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## **The Experimental Multispecies Household**

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### **ABSTRACT**

Under what conditions have people in the past come to arrange their domestic lives more intentionally, and what role have the sciences played in this process? To address this question, this essay examines the transformation of human homes into experimental sites for the study of animal behavior. Between 1880 and 1920, the “insectarium” became both a popular toy and a key tool for the scientific study of the social insects. At the same time, social change and feminist politics were calling into question bourgeois norms of domesticity. In this context, the enterprise of domestic entomology took the rigid, seemingly timeless idea of a “natural home” and transformed it into a research question: how malleable were insects’ home-making instincts? The essay argues that the idea of behavioral plasticity as it emerged in entomology circa 1900 reflected and informed an experimental, multispecies approach to human homemaking. In this way, the essay demonstrates the value of studying the history of science together with the history of private life.

KEY WORDS: domestic science, entomology, plasticity, feminism, Adele Fielde, Auguste Forel

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### **Prologue**

As I write, COVID-19 is putting unfamiliar pressures on domestic life around the world. For many people, following lockdown orders has meant enduring heightened tensions at home, tensions that are exacerbated by the scourge of unemployment. Victims of domestic abuse have nowhere to turn. Women and girls are shouldering more domestic work and childcare than usual, and the burden of home-schooling seems to fall disproportionately on mothers. I am one of the privileged, waiting out the pandemic in good health and safety in a comfortable house. Yet many academics working from home while caring for

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*Historical Studies in the Natural Sciences*, Vol. 51, Number 3, pps. 330–378. ISSN 1939-1811, electronic ISSN 1939-182X. © 2021 by the Regents of the University of California. All rights reserved. Please direct all requests for permission to photocopy or reproduce article content through the University of California Press’s Reprints and Permissions web page, <https://www.ucpress.edu/journals/reprints-permissions>. DOI: <https://doi.org/10.1525/hsns.2021.51.3.330>.

children are justifiably frustrated. Already in the first weeks of sheltering in place, academic journals reported a downturn in the number of submissions from women, even as overall submissions rose.<sup>1</sup> As a mother, I am all too aware that the hours spent writing this essay are directly measurable in the levels of clutter, dirt, and video-game overdose in my household. What motivates me is a felt need to understand this supposedly “unprecedented” crisis in relation to a longer history of domestic life. It is often said that the home is the sphere most resistant to change, and few commentators have seemed surprised by the hardening of gendered norms during this quarantine. Where does this intuition come from? What light can history shed on the dynamics of persistence and change in household relations? Under what conditions have people in the past come to arrange their domestic lives more intentionally? And have the sciences played a role in encouraging such reforms, or have they tended to reinforce the status quo? To address these questions, I turn to a curious episode in the history of science from just over a century ago, a moment of experimentation with novel forms of domesticity.

## INTRODUCTION: THE PLASTICITY OF DOMESTIC LIFE

In the history of biology, the turn of the twentieth century is commonly associated with the rediscovery of Mendel’s theory of inheritance and, with it, a hardening of biological determinism; yet the years around 1900 also saw the emergence of a contrary concept with enduring significance today: plasticity. “Plasticity” referred to the capacity of an organism to respond differently—developmentally and behaviorally—to different environments.<sup>2</sup> Use of the term “plasticity” to denote adaptive deviations from a hereditary norm dates to the beginning of the twentieth century and is indebted in part to the study of the social insects. In the nineteenth century, the term “plasticity” in French and German (*Plastizität*, *plasticité*) had described a property of

1. Giuliana Viglione, “Are women publishing less during the pandemic? Here’s what the data say,” *Nature* 581 (2020): 365–66, <https://doi.org/10.1038/d41586-020-01294-9> (accessed Mar 2021); Colleen Flaherty, “No Room of One’s Own: Early submission data suggest COVID-19 is tanking women’s research productivity,” *Inside Higher Ed* (21 Apr 2020), <https://www.insidehighered.com/news/2020/04/21/early-journal-submission-data-suggest-covid-19-tanking-womens-research-productivity> (accessed Mar 2021).

2. As Evelyn Fox Keller observes, plasticity represents a framework that transcends the “nature versus nurture” debate: *The Mirage of a Space Between Nature and Nurture* (Chapel Hill, NC: Duke Univ. Press, 2010), 75.

materials and was used mainly by geologists and engineers. Around the turn of the century, the Swiss neurologist Auguste Forel began to apply it to the malleability of brain tissue, breaking with the common belief that neural connections were permanently fixed. Forel theorized that the brain's malleability gave the organism a degree of freedom to respond to the environment. Those responses could become ingrained in the individual in the form of habits and could be passed on to future generations as instincts.<sup>3</sup> Like many of his contemporaries, Forel drew no firm line between behavioral and morphological plasticity. He contrasted plasticity with another operative concept of the day, Jacques Loeb's notion of "tropism," designating a strictly mechanical response to external stimuli. By contrast, "plasticity" demarcated a domain of behavior that was not mechanistically programmed by instincts, yet not necessarily dependent on intelligence.<sup>4</sup>

In German and French publications, *Plastizität* and *plasticité* rose in frequency from the early 1920s,<sup>5</sup> coinciding with the publication of Forel's five-volume magnum opus on the social lives of ants, *Le monde social des fourmis du globe comparé à celui de l'homme* (1921–23). This "popular and simple" account of Forel's sixty years of myrmecological research helped to bring the notion of plasticity into wider circulation. Writing as a pacifist in the wake of the Great War, Forel emphasized that plasticity was a fundamental condition of life, present in microbes as in ants and humans. He explained that by "plastic" he meant "modifiable," such that "the individual reacts in an impulsive manner to every new irritation and adapts to it as best he can," thus succeeding in "clearing new paths, adapting to the unexpected."<sup>6</sup> Forel saw in this principle a reason to believe that humanity could avoid another cataclysm like the Great

3. Charlotte Sleight, *Six Legs Better: A Cultural History of Myrmecology* (Baltimore: Johns Hopkins University Press, 2007), 31.

4. See, e.g., William Morton Wheeler, "The Compound and Mixed Nests of American Ants," *The American Naturalist* 35 (1901): 431–48, on 442, 446; and "Part II," *The American Naturalist* 35 (1901): 513–39, on 528.

5. Google Books Ngram Viewer, search results for 1800–2008: *Plastizität*, German (2012), [https://books.google.com/ngrams/graph?content=Plastizit%C3%A4t&year\\_start=1800&year\\_end=2008&corpus=20&smoothing=3&share=&direct\\_url=t1%3B%2CPlastizit%C3%A4t%3B%2CCo#t1%3B%2CPlastizit%C3%A4t%3B%2CCo](https://books.google.com/ngrams/graph?content=Plastizit%C3%A4t&year_start=1800&year_end=2008&corpus=20&smoothing=3&share=&direct_url=t1%3B%2CPlastizit%C3%A4t%3B%2CCo#t1%3B%2CPlastizit%C3%A4t%3B%2CCo); *plasticité*, French (2012), [https://books.google.com/ngrams/graph?content=plasticit%C3%A9&year\\_start=1800&year\\_end=2008&corpus=19&smoothing=3&share=&direct\\_url=t1%3B%2Cplasticit%C3%A9%3B%2CCo](https://books.google.com/ngrams/graph?content=plasticit%C3%A9&year_start=1800&year_end=2008&corpus=19&smoothing=3&share=&direct_url=t1%3B%2Cplasticit%C3%A9%3B%2CCo) (accessed Mar 2021).

6. Auguste Forel, *Le monde social des fourmis du globe comparé à celui de l'homme*, Vol. 2 (Geneva: Kundig, 1921), 3–4.

War. In this sense, plasticity was related to the nineteenth-century concept of educability (*Bildsamkeit*). However, educability implied a controllable outcome, whereas plasticity connoted an open-ended and unpredictable process of adaptation. This emphasis on indeterminacy reflected a personal experience that Forel shared with a remarkable number of his contemporaries, professional naturalists and amateurs alike: that of mutual adaptation between cohabiting species. It was a lesson gleaned from living with bugs.

