- 52 See chapter 4, “Should Feminists Clone? And If So, How?” During my PhD research, I needed to use the molecular biology technique of subcloning in order to study the possible expression of melatonin and estrogen receptors in gonadotropin-releasing hormone (GnRH) neurons of the hypothalamus. The results of this research is found in Roy and Belsham 2002, and Roy et al. 2001.
- 53 There is a funny story I must share here. Very soon after I completed my PhD and entered into my first tenure-track position in women’s studies, I had the pleasure of meeting Donna Haraway. I was presenting a paper at UC Santa Cruz and although she had not been able to attend my talk, Haraway asked if I would mind sending her my paper. Who does that? With a scholarly generosity that is beyond rare, she not only read my paper within a week’s time but also sent me comments in an email. Her comments were detailed, full of new theoretical framings for me to consider. She even provided me with a number of literature sources. I consider this email to be my very first feminist STS love note, and to this day, I do not know why on earth I didn’t print it out, frame it, and hang it up in my office. A day after this exchange, our university server crashed, and all of my emails were lost, including the one from Donna-freaking-Haraway. I was too embarrassed to ask her to send me the email again, but I did manage to recall that Haraway was most excited for me to read the work of Isabelle Stengers.
- 54 Stengers 2000a.
- 55 Dong and Pierdominici 1995, 25.
- 56 Harding 2008.
- 57 Ibid., 215.
- 58 Colebrook 2002b, xxvi.
- 59 Harding 2008.
- 60 Subramaniam 2000b.
- 61 For Bharati’s anticolonial and liberatory thought, see Bharati 1906. Bharati’s novel *Jim* (1910–11), which appeared as a serial in *The Light of India* starting in 1907, was written in direct response to the negativity toward India found in Rudyard Kipling’s novel *Kim* (1901). In a 2003 Humanities and Social Sciences (HNet) blog post by Gerald Carney, professor of religion at Hampden-Sidney College who was working on a critical study on

Bharati's life and work, Carney states that Bharati wrote *Jim* as a "systematic and virulent refutation of *Kim* in character, plot, culture and ideology" (<http://h-net.msu.edu>). For anticolonial and liberatory ideas expressed by Tagore, see Tagore 1921 [1916]. Tagore famously renounced his knighthood by the British Crown following the 1919 Jallianwala Bagh Massacre. Lastly, for treatment of J. C. Bose as an anticolonial figure, see Nandy 1995 and Abraham 2006.

62 Nandy 1995, 21.

63 Murphy 2012.

1. Biophilosophies of Becoming

Epigraphs: Bharati 1904, 212; McClintock as quoted in Keller 1983, 200–204; Tagore 1915, 129.

1 Harding 1993, 2008, 2011; Philip 2004; TallBear 2013; Subramaniam 2014.

2 Robinson 2016.

3 Grosz 1994.

4 Keller and Longino 1996; Longino 1990; Sarkar 1996a, 1996b, 2005; Daston and Galison 2007.

5 Said 1979; Mohanty 1984; Spivak 1999; Bhabha 2004.

6 Said 1979; Spivak 1999; Mohanty 1984; Meighoo 2016.

7 Schiebinger 1994; Philip 2004; Harding 2008; TallBear 2013.

8 Lorde 1984a, 116.

9 Ibid., 116; Beauvoir 2011 [1949].

10 Colebrook 2002b, xxxviii.

11 Clayton et al. 2016.

12 I am drawing on the idea of "ontological vulnerability" that has been used by Margrit Shildrick (2004) to discuss the issue of genetics and normativity.

13 Myers 2015, 29.

14 I follow philosopher Keith Ansell Pearson (1999) here, who uses the term "biophilosophy" to describe Deleuze's approach to ethics and matter.

15 Sarkar 1996a, 2005.

16 Sarkar 2005, ix.

17 Sarkar 1996b, 2005.

18 Griffiths 2017.

19 Koutroufinis 2017; 2014, 4, 6.

20 Koutroufinis 2014, 6.

21 Dolphijn and van der Tuin 2012; Grosz 2011; Braidotti 1994.

22 For feminist engagements with process ontology, see Styhre 2001; Haraway 2003; Barad 2007; Braidotti 2010; Grosz 2011; Parisi 2004, 2010; Weinstein 2010; Dolphijn and van der Tuin 2012; van der Tuin 2015. For recent work on process ontology for contemporary biology, see Koutroufinis 2017, 2014; Dupre 2015. For STS engagements with process ontology, see Myers 2015.