This essay traces the emergence of scientific evidence for the indeterminate-ness or malleability of insect behavior. In doing so, it demonstrates the value of studying the history of science together with the history of private life. My claim is that evidence for the plasticity of the homemaking instincts of insects depended materially and intellectually on an epochal shift in the conditions of bourgeois domestic life. Between the 1880s and the 1920s, many people began to question the presumed “naturalness” and inevitability of the bourgeois homes of Europe and North America as human habitats. Some of these challenges are well documented by historians, including experiences related to urbanization, globalization, and colonialism, as well as political movements including feminism, socialism, and eugenics. Reformers who questioned the definition of a natural home were often committed to some form of feminism. In some cases, their iconoclasm also reflected eugenicist and colonialist agendas. Feminists, eugenicists, and colonialists frequently shared the ambition of reconfiguring domestic life, whether by reallocating household labor, controlling reproduction, or regulating relationships within the home in the service of colonial hierarchies.<sup>7</sup> Scientific thinking about the malleability of animal behavior was shaped by this broad historical context,<sup>8</sup> but it also derived from a phenomenon that has escaped the attention of historians concerned with

7. Laura Wexler, *Tender Violence: Domestic Visions in an Age of U.S. Imperialism* (Chapel Hill: Univ. of North Carolina Press, 2000); Anne McClintock, *Imperial Leather: Race, Gender and Sexuality in the Colonial Context* (New York: Routledge, 1995).

8. Rohan Deb Roy, “White Ants, Empire, and Entomo-Politics in South Asia,” *The Historical Journal* 63 (2020): 411–36; Rohan Deb Roy, “Nonhuman Empires,” *Comparative Studies of South Asia, Africa and the Middle East* 35 (2015): 66–75; Harriet Ritvo, “The World as Zoo: Acclimatization in the Nineteenth Century,” in *The Ark and Beyond: The Evolution of Zoo and Aquarium Conservation*, ed. B. A. Minteer et al. (Chicago: Univ. Chicago Press, 2018), 28–38; Ian Miller, *The Nature of the Beasts: Empire and Exhibition at the Tokyo Imperial Zoo* (Berkeley: Univ. of California Press, 2013); Bathsheba Demuth, *The Floating Coast: An Environmental History of the Bering Strait* (New York: Norton, 2019); Rebecca J. H. Woods, *The Herds Shot Round the World: Native Breeds and the British Empire, 1800–1900* (Chapel Hill: Univ. of North Carolina Press, 2017); Alan Mikhail, *The Animal in Ottoman Egypt* (Oxford: Oxford Univ. Press, 2014).

these other trends: the household study of insects. With the proliferation of entomologically inclined households around the turn of the century came the multiplication of what Jenna Tonn has called the “laboratory of domesticity,” a site where zoological work invited a more conscious organization of private relations.<sup>9</sup> The idea of behavioral plasticity as it emerged in entomology circa 1900 reflected and informed an experimental, multispecies approach to human homemaking.

### A TEST OF THE DOMESTIC INSTINCT

Turn-of-the-century biologists typically claimed that human family relations were rooted in evolutionarily ingrained instincts and were inclined to judge alternative family structures “unnatural.”<sup>10</sup> In the late nineteenth century, however, changes in middle-class life in Europe and North America began to challenge that premise. Divorce, birth control, legal rights for illegitimate children, women’s education and work outside the home—all threw into question the allegedly instinctual basis of the traditional family. Late nineteenth-century European imperialism also contributed to this destabilization. Europeans abroad encountered ways of thinking about households that upset the gendered dichotomy between a feminine private sphere and a masculine public sphere.<sup>11</sup> Cultural comparisons like these were of great interest to some of the entomologists discussed below—including Adele Fielde, who served as the first unmarried female Baptist missionary in Bangkok and southern China between 1866 and 1883, and wrote extensively about the lives of the

9. Jenna Tonn, “Laboratory of domesticity: Gender, race, and science at the Bermuda Biological Station for Research, 1903–30,” *History of Science* 57 (2019): 231–59. Tonn uses this phrase to describe the Bermuda Biological Station for Research as a site for reinforcing the ideology of White domesticity in a colonial setting, but she shows that Blanche Crozier turned it into a site for her critical study of the racism and misogyny of American science. For recent scholarship on science and domesticity from the eighteenth through the twentieth centuries, see Donald L. Opitz, Staffan Bergwick, and Brigitte Van Tiggelen, eds, *Domesticity in the Making of Modern Science* (Basingstoke: Palgrave Macmillan, 2016).

10. On Oskar Heinroth’s ornithological studies of courtship and imprinting, see Richard Burkhardt, *Patterns of Behavior: Konrad Lorenz, Niko Tinbergen, and the Founding of Ethology* (Chicago: Univ. of Chicago Press, 2005), 138; for later developments, see Marga Vicedo, *The Nature and Nurture of Love: From Imprinting to Attachment in Cold War America* (Chicago: Univ. of Chicago Press, 2013).

11. Elizabeth LaCouture, “Translating Domesticity in Chinese History and Historiography,” *American Historical Review* 124 (2019): 1278–89.

women she met there; and Sir John Lubbock, whose archaeological and anthropological research placed him at the center of the debates over comparative studies of kinship in the 1870s. In short, the processes of colonization, industrialization, and urbanization produced mobile subjects who could not or would not conform to the ideal of domestic femininity. Meanwhile, late nineteenth-century feminists began to challenge directly the patriarchal, classist, heteronormative standards of the bourgeois home. These experiences pressed the question of just how far human “domestic instincts” could be retrained.

It was in this historical context that the scientific study of the social insects took its domestic turn. Previously, entomology had been largely a taxonomic and economic enterprise, centered on agriculture, gardening, and the management of household pests.<sup>12</sup> In the eighteenth century, naturalists who studied insects out of sheer curiosity were reputed to be solitary and boorish.<sup>13</sup> With little grounding in empirical observation, eighteenth-century moralists cited insect societies to naturalize human hierarches of race, caste, and gender.

Already in the eighteenth century, however, these moralists were becoming the butt of satire.<sup>14</sup> Meanwhile, certain naturalists were beginning to observe insect behavior more patiently, using household resources to do so.<sup>15</sup> By the late nineteenth century, amateur and professional naturalists alike were caring for, rather than eliminating, insects in their homes. They gathered up bugs, caged them, and kept careful watch as the creatures accustomed themselves to

12. On economic entomology circa 1900, with its taxonomical rather than behavioral concerns and non-domestic settings, see Kristin Johnson, *Ordering Life: Karl Jordan and the Naturalist Tradition* (Baltimore: Johns Hopkins Univ. Press, 2012).

13. Lorraine Daston, “Attention and the Values of Nature in the Enlightenment,” in *The Moral Authority of Nature*, ed. Lorraine Daston and Fernando Vidal (Chicago: Univ. of Chicago Press, 2004), 100–26.

14. Eva Johach, “Der Bienenstaat: Die Geschichte eines politisch-moralisches Exempels,” in *Politische Zoologie*, ed. Anne von der Heiden and Joseph Vogl (Zürich and Berlin: Diaphanes, 2007), 219–33.

15. In *Catching Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century* (Chicago: Univ. of Chicago Press, 2014), Mary Terrall shows that household relationships were crucial to the zoological studies of R. A. F. de Réaumur (1683–1757). On the history of domestic entomology, see Sleight, *Six Legs Better* (ref. 3); and Abigail Lustig, “Ants and the Nature of Nature in Auguste Forel, Erich Wasmann, and William Morton Wheeler,” in *The Moral Authority of Nature*, ed. Lorraine Daston and Fernando Vidal (Chicago: Univ. of Chicago Press, 2004), 282–307. On the variety of roles that insects play in the sciences, see U. Beisel et al., “Knowing Insects: Hosts, Vectors and Companions of Science,” *Science as Culture* 22 (2013): 1–15; and on human-insect relationships, Hugh Raffles, *Insectopedia* (New York: Penguin, 2010).

their new abodes. At last, naturalists had access to the “intimate” lives of insects. “Through the glass you can observe the moral life of the insects in their intimacy, because the narrowness of the box forces them to make use of the glass as the outer wall of all their rooms.”<sup>16</sup> Gamages’ department store in London began selling the “Lubbock formicarium” in 1904, and by 1905, *Good Housekeeping* was informing US readers that a 12-inch-square ant nest was the “latest addition to the toy shop in England.”<sup>17</sup>

Entomology as the study of insect behavior depended on the cohabitation of humans and insects. It involved what Abigail Lustig has described as “long-term observation and personal knowledge” of individual insects and colonies.<sup>18</sup> Behavioral entomology was typically a collaborative and family-oriented enterprise. And entomologists were not alone in this respect: founding figures in the history of ethology more generally, including Charles Darwin and Konrad Lorenz, tended to study animal behavior in their own homes.<sup>19</sup> Ethological studies called for an ethic of care and attention that had the potential to inspire a more intentional mode of domestic living.

Professional and amateur naturalists alike sought to approximate animals’ natural habitats in glass-enclosed cases indoors, as well as in their gardens and backyards. “One of the loveliest ornaments to domesticity,” according to a how-to book published in 1888, was a vivarium, or an artificial home for cold-blooded life.<sup>20</sup> In the last two decades of the nineteenth century, a vivarium or “insectarium” was becoming increasingly common “among entomological families.”<sup>21</sup>

Ordinary households thus became rather extraordinary scientific sites, where researchers laid foundations for the development of new sciences that

16. Auguste Forel, *Les fourmis de la Suisse*, 1st ed. (Zurich: Société helvétique des sciences naturelles, 1874), 252.

17. “Notes,” *Nature* 71, no. 1834 (22 Dec 1904): 181; George Cecil, “The Ants’ Nest as a Plaything,” *Good Housekeeping* 61, no. 1 (Jul 1905): 60.

18. Lustig, “Ants and the Nature of Nature” (ref. 15), 283; cf. Christian Reiß, “Gateway, Instrument, Environment: The Aquarium as a Hybrid Space between Animal Fancying and Experimental Zoology,” *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin* 20 (2012): 309–36, on 329.

19. Paul S. White, “Darwin’s Home of Science and the Nature of Domesticity,” in *Domesticity in the Making of Modern Science*, ed. Donald Opitz, Staffan Bergwik, and Brigitte Van Tiggelen (London: Palgrave MacMillan, 2016), 61–83.

20. Hermann Lachmann, *Das Terrarium: seine Einrichtung, Bepflanzung und Bevölkerung* (Magdeburg: Creutz’sche Verlag, 1888), iii.

21. L. E. E. Müller-Schmölln, “Billiges und praktisches Insektarium für Naturforscher und Biologen,” *Insekten-Welt* 4, no. 3 (1887): 16.

depended on the observation of animal behavior in approximately natural settings, including ecology, ethology, and comparative psychology. Reacting against the dominance of Mendelism, organismic and evolutionary biologists after 1900 turned to the technology of the vivarium to demonstrate environmental influences on cold-blooded animals under controlled conditions. Some of them aimed to study the biological mechanisms of “acclimatization” with an eye toward projects of settler colonialism; others hoped to demonstrate the value of investments in hygiene and social welfare.<sup>22</sup> As Robert Kohler has argued, precise knowledge of the relationship between organisms and their environments came from investigations conducted on a thin line between wild nature and human artifice.<sup>23</sup> In this sense, homes were spaces that creatively combined the advantages of the field and the laboratory.

But how far were entomologists willing to go in co-habiting with insects? How did they react when they found bugs between their sheets at night?

This essay takes domestic entomology seriously as a cross-species encounter. As Donna Haraway has argued, communication between species can take the form of a process of co-adaptation. Profoundly new knowledge can emerge “when species meet.”<sup>24</sup> Some scholars have argued that organismic biology has tended to disregard these elements of relationality between humans and animals.<sup>25</sup> By defining human influences on animal subjects as irrelevant “disturbances,” scientists become incapable of observing how animals adapt their behavior to the physical and social circumstances of life with humans. I argue that domestic entomologists avoided this trap. Their records foreground the mutual interrogation of humans learning the ways of insects and insects learning the ways of humans.

Domestic entomology stands out, even at first glance, for its reflexive attention to two aspects of research that normally remain invisible in reports of

22. Michael Osborne, *Nature, the Exotic, and the Science of French Colonialism* (Bloomington: Indiana University Press, 1994); Christian Reiß, “Gateway, Instrument, Environment, Vivarium: Experimental, Quantitative, and Theoretical Biology at Vienna’s Biologische Versuchsanstalt (Cambridge, MA: MIT Press, 2017); Cheryl A. Logan, *Hormones, Heredity, and Race: Spectacular Failure in Interwar Vienna* (New Brunswick, NJ: Rutgers Univ. Press, 2013).

23. Robert E. Kohler, *Lords of the Fly* (Chicago: Univ. Chicago Press, 1993), *Landscapes and Labscapes* (Chicago: Univ. Chicago Press, 2002).

24. Donna Haraway, *When Species Meet* (Minneapolis: Univ. Minnesota Press, 2007).

25. Dominique Lestel, Jeffrey Bussolini, and Matthew Chrulow, “The Phenomenology of Animal Life,” *Environmental Humanities* 5 (2014): 125–48. On multispecies ethnography more generally, see S. Eben Kirksey and Stefan Helmreich, “The Emergence of Multispecies Ethnography,” *Cultural Anthropology* 25 (2010): 545–76.



scientific experiments: the experimenters' assistants and the place of research.<sup>26</sup> First, the intense, continuous, and protracted observation of insects was almost always facilitated by teamwork among human members of the household. The influential British naturalist and politician, Sir John Lubbock, set a precedent for this style of reporting in the late 1870s: "This winter I have kept two nests under close observation—that is, I arranged with my daughters and their governess, Miss Wendland, most conscientious observers, that we should look at the nest once every hour throughout the day, and this has been done since the middle of November, with a few exceptions not enough to affect the conclusion."<sup>27</sup> As in other branches of zoology and astronomy in the nineteenth century, in entomology it proved convenient to recruit members of the household to furnish observations around the clock.<sup>28</sup> Thus the experimenter was not an individual but a collective, and a collective bound by emotional ties. As the married entomologists George and Elizabeth Peckham put it, "all *our* knowledge of [the wasps] was gained by the sweat of *our* brows."<sup>29</sup> The naturalist John Burroughs cannily described the Peckhams' writing as "a wonderful record of patient, exact, and loving observation, which has all the interest of a romance."<sup>30</sup> Here "loving" describes both the authors' attitudes toward their insects and toward each other. Likewise, their essays resemble a "romance" or novel not only in their accounts of mating among the insects but also in the stories they told indirectly about their own lives.

The second element that distinguishes reports on domestic entomology is attention to the *emplacement* of the research. Unlike a laboratory, which was meant to be a neutral, unchanging backdrop to the experimental action, the human home often played an elaborate role in reports on entomological research. Readers learned about the seamy underside of the experimenter's

26. Steven Shapin and Simon Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, NJ: Princeton Univ. Press, 1985).

27. Sir John Lubbock, "On the Habits of Ants," *Popular Science Monthly* 11 (May 1877), [https://en.wikisource.org/wiki/Popular\\_Science\\_Monthly/Volume\\_11/May\\_1877/On\\_the\\_Habits\\_of\\_Ants](https://en.wikisource.org/wiki/Popular_Science_Monthly/Volume_11/May_1877/On_the_Habits_of_Ants) (accessed Mar 2021); repeated in his widely read *Ants, Bees, and Wasps* (1882), which went through eighteen editions by 1929 (J. F. M. Clark, *Bugs and the Victorians* [New Haven, CT: Yale Univ. Press, 2009], 86).

28. White, "Darwin's Home" (ref. 19); Alix Cooper, "Homes and Households," in *Early Modern Science*, vol. 3 of *The Cambridge History of Science*, ed. Lorraine Daston and Katharine Park (Cambridge: Cambridge Univ. Press, 2003), 224–37.

29. George W. Peckham and Elizabeth G. Peckham, *Wasps, Social and Solitary* (Boston: Houghton and Mifflin, 1905), 21.

30. John Burroughs, "Introduction," *ibid.*, xiii–xv, on xiii.

abode: its dusty corners, cracks in the walls, and untended gardens—all those nooks and crannies where insects might make themselves comfortable. At certain moments one even glimpses the home and its residents as if through the eyes of the insects themselves. In what follows, I pay particular attention to such moments, when the magnifying glass is turned, as it were, from six-legged subjects to two-legged ones.

In this way, domestic entomology had the power to construct and reveal household webs of interdependence that unsettled the gender and class norms of the nineteenth century. The artificial ant colony inverted the logic of the bourgeois household, bringing into the light the dark-clad, scurrying laborers that wealthy homes were designed to hide.<sup>31</sup> Domestic entomology took the rigid, seemingly timeless idea of a “natural home” and transformed it into a research question.

## DE-NATURALIZING THE BOURGEOIS HOME

Natural histories of the bourgeois home were a popular genre in the nineteenth century. Since the Enlightenment, the age of Mandeville and Réaumur, both naturalists and moralists had held up insect societies as allegories of human sociability. Popular works of natural history instructed readers to take the selfless cooperation of the ants and bees as their model. In the nineteenth century, didactic writers recounted the behavior of the social insects and their architectural feats for a wider audience. Evolutionary theory encouraged racist speculations about continuities between the ways of insects and those of “primitive” peoples. In books like *Homes without Hands* and *Nature’s Teachings* (Fig. 1), the Oxford-educated Rev. J. G. Wood compared the architectural achievements of termites, beavers, and human communities of the Arctic.<sup>32</sup> Another work of natural history for children, *Little People and Their Homes*, by the popular writer Stella Hook, compared wasp nests to adobe homes in Mexico.<sup>33</sup> These comparisons reduced human technological achievements to

31. I owe this insight to A. S. Byatt’s 1992 novella of Victorian entomology, domesticity, and transgression, *Morpho Eugenia*, in *Angels & Insects* (London: Chatto & Windus, 1992).