- 23 For recent work on biology and feminism through a philosophy of biology approach, see Hankinson Nelson 2017.
- 24 Adkins 2015; Colebrook 2002b; Ansell Pearson 1999.
- 25 Deleuze and Guattari 1987, 261.
- 26 Ibid.; Deleuze and Guattari 1994.
- 27 Ansell Pearson 1999, 12.
- 28 Ibid., 11.
- 29 Adkins 2015, 1.
- 30 Penfield 2014.
- 31 Adkins 2015.
- 32 Deleuze and Guattari 1987, 20.
- 33 Adkins 2015, 31 (emphasis in original).
- 34 Chatterjee 2016, 30.
- 35 Subramaniam et al. 2017, 410.
- 36 Ibid.
- 37 Harding 2016, 1069.
- 38 Ibid., 1065.
- 39 Ibid., 1077.
- 40 Foster 2016, 151.
- 41 Ibid. Foster draws here from Linda Tuhiwai Smith's (1999) work on decolonizing methodologies.
- 42 Bignall and Patton 2010, 5; Spivak 1988a.
- 43 Bignall and Patton 2010, 3.
- 44 Ibid.
- 45 Chatterjee 2016, 30.
- 46 Ibid.
- 47 Chow 2012, 159.
- 48 Deleuze and Guattari 1987, 261.
- 49 Bensmaïa 2017, 21.
- 50 Ibid., 20.
- 51 Abraham 2006, 210.
- 52 Ibid.
- 53 For more on the postcolonial interventions in STS made by these scholars, refer to Abraham 1998, 2000, 2006; Seth 2009; Anderson 2002, 2009; Harding 2008, 2011; Shiva 1995, 1997; Philip 2004; Philip, Irani, and Dourish 2012; Murphy 2009; Hecht 2002, 2014; Subramaniam 2000a, 2000b, 2014; Roy and Subramaniam 2016; Subramaniam et al. 2017; Foster 2016, 2017; Pollock and Subramaniam 2016; Prasad 2014; Sunder Rajan 2006, 2017.
- 54 Bharati 1904.
- 55 For more on this topic, see Subramaniam 2000a; Nanda 2003.
- 56 Bharati 1904, 8.
- 57 Ibid., 69.
- 58 Ibid., 37.
- 59 Bose 1902.

- 60 Colebrook 2002b, 109; Bharati 1904, 69.
- 61 Colebrook 2002b, 65–66.
- 62 Grosz 2017, 259.
- 63 McClintock as cited in Keller 1983, 200. For more on the abilities of the nonhuman to scream, see the insightful work on “screaming yeast” by historian of science Sophia Roosth (2009).
- 64 McClintock 1950.
- 65 Keller 1983, 200.
- 66 Ibid.
- 67 Haraway 1990, 2008, 2015.
- 68 Haraway 2015, 161.
- 69 Adkins 2015, 2.
- 70 Colebrook 2002b, xxv.
- 71 McClintock as quoted in Keller 1983, 204.
- 72 Banerji 2015, 4.
- 73 Barad 2007.
- 74 Colebrook 2002a, 69.

2. Microphysiologies of Desire

Epigraphs: Bose 1902, 28; Waters and Watson 2015, 2.

- 1 For a detailed biographical account of Bose’s life and his framing as an anticolonial figure, see Nandy 1995 and Abraham 2006.
- 2 Sen Gupta 2009. In 2014, I had the opportunity to visit the Bose Institute in Kolkata and see these instruments.
- 3 Ibid.
- 4 Brahmo Samaj.
- 5 Sen Gupta, Engineer, and Shepard 2009.
- 6 Grosz 1993, 171.
- 7 Bose 1902; Deleuze and Guattari 1994; Grosz 1993; Haraway 2008b; Braidotti 2013.
- 8 Subramaniam 2014.
- 9 Ibid., 2.
- 10 Ibid., 27.
- 11 Davies, Stacey, and Gilligan 1999.
- 12 Waters and Watson 2015, 2.
- 13 Ibid., emphasis added.
- 14 van der Tuin 2015, 9.
- 15 Martin 1987.
- 16 Haraway 1990, 1997; Oudshoorn 1994; Basen, Eichler, and Lippman 1993.
- 17 Braidotti 2006; Sandoval 2000.
- 18 McClintock 1950.
- 19 Rosser 1989; Roy 2004; Roosth and Schrader 2012; Willey and Subramaniam 2017.