32. Rev. J. G. Wood, *Homes Without Hands* (London: Longmans, Green & Co., 1865), and *Nature’s Teachings: Human Invention Anticipated by Nature* (London: Daldy, Isbister & Co.), 159ff. On the fascination with insect architecture, see Jussi Parikka, *Insect Media: An Archaeology of Animals and Technology* (Minneapolis: Univ. of Minn. Press, 2010), chap. 2.

33. Stella Louise Hook, *Little People and Their Homes in Meadows, Woods, and Waters* (New York: Scribner’s, 1907), 137.



**FIGURE 1.** "The Home," frontispiece to Rev. J. G. Wood, *Nature's Teachings: Human Invention Anticipated by Nature*, 1877.

the status of mere animal instinct, obscuring the ingenuity of these examples of ecologically sustainable engineering. Wasps and bees drew special attention for their home-making and child-rearing instincts. Recounting how a wasp constructed its nest, Wood described the female insect "fussing about" until at last

she “seems to make up her mind. In fact, she is house-hunting, and all her movements are very like those of a careful matron selecting a new home.”<sup>34</sup> Hook praised the leaf-cutter bee as a “neat housekeeper” and imagined “her” thinking: “No one shall say that I can’t keep my house in order, though I may not live in a fine hive like the honey-bees; or that I leave bee-bread lying about the floor, or let the babies tumble out the windows.”<sup>35</sup> In Hook’s imagination, bourgeois standards of housekeeping applied not only across class lines but across species as well. The genre of the natural history of the home carried the lesson that the bourgeois household was timelessly rooted in “nature.”

From the 1860s, however, advocates of women’s rights began to challenge this axiom. Charlotte Perkins Gilman, a feminist and avid Darwinian, did not dispute the evolutionary genealogy of the human home, but she urged women to overcome it. It was true, she acknowledged, that a “maternal instinct” was observable in insects, but what did that imply? If the bourgeois domestic ideal shared evolutionary roots with the “lower organisms,” this proved only “the bottomless depth of our attachment to the idea.”<sup>36</sup> Why would men of science expect modern women to have anything in common with six-legged critters? Her South African contemporary Olive Schreiner compared women to insects only to emphasize the injustice of their social position. Women were “sex parasites,” no better off than female insects whose sole purpose and activity in life was to bear offspring. The housewife was indeed like a female insect, having “lost wings and all activity, and power of locomotion; having become a mere distended bladder, which when filled with eggs bursts and ends a parasitic existence which has hardly been life.”<sup>37</sup> Like Schreiner, Gilman placed the reform of domestic life at the top of the agenda for advocates of women’s rights. It was time to reject the notion that the confinement of women’s activity to the home was “the true way to live, the natural way, the only way.”<sup>38</sup>

Schreiner and Gilman were part of a generation of European and North American women activists who worked to make visible the hidden labor performed by women as housewives, as well as the indignities that women suffered as domestic servants. The solution to these injustices, they argued, was to identify and reform the anachronistic elements of domestic life. These

34. *Ibid.*, 140.

35. *Ibid.*, 150.

36. Charlotte Perkins Gilman, *The Home: Its Work and Influence* (New York: Charlton, 1910 [1903]), II.

37. Olive Schreiner, *Woman and Labour* (Leipzig: Tauchnitz, 1911), 73.

38. Gilman, *The Home* (ref. 36), 6.

“material feminists,” as Delores Hayden has termed them,<sup>39</sup> argued that the home had been artificially cut off from historical change. It was time for domestic life to evolve in step with urban development and technological innovation. Thus the period from the 1860s through the turn of the century brought forth a panoply of projects to redesign domestic life. These included boarding houses for single working women and multi-family dwellings with cooperative housekeeping. Unobjectionable as such innovations might seem today, in the late nineteenth century the very idea of the apartment building had an air of scandal to it. But the material feminists embraced the architectural possibilities, emphasizing the virtues of flexible space, including innovations like movable walls. Among the earliest such experiments was the Cambridge (Massachusetts) Cooperative Housekeeping Society (1869–71). Its scholarly supporters included Harvard’s Louis Agassiz and his second wife, Elizabeth Cabot Cary, a naturalist and advocate of women’s education who became the first president of Radcliffe College. The Agassiz’ marriage demonstrates one avenue through which professional natural history communicated with the domestic reform movement.<sup>40</sup>

Although material feminism had roots in the communitarian-socialist farms associated with visionaries like Robert Owen and Charles Fourier, the movement was concentrated in large urban centers, with little concern for agriculture or husbandry. Tellingly, Gilman’s feminist utopia in the novel *Herland* had virtually eliminated humans’ economic dependence on animals, just as it eliminated women’s reproductive dependence on men.<sup>41</sup> For the material feminists, non-human species could only be a painful reminder of the evolutionary heritage that women had to overcome.

In retrospect, this was a fateful oversight. It was not due to ignorance, since Gilman was in fact familiar with the work of Adele Fielde and praised her highly. Gilman once remarked of Fielde that she had “never known a woman more richly ‘human’” and not merely “sweet and good” in a “feminine” way.<sup>42</sup> Gilman recognized that Fielde was pushing back against traditional gender

39. Delores Hayden, *The Grand Domestic Revolution: A History of Feminist Designs for American Homes, Neighborhoods, and Cities* (Cambridge, MA: MIT Press, 1981).

40. *Ibid.*, 79–89.

41. This observation is due to Agnes Malinowska, “Charlotte Perkins Gilman’s Fungal Female Animal: Evolution, Efficiency, and the Reproductive Body,” *Modernism/modernity* 26 (2019): 267–88, on 275.

42. Quoted in Helen Norton Stevens, *Memorial Biography of Adele M. Fielde, Humanitarian* (Seattle: Piggot, 1918), 48.

norms, but not *how* she was doing so. Gilman and her allies were unable to appreciate the radical potential of the new experimental multispecies household and its affinity with *fin-de-siècle* feminist experiments in collective domestic life.

### “ARTIFICIAL” HOMES FOR INSECTS

The new insectariums, widely advertised through popular natural history magazines and clubs, caught the imagination of an urbanizing public in Europe and North America. Ads portrayed them as a perfect accoutrement to life in the city, a means of bringing nature indoors.<sup>43</sup> But their connections to material feminism ran deeper. First, as we will see, these “artificial” insect homes were described using the same vocabulary as the new forms of domesticity supported by material feminists. The insects, too, lived in communal “apartments” with conveniently movable walls. Second, as in Gilman’s prescriptions for the modern home, domestic entomologists understood themselves to be testing the plasticity of insects’ domestic instincts. In this sense, insects and their human hosts each became the subjects of experiments in the reform of domestic life.

Domestic entomologists designed experiments to test the so-called maternal instincts of insects. In doing so, they addressed anxieties raised by early feminists’ demands for women’s sexual freedom.<sup>44</sup> Some of the most prominent domestic entomologists were personally connected to one or another branch of the turn-of-the-century feminist movements: members of the Exner-Frisch family were advocates for women’s education, and Auguste Forel took a leading role in the movements for sexual reform and the reform of domestic service. Others supported feminism by example. Elizabeth Peckham earned a master’s degree from Vassar in 1889 and claimed individual authorship for some of the research that she conducted collaboratively with her husband. Adele Fielde modeled the autonomy of the New Woman by living, single and childless, in a boarding house in New York City. My goal here is not to trace mutual influences between domestic entomology and material feminism. Rather, I hope to demonstrate that the household study of social insects had an implicit

43. Sally Gregory Kohlstedt, *Teaching Children Science: Hands-On Nature Study in North America, 1890–1930* (Chicago: Univ. of Chicago Press, 2010).

44. See, e.g., Kirsten Leng, *Sexual Politics and Feminist Science: Women Sexologists in Germany, 1900–1933* (Ithaca, NY: Cornell Univ. Press, 2018).

feminist potential. It enlisted humans and insects alike in a more intentional mode of home life. Domestic entomologists demonstrated to their own satisfaction the *plasticity* of household relations.

Domestic entomology often spoke directly to the social concerns of its day. Its experiments frequently echoed the racial anxieties that accompanied women's increasing independence and the growth of immigrant populations in urban centers, many of whom found employment in domestic service. Particularly generative for the development of the concept of plasticity were experiments on the co-habitation of insects presumed to represent different "races." Some observers described belligerent "raids" and the "enslavement" of one colony by another, while other observers saw the capacity for peaceful coexistence. Some (like Frisch and Wheeler) concluded that nationalism was instinctive, while others (like Forel and Fielde) drew the lesson that xenophobia was a "plastic" behavior that could be overcome. Even Forel, an activist for world peace and critic of nationalism, affirmed White superiority, as did Fielde, who nonetheless wrote and lectured in support of the welfare of Chinese and Indian women and Russian Jews. Forel was an outspoken eugenicist, and he wrote of people of African descent as an "inferior race," while Fielde aligned herself with anti-immigrant politics.<sup>45</sup>

It may seem paradoxical that theorists of the plasticity of animal behavior often interpreted behavior in racist terms. But entomology circa 1900 was a deeply colonial discipline. Taxonomists relied on colonial networks to build their collections, while economic entomologists often described their task as the elimination of the "enemies of civilization."<sup>46</sup> Moreover, eugenic thinking was pervasive among modernists and progressives circa 1900; even the most dedicated opponents of racism struggled to think outside of the eugenic paradigm.<sup>47</sup> More fundamentally, certain elements of eugenics, broadly construed, resonated with the lessons of domestic entomology. Historians have amply demonstrated that eugenics provided a political platform for White feminists. White women used the cause of national or racial "fitness" as an argument for women's sexual freedom, even in defense of female homosexuality.<sup>48</sup> More specifically, material feminists like Gilman understood eugenics

45. Bernard Kuechenhoff, "The psychiatrist Auguste Forel and his attitude to eugenics," *History of Psychiatry* 19 (2008): 215–23; Leonard Warren, *Adele Marion Fielde: Feminist, Social Activist, Scientist* (London: Routledge, 2002), chap. 9.

46. Deb Roy, "White Ants" (ref. 8), 436; Johnson, *Ordering Life* (ref. 12), 231.

47. See, e.g., Daylanne English, *Unnatural Selections: Eugenics in American Modernism and the Harlem Renaissance* (Raleigh: Univ. North Carolina Press, 2004).

48. Leng, *Sexual Politics* (ref. 44).

as a means of freeing domestic life from the strictures of tradition and “instinct.” In this respect, domestic entomologists may have seen eugenics as aligned with the notion of plasticity, despite the tension between hereditarian and plastic theories of behavior.

In less obvious ways as well, the concept of plasticity remained embedded in the racist science that upheld slavery and other forms of racial violence in the nineteenth century. Those who were marginalized on racial grounds were often described as plastic or “impressible,” as literary scholars have recently observed.<sup>49</sup> Zakiyyah Iman Jackson argues, “The black(ened) are, therefore, defined as plastic: impressionable, stretchable, and misshapen . . . *Slavery’s technologies were not the denial of humanity but the plasticization of humanity.*”<sup>50</sup> The concept of plasticity may have been too deeply bound to scientific racism to support a program of feminist reform that would not reproduce White privilege.<sup>51</sup>

### BRUNNWINKL “A LIVING ENTOMOLOGICAL LABORATORY”

Figure 2, according to its key, is a map of two colonies of bees, B<sub>1</sub> and B<sub>2</sub>. It accompanied the report of an experiment conducted by the zoologist Karl von Frisch in the summers of 1912 and 1913. I first encountered it years ago while researching the Exner-Frisch scientific dynasty, and it has continued to puzzle me ever since. Both Frisch and his uncle, Sigmund Exner, made prize-winning contributions to what we might call the sensory ecology of insects: Exner through his study of the workings of the compound eye, published in 1891, and Frisch through his exploration of what he termed the “dance of the honeybees.”<sup>52</sup> Both Exner and Frisch conducted this research at their extended

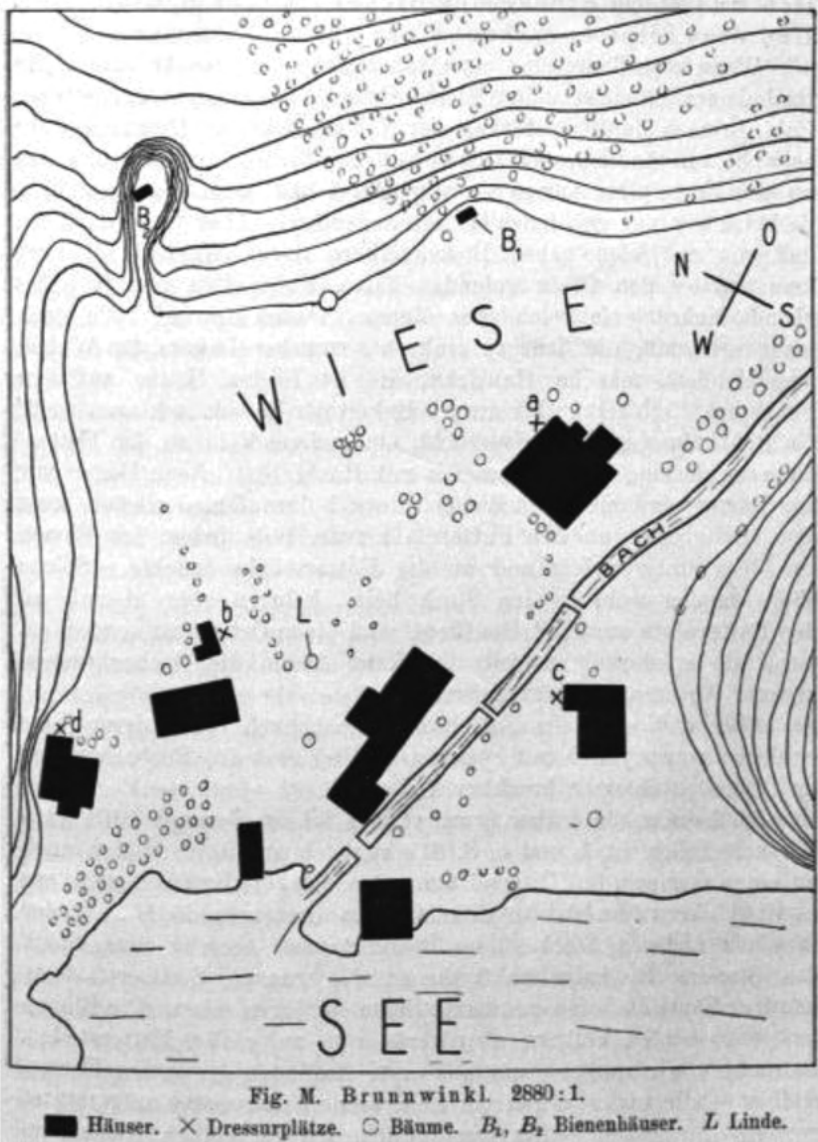
49. Kyla Schuller notes that “the concept of race . . . crystallized as a relative index of the body’s degree of impressibility . . . Racialized bodies were seen as overly excitable and functionally dead, due to the absence of the regulatory capacity to respond appropriately to their stimulations.” Kyla Schuller, *The Biopolitics of Feeling: Race, Sex, and Science in the Nineteenth Century* (Durham, NC: Duke Univ. Press, 2018), 55.

50. Zakiyyah Iman Jackson, *Becoming Human: Matter and Meaning in an Antiracist World* (New York: NYU Press, 2020), 60.

51. This history likewise calls into question the interpretation of recent theories of neural plasticity as underwriting individual agency; see Nikolas Rose and Joelle M. Abi-Rached, *Neuro: The New Brain Sciences and the Management of the Mind* (Princeton, NJ: Princeton Univ. Press, 2013).

52. Tania Munz, *The Dancing Bees: Karl von Frisch and the Discovery of the Honeybee Language* (Chicago: Univ. of Chicago Press, 2016); Deborah R. Coen, *Vienna in the Age of Uncertainty: Science, Liberalism, and Private Life* (Chicago: Univ. of Chicago Press, 2007).





**FIGURE 2.** Map of Karl von Frisch's bee experiments at Brunnwinkl circa 1914. *Source:* Karl von Frisch, "Der Farbensinn und Formensinn der Biene," *Zoologischer Jahrbücher* 35 (1914): 1–105, on 81

family's summer retreat, Brunnwinkl, located on an alpine lake near Salzburg. Brunnwinkl took shape in the 1880s as a utopian model of a liberal society, a community respecting the "perfect freedom" of its members. Scientific work

at Brunnwinkl was often collaborative and blended seamlessly into leisure activities: kite-flying, for instance, had meteorological applications; the lake where the Exners swam and sailed was also an object of geophysical and zoological research; hunting allowed for bird-watching, hiking for botany.