- 20 Roosth and Schrader 2012, 2.
- 21 Harding 1993; Roberts 1998; Philip 2004; Sunder Rajan 2006; McNeil 2007; Cooper 2008; Hammonds and Herzig 2009; Benjamin 2013; TallBear 2013; Subramaniam 2014; Lee 2013, 2014.
- 22 Murphy 2009.
- 23 Latour 2007; Suchman 1987; Wajcman 1991; Haraway 1990.
- 24 Weber 2006, 400.
- 25 Ibid.
- 26 Haraway 1997; Stengers 1997; Barad 2007; Subramaniam 2014; Roy 2004; Kaiser et al. 2009; van Anders 2013; Ritz et al. 2014; Giordano 2016.
- 27 Weber 2006, 400.
- 28 Ferrando 2013, 29.
- 29 Ibid.
- 30 Haraway 2003.
- 31 Åsberg 2013, 11, 10.
- 32 Ibid., 8, emphasis in original.
- 33 Rosser 1989, 3.
- 34 Within the same anthology, several authors voiced concern over a separate science that was qualified as a “feminist science.” For more on this, see Tuana 1989a, 1989b; Longino 1989; Keller 1989; Harding 1989.
- 35 Rosser 1989, 3.
- 36 Harding 1991; Code 1991.
- 37 Rosser 1989.
- 38 Ibid., 3.
- 39 Mills 2010, 146.
- 40 Ibid.
- 41 Also see Myers 2015.
- 42 Roy 2004, 2007, 2008a, 2008b.
- 43 Mills 2010, 146.
- 44 Murphy 2012.
- 45 Boston Women’s Health Book Collective 2005.
- 46 Barad 2007, 19.
- 47 Ibid., 33, 44, 45.
- 48 Ibid., 361.
- 49 Ibid., 175.
- 50 Buck and Axel 1991.
- 51 Boehm, Zou, and Buck 2005.
- 52 Ibid., 683.
- 53 Zou et al. 2001.
- 54 Zou et al. 2008, 120.
- 55 Drug Monkey 2008.
- 56 Barad 2003, 2007.
- 57 Haraway 2016, 10.
- 58 Haraway 2008b, 3.

- 59 Ibid., 23.
- 60 Ibid., 24–25.
- 61 Ibid., 30.
- 62 Haraway 2016, 12–13.
- 63 Haraway 2008b, 287.
- 64 Lather 2007, viii.
- 65 Ibid., x.
- 66 Ibid., 10–11.
- 67 Ibid., 11.
- 68 Haraway 2016.
- 69 Lather 2007, 17, 74.
- 70 Ibid., 11.
- 71 Ibid., 76, emphasis added.
- 72 Stengers 2005.
- 73 Ibid., 195.
- 74 Stengers 1997.
- 75 Latour 1997, xiv.
- 76 Ibid.
- 77 Shaviro 2005.
- 78 Kember 2003, 189.
- 79 Barad 2007, 26.
- 80 Kember 2003, 189.
- 81 McClintock as quoted in Keller 1983.
- 82 Barad 2007, 2012.
- 83 Bergo 2015; D. Smith 2003.
- 84 Barad 2007, 364.
- 85 Ibid., 393.
- 86 Grosz 1993, 172.
- 87 Ibid.

3. Bacterial Lives

Epigraphs: Margulis and Sagan 1997, 63; *Gendered Innovations* n.d.

- 1 Darwin 1859; Margulis 1998.
- 2 Human Microbiome Project 2017.
- 3 Sagan 1967.
- 4 Margulis 1998.
- 5 Ibid., 73.
- 6 Margulis 1998; Margulis and Sagan 1986, 1991, 1997, 2002; Sagan and Margulis 1988.
- 7 Margulis and Sagan 1991, 200.
- 8 Ibid.
- 9 Margulis and Sagan 1986, 2.
- 10 Ibid.

- 11 Ibid., 3.
- 12 Margulis and Sagan 1997, 58–59.
- 13 *Gendered Innovations* n.d.
- 14 Margulis and Sagan 1991, 201.
- 15 Stengers 2000a.
- 16 Epstein 2007.
- 17 National Science Foundation 2014.
- 18 National Institutes of Health 2017.
- 19 US Food and Drug Administration 2013.
- 20 Ibid.
- 21 There is an excellent *60 Minutes* documentary on this topic. See the CBS news story “Sex Matters: *60 Minutes* Investigates Men, Women and Drug Dose,” released on February 9, 2014.
- 22 Clayton and Collins 2014.
- 23 Ritz 2016; Joel et al. 2015.
- 24 Jordan-Young 2010; Fausto-Sterling 2000; Joel 2014.
- 25 For a history of the scientific research on human sex chromosomes, see Richardson 2013.
- 26 *Gendered Innovations* n.d.
- 27 Ibid.
- 28 Ibid.
- 29 Ibid.
- 30 Schiebinger 1999.
- 31 Collins 1990; Crenshaw 1993.
- 32 Epstein 2007; Roberts 2012; Pollock 2012; TallBear 2013.
- 33 An example of the application of this interactionist frame is the UCLA Center for Gender-Based Biology.
- 34 Oyama, Griffiths, and Gray 2003.
- 35 Fausto-Sterling 2000, 2005, 2014.
- 36 Oyama, Griffiths, and Gray 2003, 1.
- 37 Barad 33, 2007.
- 38 Haraway 1985.
- 39 Harding 1986.
- 40 Rosser 1989.
- 41 Haraway 1990; Fausto-Sterling 2000; Barad 2003; Subramaniam 2014.
- 42 Rubin 2012, 891.
- 43 J. Butler 1999 [1990], 10–11.
- 44 Ibid., 10.
- 45 Keller 1985; Harding and O’Barr 1987; Birke 1999; Fausto-Sterling 2000; Kaiser et al. 2009; Jordan-Young 2010.
- 46 Willey 2016, 124–25.
- 47 J. Butler 1999 [1990], 11.
- 48 Ibid.
- 49 Deleuze and Guattari 1987, 212.

50 Ibid., 213.
 51 Grosz 1993.
 52 Deleuze and Guattari 1987, 213.
 53 Grosz 1994, 14, 18, 181.
 54 Parisi 2004, 16–17.
 55 Ibid., 187, 61, 4.
 56 Ibid., 187.
 57 Ibid., 188.
 58 Hird 2004, 2009.
 59 Hird 2004, 149.
 60 Ibid., 151.
 61 Hird 2009, 42.
 62 Ibid.
 63 Ibid., 53.
 64 Ibid.
 65 Although Jane Bennett (2010) directs her work more toward the nonorganic, she might describe bacteria that talk as a type of vital materialism.
 66 Barad 2007, 132.
 67 Dolphijn and van der Tuin 2012, 13, 85, 110, 90.
 68 van der Tuin 2008, 414; 2011.
 69 Dolphijn and van der Tuin 2012; Braidotti 2013, 1994.
 70 Haraway 1988.
 71 Alaimo 2000, 237; Dolphijn and van der Tuin 2012, 94.
 72 Alaimo and Hekman 2008.
 73 J. Butler 1993, 30.
 74 Kirby 2006; Hekman 2008.
 75 Braidotti as cited in Dolphijn and van der Tuin 2012, 27.
 76 J. Butler 1986.
 77 Dolphijn and van der Tuin 2012, 143.
 78 Ibid., 147.
 79 J. Butler 1999 [1990], 11; Kirby 2008, 214 and 219.
 80 Breen et al. 2001; Kirby 2008, 2011, 2012.
 81 Kirby 2008, 219.
 82 Kirby as quoted in Breen et al. 2001, 13.
 83 J. Butler as quoted in *ibid.*
 84 Kirby 2008, 219.
 85 Kirby 2012, 200.
 86 Bugg et al. 2011.
 87 Tavares et al. 2013; Lambert 2005; Lawrence 1999.
 88 Kirby 2008, 2011, 2012.
 89 Kirby 1997, 60.
 90 Ibid., 60–61.
 91 Ibid., 61, emphasis in original.