In this context, Karl von Frisch's beekeeping posed a dilemma. His early experiments, designed to judge whether bees could distinguish members of their own hive from "intruders" or "foreigners," required counting and repeatedly recounting the bees at regular intervals. This Frisch accomplished with help from members of his extended family, each of whom was required to pass a test for accuracy. What puzzled me was how such a strict labor regime could be squared with the Exners' ideal of perfect freedom. It turns out this wasn't always possible. Shortly after Frisch's wedding, for instance, one of his brothers had to force him to quit bee-counting long enough to take his bride on a little honeymoon. Brunnwinkl, then, was not simply a site for scientific experiments; it was itself an experiment in domestic life. And Frisch's map is not simply a representation of insect colonies; it is equally and unabashedly a map of a human summer colony, going so far as to mark the location of the linden tree that served as the family bulletin board (Fig. 2, *L*). The map overlays the space of insect social relations on the space of human social relations, "bee houses" and "human houses." It also marks the *Dressurplätze*, the training arenas, where humans and bees came together to learn new behaviors: the bees to learn the association of a color or form with honey, the humans to learn to count the bees. It is a map of both intraspecies and interspecies relations. The miniature liberal utopia of Brunnwinkl was more than an experimental household: it was an experimental multispecies household.

Frisch's map suggests how the practice of domestic entomology conditioned a heightened intentionality with respect to domestic life. Domestic entomologists were interested in how insects inhabited human homes—not necessarily for the purpose of pest control, but rather to understand these spaces from an insect's point of view. Forel, for instance, intentionally released colonies of ants in his house and recorded their return to the nest.<sup>53</sup> Viewing and representing a domestic space as a site of entomological experiment made the household look simultaneously familiar and strange. A reader of Frisch's map cannot help but wonder at the nature of the experiment being performed on the human inhabitants of this unique "training ground."

53. Forel, *Les fourmis de la Suisse* (ref. 16), 195.

Another representation of Brunnwinkl makes this point more directly. In Sigmund Exner's 1891 *Physiology of the Faceted Eyes of Crustaceans and Insects*, we find a description of the view out his window at Brunnwinkl: "the white brick columns of the barn facing one of my windows, its red-tiled roof and brown planked walls . . . each of the delicate branches of a small plum tree against the blue sky."<sup>54</sup> In point of fact, Exner was describing the image formed by an amputated firefly's eye, reflected in the mirror of his microscope. He had quite literally managed to see his home from an insect's point of view.

### THE FOURMILIÈRE

The domestic setting moved to the foreground of many entomological publications circa 1900. Auguste Forel, for instance, named his family home La Fourmilière, the ant colony.<sup>55</sup> It was only after he had achieved a successful career as a psychiatrist that he settled in the countryside near Lausanne to dedicate himself to his youthful passion, entomology. As he took pains to clarify, the term *fourmilière* referred to the "community" or "family" of ants, not to the physical "nest" they shared. The name thereby acknowledged the house's status as a multispecies colony, pressing the question of whose rights of habitation took precedence. In Switzerland, Forel wrote, everyone knew that domestic ants "consider themselves the true landlords of the building."<sup>56</sup> The name Fourmilière was a reminder that the architects of a human home were not exclusively human.

Forel therefore studied the material structure of the home for clues to the survival strategies of the ants. "In the course of repairs carried out on my father's house," he wrote, "I had the opportunity to see the large holes or rooms, low and horizontal, of *Lasius emarginatus* between the foundation stones of the walls that were being demolished."<sup>57</sup> He remarked too on a garden he had seen in Zurich that had been so thoroughly "mined" by ants that it was like a "single, vast nest": a plot of ground tended from above by human

54. Sigmund Exner, *Die Physiologie der facettierten Augen von Krebsen und Insekten* (Leipzig/Vienna, 1891), 37.

55. On the term "colony" in nineteenth-century German-language natural history, see Lynn Nyhart, "Emigrants and Pioneers: Moritz Wagner's 'Law of Migration' in Context," in *Knowing Global Environments: New Historical Perspectives in the Field Sciences*, ed. Jeremy Vetter (New Brunswick, NJ: Rutgers University Press, 2010), 39–58.

56. Forel, *Les fourmis de la Suisse* (ref. 16), 106

57. *Ibid.*, 107

gardeners and from below by insects.<sup>58</sup> Who then had the right to call it home? And if such reciprocal domestication was ubiquitous, what was the meaning of a “normal” home, a “wild” home? In short, the name Fourmilière posited the home not simply as a multispecies nest but, more specifically, as an “artificial” nest, a space of social experimentation.

By calling attention to their homes as sites of entomological experimentation, Forel, Exner, and Frisch also called attention to the ways in which their homes did not conform to bourgeois norms of domestic “respectability.” Far from vaunting middle-class tidiness, accounts of entomological households underlined these spaces’ openness to non-humans and to their preferred ways of living. The texts of domestic entomology refuse to draw the line between pest and housemate.

Life at Brunnwinkl and at the Fourmilière resisted conformity in other ways as well. Forel’s iconoclasm is no secret, thanks to his popular 1905 book, *The Sexual Question*.<sup>59</sup> There Forel took a microscope to nineteenth-century marriage and family life, questioning nearly every aspect of what was considered right and natural. Forel’s commitment to eugenics led him to encourage a wholesale reevaluation of the ethical strictures around reproduction, even as he opposed reproduction for the “unfit” and “lowest races.” He questioned the superficial standards that defined a “good” home, deriding “useless luxury and conventional formality.” In the future, he hoped, husbands and wives would both work “either together or independently.” Domestic servants would receive the same “education and social position” as the families they served; “no domestic work will be considered as degrading.” Forel emphasized the importance of sexual satisfaction for both partners and urged that young people be educated about sex and contraception. Like other sexologists of his day, he labeled non-reproductive sexual behavior as pathological, yet he sent a different message by documenting its prevalence and profusion of forms. Just how radical Forel was in his private life remains to be investigated. That he pushed back against the dominant norms of family life is indisputable.

Brunnwinkl also fostered domestic iconoclasm. Female members of the Exner-Frisch family were outspoken feminists. Sigmund Exner’s wife, Emilie, advocated for women’s education and their entrance into “suitable” professions. Her nieces, the artists Nora and Hilde Exner, went further, pursuing

58. *Ibid.*, 80.

59. Auguste Forel, *Die sexuelle Frage* (Munich: Reinhardt, 1905), 531. On Forel and eugenics, see Kuechenhoff, “The psychiatrist Auguste Forel” (ref. 45).

careers as artists with the Vienna Secession, living abroad unchaperoned, and foregoing motherhood.

Other well-known spaces of domestic entomology broke with domestic norms in quieter ways. These included the homes of two famous naturalist couples: Anna Botsford Comstock and John Henry Comstock, and Elizabeth Gifford Peckham and George W. Peckham. The Comstocks' household in Ithaca, New York, was childless, populated instead by a rotating cast of visiting students and colleagues. Although Anna Comstock subordinated her career to her husband's, she eventually earned the title of professor at Cornell. The Peckhams, with three children, nonetheless had a far more egalitarian collaboration than most, and Elizabeth occasionally appeared as lead author on scientific articles. Adele Fielde, by contrast, lived alone with her ants, shifting seasonally between New York City and Wood's Hole—and quietly questioning the dictum that a woman was not whole without a man.

## THE HARMAS

One home outshone all others as a site of entomological research. This was a dilapidated villa in the south of France, near Avignon. Jean-Henri Fabre acquired this modest residence late in life. As the son of peasants, Fabre struggled for decades to earn a living as a *lycée* instructor, all the while dreaming of a home where he could observe his insects “every day, at every hour.” At the age of 56, he finally settled with his wife and children outside the village of Sérignan on what he called “an abandoned, sterile patch of earth.”<sup>60</sup> His move to Sérignan was an explicit rejection of French academic society. Although never politically active, Fabre strongly identified with his peasant forebears. While the bourgeois home celebrated the nuclear family and the latest modern comforts, Fabre's home was to be a monument to his ancestors, a place with a different relationship to time than the modern world.

Fabre dedicated the Harmas and his research there to the memory of his ancestors and their ethic of hard work. Of his grandmother, for instance, Fabre remarked that she “went through life unwearied, attending to the order and the welfare of the house. I owe a great deal to you, dear

60. Jean-Henri Fabre, *Nouveaux Souvenirs Entomologiques: Études sur l'instinct et les moeurs des insectes* (Paris: Delagrave, 1882), 1

grandmother.”<sup>61</sup> Fabre also crafted his home and his writings as a legacy for his children—a legacy that peasants had long been denied. “The common people have no history,” he wrote in a chapter that combined observations on heredity among insects with reflections on his own ancestry. “Persecuted by the present, they cannot think of preserving the memory of the past. And yet what surpassingly instructive records, comforting too and pious, would be the family papers that should tell us who our forebears were and speak to us of their patient struggles with harsh fate, their stubborn efforts to build up, atom by atom, what we are today.”<sup>62</sup> Peasants had not been able to rely on the historical memory preserved in a home’s material existence: “by the very force of things, the home is abandoned; and, when the brood has flown, the nest is no longer recognized.” Peasant homes were as fragile and ephemeral as animals’ nests. Like the American amateur naturalist George Perkins Marsh, Fabre recognized the affinity of natural history with what would later come to be called the history of everyday life.<sup>63</sup> It took a uniquely patient and sympathetic chronicler to record lives of hard work and minimal rewards, generation after generation.