- 92 Kirby 2006, 84.
 93 Haraway 2003; Braidotti 2013.
 94 Kirby 2012, 200.
 95 Tuana 2008, 209.
 96 Alaimo and Hekman 2008, 7–8.
 97 Kirby 2006, 84.
 98 Kirby 2008, 219.
 99 Butler as quoted in Breen et al. 2001, 13.
 100 Alaimo and Hekman 2008, 8.
 101 Although I find the insertion of human-created poetry into bacterial genomes, as in Christian Bök’s work in *The Xenotext: Book 1* (2015), to be of interest, I would align this project with other biotechnologies that have turned to bacteria for their mechanistic appeal. The bacterial poetry that I am thinking about here is writing that bacteria conducts that we as humans might learn to appreciate outside of our typical productionist frameworks.
 102 Haraway 2008a, 178.
 103 Derrida 1997, 158; Kirby 1997, 60.
 104 Derrida 1988, 136 and 152.
 105 Philip 2004; McNeil 2005; Reardon 2005; Sunder Rajan 2006; Cooper 2008; Harding 2008; Murphy 2012; Pollock 2012; TallBear 2013; Benjamin 2013; Roy and Subramaniam 2016; Subramaniam et al. 2017; Foster 2017.
 106 Sunder Rajan 2006, 3, 6; emphases in original.
 107 Cooper 2008, 4.
 108 Ibid., 33.
 109 Ibid., 9.
 110 Philip 2004, 197.

4. Should Feminists Clone?

Epigraphs: Braidotti 2002, 10; Massumi 1987, 95.

- 1 Deleuze and Guattari 1987, 272, 11.
- 2 Ibid., 276.
- 3 In Bruno Latour’s foreword to Stengers’s *Power and Invention* (1997), he discusses Stengers’s notion of “risk” as being integral to properly constructed propositions. According to Stengers, although constructions without risk may be moral and politically correct, they may not be CC (cosmopolitically correct) (Latour 1997, xiv). Although my effort may not fully measure up, the risk I run by posing the question “Should feminists clone?” reflects my goal to be CC.
- 4 Cloning is often used as shorthand for the molecular biology technique of subcloning.
- 5 The Biology As If the World Matters (BAITWorM) panel was held at the Ontario Institute for Studies in Education, University of Toronto. The

- BAITWorM Network consisted of natural and social scientists committed to interdisciplinary research and teaching in the sciences.
- 6 Corea 1985.
 - 7 The phrase “technical, organic, and political” is commonly used by Haraway (1991; 1997). The technical, organic, and political also comprise three of the six imploding categories that inform her practice of figuration (Haraway 1997).
 - 8 Braidotti 2006, 12.
 - 9 Massumi 1987, 90.
 - 10 Ibid., 96.
 - 11 Ibid., 96–97.
 - 12 Baudrillard 1983, 4.
 - 13 Massumi 1987, 96.
 - 14 Ibid., 97.
 - 15 Ibid., 91.
 - 16 Parr 2005, 223.
 - 17 Wilson 1999, 8.
 - 18 Keane and Rosengarten 2002, 261.
 - 19 Wilson 1999, 8.
 - 20 Haraway 2004, 9.
 - 21 Rouse 1996, 215–19.
 - 22 Braidotti 2002, 169.
 - 23 Stengers 2000b, 155.
 - 24 New England Biolabs 2018.
 - 25 ThermoFisher Scientific 2017.
 - 26 Ibid., 4.
 - 27 Haraway 1997.
 - 28 Ibid., 3.
 - 29 In her elegant fictional story “Confessions of a Bioterrorist,” Charis Thompson (1999) writes about a reproductive biologist who yearns to reproduce. In this case, however, the resident biologist for the San Diego Zoo yearns to give birth to human-bonobo interspecies offspring.
 - 30 Haraway 1998; Sandoval 2000; McClintock as cited in Keller 1983.
 - 31 Sandoval 2000, 104, 83.
 - 32 Martin 1987.
 - 33 Roy, Angelini, and Belsham 1999.
 - 34 Haraway (1997, 12) has articulated six categories that “inform the practice of figuration,” including the “technical, organic, political, economic, oneiric and textual.”
 - 35 Diprose and Ferrell 1991, ix.
 - 36 Wilson 1998, 201.
 - 37 Deleuze and Guattari 1987, 12.
 - 38 Sandoval 2000, 114.
 - 39 Haraway 1997, 129.