Fabre named the villa the Harmas, from a local word for “fallow.” Its desolation suited his purposes. In place of common standards of domestic comfort, Fabre sought a home where humans and insects both would thrive. He cultivated a garden with plants chosen to attract the insects he hoped to observe. At the end of his life he would look back with affection on the years he had spent arranging his home to this end, describing the Harmas as “this patch of earth that has been nurtured so tenderly to become a living entomological laboratory.”<sup>64</sup> Thanks to the success of Fabre’s publications, the Harmas became a model for other entomological households.<sup>65</sup>

Fabre’s style of natural history shared more with eighteenth-century natural theology than with the Darwinian biology of his day. Nonetheless, Fabre earned the respect of leading naturalists, including Darwin, for his acute observations. He was equally admired as a prose stylist, capable of spinning the

61. Jean-Henri Fabre, *The Life of the Fly*, trans. Alexander Teixeira de Mattos (New York: Dodd, Mead and Co., 1913), 124.

62. *Ibid.*, 118.

63. David Lowenthal and George Perkins Marsh, *Prophet of Conservation* (Seattle: Univ. Washington Press, 2000), 96.

64. Fabre, *Nouveaux Souvenirs Entomologiques* (ref. 60), 4.

65. The Peckhams, for instance, acknowledged their debt to Fabre’s example, even as they disagreed with his conclusions.

lives of insects into lyrical, dramatic stories. He was even nominated for a Nobel Prize in literature in 1912.

The Harmas played a starring role in Fabre's books. He gave readers a tour of the grounds, pointing out the wide variety of insects among the trees and vines that he had planted and left to grow as they pleased. He displayed his study, a room in which humans and insects could work side by side. At least one of the study's south-facing windows was "always open, that the insects may come and go at liberty."<sup>66</sup> At the center of the study lay a large table on which Fabre had arranged his makeshift tools—"bottles, test-tubes, and old sardine boxes," "earthenware saucers full of sand, a few carboys and flower-pots or sweetmeat jars closed with a square of glass." This humble apparatus was all he needed to observe what he insisted on calling the insects' "labor" (*travail*). In this room, Fabre explained, the experimenter could "see his insects working on the very table upon which he is writing their history."<sup>67</sup> In Fabre's study, the work of the insects and of their chronicler coalesced into one painstaking, coordinated effort.

The Harmas even appeared in Fabre's books as an artifact of natural history in its own right. "My very window-ledge," he wrote, "the confidant of bygone ages, talks to me of a vanished world . . . That block of stone has lived. Spines of sea-urchins, teeth and vertebrae of fish, broken pieces of shells, shivers of madrepores form a pulp of dead existences. Examined ashlar by ashlar, my house would resolve itself into a reliquary, a rag-fair of things that were alive in the days of old."<sup>68</sup> Here we are a long way from the futurist utopias of the material feminists. And yet Fabre's paleontological vision of a human home shares their commitment to redefining what counts as a "natural" form of domestic life. Like the material feminists, Fabre insisted on designing a domestic space deliberately and from the ground up. Unlike them, however, he did not seek to bring domestic life into step with modernity, closing the gap between the temporality of private and public life. On the contrary, he designed a domestic space that invited the closest examination of the passage of time—from the fleeting intervals of an insect's life to the geological epochs traced in the cornerstones.

66. Augustin Fabre, *The Life of Jean-Henri Fabre, the Entomologist, 1823–1910*, trans. Bernard Miall (New York: Dodd, Mead, and Co., 1921), 318.

67. Ibid. On Fabre's insect "collaborators," see too Raffles, *Insectopedia* (ref. 15).

68. Jean-Henri Fabre, *The Life of the Weevil*, trans. Alexander Teixeira de Mattos (New York: Dodd, Mead and Co., 1922), 7.

As Fabre detailed his insects' "house-keeping" habits and "domestic manners," he paid nearly equal attention to the organization of his own domestic life. A 1913 biography of Fabre called the Harmas "a prototype, one that remains entirely unique, of the residence of a solitary observer at the opening of the twentieth century, and what gives it truly exceptional significance is that Fabre himself furnished it down to its smallest details and that he adapted it so well to the needs of his work that if one wanted to build an analogous station, one could do no better than to copy his model."<sup>69</sup> Only one element of this description rings false: despite cultivating the air of a hermit, Fabre was anything but a "solitary observer."

On the contrary, Fabre portrayed the Harmas as a site of cooperative labor. From as young an age as 6, his five children played essential roles in his research. He even recruited the children of the village to collect insects for him for a fee. "They are his assistants, his appointed collaborators," his biographer, Georges Legros, wrote of Fabre's children. They "keep and relieve guard, undertaking, in his absence some observation already in hand, so that no detail may be lost, no incident of the story that unrolls itself sometimes with exasperating slowness beneath the bell-covers of the laboratory or on some bush in the garden. He inspires the whole household with the fire of his own genius, and all those about him are almost as interested as he."<sup>70</sup> Fabre apparently intended for his son Jules to take over his entomological work, but Jules died at 16, leaving Fabre "inconsolable."

Along with his children, a servant named Favier played a central role in Fabre's popular writings. Favier was the source of "invaluable" information about the habits and anatomies of animals, as well a master storyteller in his own right. Like the indigenous informers on whom Darwin relied, Favier's zoological knowledge derived largely from his varied diet: "Favier knows many things, and he knows them above all because he has eaten them."<sup>71</sup> In this way, Fabre underscored the role that domestic servants played in domestic entomology.

Fabre's portraits of his home life offered a subtle critique of urban bourgeois culture. Upon acquiring a glass house for a collection of scorpions, Fabre slyly christened it the "crystal palace," that symbol of the values of industrial

69. Anne-Marie Slézec, *Jean-Henri Fabre en son harmas de 1879 à 1915* (Aix-en-Provence: Éditions de la Lesse, 2011), 101.

70. Georges V. Legros, *Fabre, Poet of Science*, trans. Bernard Miall (New York: Century, 1913), 285.

71. Fabre, *Nouveaux Souvenirs Entomologiques* (ref. 60), 17.



modernity. If the Crystal Palace erected in London in 1851 heralded a new era of commercial spectacle, Fabre's crystal palace stood for a very different form of entertainment.<sup>72</sup> Fabre tells of an evening when the members of his household, human and canine, were so transfixed by a drama among scorpions that they watched until they could barely keep their eyes open. "As soon as supper is finished, the whole household runs out to look at it . . . It is our diversion after the worries of the day; it is our play-house. In this theatre of simple folk, the performances are so interesting that, in the moment the lantern is lighted, we all, old and young, come and take our seats in the pit: all, including even Tom, the house-dog."<sup>73</sup> Here the reader sees the family assembled as if through the eyes of the caged invertebrates. Even as Fabre goes on to describe the scene within the cage, the reader's imagination lingers on the portrait of the "simple folk" outside it. Observing a ritual of insect social life, we are privy to a ritual of human domestic life.

When Fabre finally retired that evening, he dreamed of scorpions: "they run under my blankets, they pass over my face, and I am not greatly disturbed thereby, such remarkable things do I see in my imagination!"<sup>74</sup> One biographer (in fact, a distant relative), in noting that Fabre often shared his bed with insects, adds cautiously: "Here we come to an episode of the entomologist's private life."<sup>75</sup> Yet the point Fabre made with such vignettes is precisely that he drew no line between his science and his "private life." Like Frisch and Forel, he challenged the bourgeois distinctions between public and private, work and leisure.

Fabre believed that the coordinated labor of the social insects was nonetheless rigidly governed by instinct: the product of divine design, not natural selection. Whereas Forel, Frisch, the Peckhams, Fielde, and Wheeler all emphasized the adaptability and plasticity of insect behavior, Fabre described insects as "tiny, living machines."<sup>76</sup> And yet, like them, he conceived of his home as an experimental space: as a site for testing the responses of insects to their surroundings and as a testing ground for resisting bourgeois norms. In his deliberate design of the Harmas and his delicate portraits of it, he was inventing a new model of multispecies coexistence as well as of rural working-class dignity.

72. Incidentally, *Nature* reported in 1905 that artificial ant nests were on view at the Crystal Palace ("Notes," [ref. 17]).

73. Jean-Henri Fabre, *The Life and Love of the Insect*, trans. Alexander Teixeira de Mattos (London: Adam and Charles Black, 1911), 227.

74. *Ibid.*, 231.