- 40 This is a derogatory and racist term used to describe an individual of South Asian descent, derived from the term “Pakistani.”
- 41 Haraway 1997, 129.
- 42 Roy, Angelini, and Belsham 1999.
- 43 ThermoFisher Scientific 2017.
- 44 Keller 1983, 198.
- 45 Ibid., 8.
- 46 Ibid., 194.
- 47 Diprose and Ferrell 1991, ix.
- 48 ThermoFisher Scientific 2017.
- 49 Firestone 2003, 29.
- 50 Ibid., 180.
- 51 Ibid., 164.
- 52 Ibid., 183.
- 53 Ibid., 185, emphasis added.
- 54 The revisioning of society, where only women reside and reproduction occurs through parthenogenesis, can be found in such novels as Charlotte Perkins Gilman’s *Herland* (1979 [1915]), Joanna Russ’s *The Female Man* (1975), and Suzy McKee Charnas’s *Motherlines* (1978). Technologies such as cloning are used for reproduction in Pamela Sargent’s *Cloned Lives* (1978), Kate Wilhelm’s *Where Late the Sweet Birds Sang* (1998 [1976]), and Ursula Le Guin’s short story “Nine Lives” (1976 [1969]). Some other form of genetic manipulation occurs for the purpose of reproduction in Marge Piercy’s *Women on the Edge of Time* (1976) and Octavia Butler’s *Dawn* (1987).
- 55 Sargent 1976, xix.
- 56 I was unable to find out the contraceptive for which the clinical trial was being conducted, or if it was a contraceptive at all, but the patches looked very similar to the Ortho Evra patch. A local woman informed me that they were participating in a government-subsidized family-planning incentive program. By participating in the trial, these women were provided with food rations and shoes for their children.
- 57 Bhatia 2005.
- 58 Times of India 2016.
- 59 Kfoury 2007, 112.
- 60 For a more detailed analysis of stem cell research in California, see Benjamin 2013.
- 61 Murugan 2009.
- 62 In this announcement Bush limited public funding of human embryonic stem cell research to seventy-eight cell lines that had already been established before August 9, 2001. It was later reported that of these seventy-eight cell lines, only nineteen were actually viable (*USA Today* 2005).
- 63 MSNBC Online 2004.
- 64 Adelson and Weinberg 2010.
- 65 *USA Today* 2007.

- 66 NIH Stem Cell Information Home Page 2016.
- 67 NBC News 2017.
- 68 Hiltzik 2017.
- 69 Waldby 2002; Waldby and Carroll 2012.
- 70 Salleh 2007.
- 71 BBC News 2005.
- 72 NPR 2006.
- 73 ViaGen 2017.
- 74 Sandoval 2000.
- 75 Haraway 1991; Sandoval 2000.
- 76 Haraway 1991, 150.
- 77 Sandoval 2000, 167.
- 78 Ibid.
- 79 Ibid., 30.
- 80 Ibid.
- 81 Roy, Angelini, and Belsham 1999.
- 82 Stengers 2000a, 41.
- 83 Stengers 2005, 187.
- 84 Ibid., 187–88.
- 85 Ibid., 188. Stengers explains here that her ecology of practices is composed of what Brian Massumi has referred to as a Leibnizian technology.
- 86 Braidotti 2006, 15.
- 87 Ibid., 83. In her discussion of poststructural ethics, Braidotti (ibid.) states that becoming political involves “a radical repositioning or internal transformation on the part of subjects who want to become-minoritarian in a productive and affirmative manner.”
- 88 Ibid., 134.

5. *In Vitro* Incubations

Epigraphs: Barad 2007, 172; Ansell Pearson 1999, 20.

- 1 Landecker 2007, 7.
- 2 Ibid., 26.
- 3 Ibid., 3.
- 4 Wetsel et al. 1991.
- 5 RU486, also referred to as mifepristone, is an antiprogesterin used for medical abortions. In the presence of progesterone, RU486 acts as a competitive progesterone antagonist (a ligand or drug that blocks a biological response). However, in the absence of progesterone, it acts as a partial agonist (a ligand or drug that binds to a receptor and activates a biological response). For reviews on the molecular mechanisms of RU486, see Kakade and Kulkarni 2014; Mahajan and London 1997.
- 6 Alaimo and Hekman 2008; Coole and Frost 2010.
- 7 Thacker 2010, 220.

- 8 Haraway 2003; Barad 2007; Bennett 2010; Chen 2012.
- 9 Foucault 1970, 160–61.
- 10 Deleuze and Guattari 1987, 499, emphasis in original.
- 11 Haraway 2015, 116.
- 12 Grosz 2008, 24.
- 13 Kirby 2006, 84.
- 14 Barad 2010, 264–65.
- 15 Jagger 2015, 336.
- 16 Landschoot 2018.
- 17 Thanks to a grant I received in 2010 from the National Academies KECK Futures Initiative, I was able carry out my project “Developing a Bench-side Ethics and Community Based Participatory Research Training Program in Synthetic Biology.” Dr. Sara Giordano was the postdoctoral fellow on this project and has recently published an article on synthetic biology, feminist pedagogy, and bioethics (Giordano 2016).
- 18 Thacker 2010, ix.
- 19 Ibid., xiii.
- 20 Ibid.
- 21 Ibid., 141. Thacker refers here to Deleuze’s ontology in *Difference and Repetition* (1994).
- 22 Haraway 1997.
- 23 Thacker 2010, 219, emphasis in original.
- 24 Ibid.
- 25 Ansell Pearson 1999, 4; Dema 2007.
- 26 Ansell Pearson 1999, 152.
- 27 See Dema 2007. John Protevi (2012, 239) has explained that we should “remember Deleuze’s love of provocation” and his “idiosyncratic notion of vitalism” when we consider how vitalism operates in Deleuzian thinking.
- 28 Protevi 2012, 247.
- 29 Deleuze and Guattari 1987, 15, 158.
- 30 Ansell Pearson 1999, 154.
- 31 Dema 2007.
- 32 Ibid.
- 33 Deleuze and Guattari 1987, 22.
- 34 Bryant 2011b.
- 35 Ansell Pearson 1999, 141–42.
- 36 Ibid., 2.
- 37 Deleuze and Guattari 1987, 4.
- 38 Protevi 2012, 248.
- 39 Barad 2010, 264.
- 40 Foucault 1970, xii–xiii.
- 41 Describing Deleuze and Guattari’s three strata, Eugene Holland (2013, 23) writes that “the inorganic stratum starts with a bang—with the Big Bang, that is.”

- 42 Protevi 2012, 251.
- 43 For a more extensive treatment of the role of central dogmas in the history and philosophy of molecular biology, see Sarkar 1996a, 1996b, and 2005.
- 44 Breen et al. 2001, 13.
- 45 For rich historical accounts of the people, funding sources, and universities involved in the development of molecular biology and genetics research in the United States, see the work of Lily E. Kay (1993, 1996, 2000).
- 46 Crick 1988, 109.
- 47 Protevi 2012, 251.
- 48 In the PBS television series *DNA: Pandora's Box* (2003), James Watson speaks about the importance of eugenics and how the events of Nazi Germany have given eugenics a bad name (Duncan and Glover 2003).
- 49 BioBricks Foundation 2017.
- 50 Lentzos et al. 2008; Fritz et al. 2010; Ausländer, Ausländer, and Fussenegger 2017.
- 51 Endy 2008, 1196–97.
- 52 Hutchison et al. 2016. The first synthetic minimal yeast genome has also recently been reported. This minimal genome is a reduced version of the genome derived from the yeast species *Saccharomyces cerevisiae*. See Richardson et al. 2017.
- 53 Lentzos et al. 2008, 316.
- 54 Rabinow and Bennett 2009.
- 55 Protevi 2012, 251.
- 56 N. Rose 2007, 3.
- 57 Ibid., 4.
- 58 Ibid.
- 59 Protevi 2012, 251.
- 60 Eimer 2010, 75, emphasis in original.
- 61 Hutchison et al. 2016.
- 62 Glass et al. 2017.
- 63 Lartigue et al. 2007.
- 64 Hutchison et al. 2016.
- 65 Engineering and Physics Research Council 2017.
- 66 Ibid.
- 67 Roosth 2009.
- 68 Ibid., 337.
- 69 Holland 2013, 24.
- 70 Shou, Ram, and Vilar 2007.
- 71 Dunham 2007, 1741.
- 72 Shou, Ram, and Vilar. 2007, 1877.
- 73 Ibid.
- 74 Ibid.
- 75 Breen et al. 2001, 13.
- 76 Cooper 2008.

- 77 Holland 2013, 29.
- 78 Chatterjee 2016, 30.
- 79 Deleuze and Guattari 1987, 60.
- 80 Welchman 1997, 224; Bryant 2011a; Harding 2016; Foster 2016.
- 81 Gibson et al. 2008.
- 82 Hutchison et al. 2016.
- 83 ETC Group 2007, 2016.
- 84 J. Craig Venter's full bio is available on the JCVI website, at www.jcvi.org/cms/about/bios/jcventer.
- 85 Venter used the shotgun technique once again when he set out to beat the publicly funded sequencing effort of the Human Genome Project in the mid-1990s.
- 86 Glass et al. 2006, 425.
- 87 Sweet 2009, 823.
- 88 Hartmann 2009, 371.
- 89 Cooper 2008, 58.
- 90 Keasling 2009.
- 91 Farooq and Mahajan 2004. For several years now the World Health Organization (2015) has recommended the use of artemisinin-based combination therapies for the treatment of malaria, a disease caused by a plasmodium parasite that infects red blood cells and leads to severe disease and death.
- 92 Ro et al. 2006, 940.
- 93 Ibid.; Westfall et al. 2012.
- 94 Paddon et al. 2013, 528.
- 95 The pharmaceutical giant Sanofi Aventis took on the manufacturing of semisynthetic artemisinin. The product hit the market in 2016 apparently with a fair bit of resistance. Without the proper market demand, semisynthetic artemisinin is no longer being touted as a panacea for malaria (see Peplow 2016).
- 96 Sandoval et al. 2014, 215–16.
- 97 MacKenzie 2013, 194.
- 98 Ibid., 190.
- 99 Edel 1969; Ebert 2008.
- 100 Ortiz 1947, 268.
- 101 Ibid., 98, 101.
- 102 Amyris recently announced that it will build a 23,000-ton production plant in Queensland, Australia, to produce farnesene for use in cosmetics. Sugar-cane will serve as the feedstock in their operations and with the proximity to Asia, the hope is to tap into the Asian cosmetics market (see biofuels-digest.com).
- 103 Mohanty 2003, 229.
- 104 This sentiment can be found in Thomas's eloquent public debate with Drew Endy and is an excellent example of postcolonial and decolonial STS practices at work. For more, see the Long Now Foundation 2008.

- 105 Venter et al. 2004, 66.
- 106 Although the website is no longer active, Venter's voyages aboard the *Sorcerer II* were recorded in detail at www.sorcerer2expedition.org. As one entered into Venter's virtual world aboard the website for his expedition vessel, a map of the planet and the path of scientific progress could be seen as it is rolled out to the sound of splashing waves. The information available on the website was divided into sections titled "Expedition Info," "Voyage Tracker," "Sampling Methods," and "Scientific Data."
- 107 Ajjawi et al. 2017.
- 108 Ibid., 652.
- 109 See Synthetic Genomics 2017.
- 110 In 2017, ExxonMobil released the commercial "Energy Farmer," which references the development of biofuels.
- 111 According the JCVI website, Synthetic Genomics Inc., the private company held by J. Craig Venter, holds intellectual property rights to the tools and technologies developed for the synthetic engineering of organisms and has filed thirteen patent family applications. Patents approved as of 2017 include digital-to-biological converter, programmable oligonucleotide synthesis, assembly of large nuclei acids, method for producing polymers, *in vitro* recombination method, and more (see <http://patents.justia.com/assignee/synthetic-genomics-inc>).
- 112 Duncan and Selim 2004.
- 113 Russell 2004.
- 114 This episode of *The Colbert Show* with Venter aired on October 20, 2007, on Comedy Central.
- 115 Spivak 1985, 243, 253, 243.
- 116 Ibid., 241.
- 117 Ibid., 252.
- 118 Ibid., 253–54.
- 119 Ibid., 240, 241.

Conclusion

Epigraphs: *Oxford English Dictionary*, s.v. "grass root," accessed January 14, 2018, <http://www.oed.com.proxy.library.emory.edu/view/Entry/80912?redirectedFrom=grassroots#eid>. "Grass roots" is from *Oxford Living Dictionaries*, accessed January 14, 2018. https://en.oxforddictionaries.com/definition/grass_roots.

- 1 Black Lives Matter 2018.
- 2 Minnite and Piven 2016, 275.
- 3 Ibid., 278.
- 4 Ibid., 277.
- 5 Black Lives Matter 2018.