75. A. Fabre, *Life of Jean-Henri Fabre* (ref. 66), 250.

76. Legros, *Fabre, Poet of Science* (ref. 70), 149.

## ADAPTIVE ARCHITECTURE

Ants' nests, by contrast, are almost all *irregular, variable, and adaptable* to circumstances.<sup>77</sup>

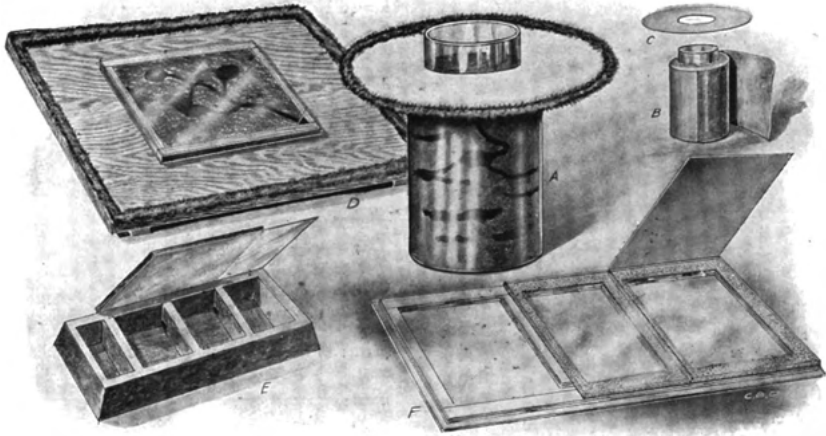
As entomologists tracked the domestic lives of their insect housemates, they documented a remarkable range of behaviors. Without necessarily using the word “plastic,” they described a capacity for environmentally adaptive deviations from instinctive behaviors. They paid special attention to variability in the construction of nests. The Peckhams observed that no two wasps' nests were ever alike. In this respect, they disagreed vehemently with Fabre's characterization of insect behavior as mechanical: “The conclusions that we draw from the study of this genus [*Ammophila*] differ in the most striking manner from those of Fabre. The one preeminent, unmistakable and ever present fact is variability. Variability in every particular—in the shape of the nest and the manner of digging it, in the condition of the nest (whether closed or open) when left temporarily.”<sup>78</sup> The Peckhams likewise found that wasps of the genus *Pelopaeus* exhibited remarkable diversity in the design of their nests and the spaces they used to build them, which included chimney interiors, barn rafters, and out-houses. Usually the wasps built from scratch, but occasionally they recycled existing nests. “The chief interest of *Pelopaeus* lies in instances like this, of marked variation in an important instinct.”<sup>79</sup> Wasps appeared to be endlessly adaptable when it came to nesting.

The implication was that no nest could be judged more “natural” than another. Writing on ants, Forel likewise stressed the “immense variety” of forms that their nests took. Attempting to classify these, he identified (1) those built of pure earth, (2) those bored in wood, (3) nests of cardboard or paper, (4) nests of mixed materials, and (5) “abnormal” nests, or those “that no longer correspond to wild nature.” Abnormal nests, in other words, took advantage of pre-existing structures, such as walls and rocks. “These nests have a peculiar quality, that of not requiring any special architecture on the part of their owners. Thus one can hardly give them the name of nests.” Nests within houses were similarly “abnormal.” Some types of domestic ant could

77. As opposed to bees' hives, “the structure of which is fixed by inherited instinct.” Forel, *Le monde social* (ref. 6), 135 (emphasis in original).

78. George W. Peckham and Elizabeth G. Peckham, *On the Instincts and Habits of the Solitary Wasps* (Madison, WI: State of Wisconsin, 1898), 30.

79. *Ibid.*, 177–78.



**FIGURE 3.** Artificial ant nests, as described in the text. Diagrams A, B, and C represent a Barth nest, D is a Lubbock nest, E is a Janet nest, and F is a Fiedle nest. *Source:* Clement B. Davis, “Curious Habits and Structures of Ants,” *St. Nicholas* 36 (1909): 938–41, on 941

“constitute a veritable infection for the house, which rendered it nearly uninhabitable unless one discovers and destroys the nest.” In such rare cases, the house would become uninhabitable either for humans or for ants. More often, the two species adapted to each other. Forel’s use of the term “abnormal” had an ironic ring, given the evidence he presented of the endless multiplicity of nests. As he observed, “This title [Abnormal Nests] does not convey very well the character of the varied nests we will discuss, which have little else in common than that they do not fit into any of the preceding categories, but I have not been able to find a better one.”<sup>80</sup> The lesson to be drawn from observations like these was that insects’ homes could take an endless variety of forms.

### MODULAR LIVING

In keeping with this insight, the decades before and after 1900 saw a proliferation of designs for terrariums, or man-made homes for cold-blooded life (Fig. 3). Following Forel, we might think of the Harmas, Fourmilière, and Brunnwinkl as themselves terrariums writ large, but the most popular tool for

80. Forel, *Les fourmis de la Suisse*, 1st ed. (ref. 16), 198; 2nd ed. (La Chaux-de-fonds: Le Flambeau, 1920), 62, 106.

observing the social lives of insects took a far more compact form: the “artificial” nest or “insectarium.”

Like the home aquarium, which also surged in popularity in these years, the insectarium was intended to bring the benefits of Nature Study to urban populations.<sup>81</sup> Insectariums were often described, like aquariums, as ornamental. Yet insectariums were much more than decorative: they invited concentrated observation and experimentation, and numerous societies and magazines emerged to advise amateur domestic entomologists. Insectariums and aquariums both taught ecological lessons, but whereas aquariums were designed to convey the dependence of aquatic organisms on plants, water, and air, insectariums tended to demonstrate the dependence of insects on each other. Finally, insectariums diverged from aquariums in that they did not attempt to simulate a natural milieu. On the contrary, the artificiality of the insects’ living conditions was frequently commented on and accentuated by the insectarium’s wide variety of designs.

The most popular insectarium was the formicarium, or artificial ant nest. Formicarium designs started from a paradox: how to make visible the behavior of creatures who were only “themselves” in the dark?<sup>82</sup> What’s more, ants required a constant degree of humidity, which presented a problem in an age before indoor climate control. In short, myrmecologists faced a quandary akin to that of observing quantum entanglement: the conditions of observation destroyed the phenomenon to be observed. This was obvious to anyone who had ever overturned a stone and witnessed an orderly ant colony breaking into chaos.

The design of artificial ant nests therefore called for ingenuity. The basic idea was not new. The Swiss entomologist Pierre Huber had announced his design for an “artificial ant-hill” or *ruche* in 1810. Huber had created a thin space between two plates of glass, using shutters that could be removed for observation to control the lighting. Huber used soil to regulate the humidity.

81. On aquariums, see Mareike Vennen, *Das Aquarium: Praktiken, Techniken und Medien der Wissensproduktion, 1840–1910* (Göttingen: Wallstein Verlag, 2018). On the Nature Study movement, see Anna Comstock, *Handbook of Nature-Study* (Ithaca, NY: Comstock Publishing, 1927).

82. Charles Janet, inventor of the first artificial nest without soil, presented this device to the Entomological Society of France in 1893 under the title “Apparatus for raising and observing ants and other small animals that live in hiding and require a humid environment”: “Appareil pour l’élevage et l’observation des Fourmis et d’autres petits animaux qui vivent cachés et ont besoin d’une atmosphère humide,” *Annales de la Société Entomologique de France* 62 (1893): 467–82.

The thinner the space between the panes, the less likely that ants would be hidden within the soil.

What was new in the late nineteenth century was the rapid proliferation of such contraptions in multifarious forms. The new nests were easier and cheaper to construct and allowed for closer observation of ant behavior. The formicarium fad began with the publication of Sir John Lubbock's bestseller, *Ants, Bees, and Wasps*, in 1882. Lubbock was heir to a politically powerful family of bankers, as well as a protégé to Darwin; today, he might be known as an influencer. From the early 1880s, popular periodicals published do-it-yourself instructions for building glass-plated insect nests. Some of these were written by and/or for women. One article claimed that women were best suited to tending a formicarium, "since when it comes to maintaining good health, women are known to take greater care than men—that is, as long as they're not afraid of these 'beasts!'"<sup>83</sup>

The Lubbock nest required modifications to allow for closer manipulation of the ants. In 1893, Charles Janet, an engineer by training, introduced a nest built of a porous substance (he recommended clay or plaster), which allowed for respiration and could be moistened to maintain constant humidity. Since it was not necessary to add soil to control humidity, the nest contained only the soil that the captured ants carried with them. He retained the glass pane for observation, and holes in the plaster allowed the experimenter to remove larvae or eggs at will. Janet's nest consisted of different "rooms" connected by narrow passageways. Each room corresponded to a different landscape, each of which could be adjusted to a different level of humidity. Thus a "dry chamber" open to the light represented "the outside world," while moister, darkened chambers imitated underground conditions.<sup>84</sup>

As this suggests, flexibility was a priority for the design of ant nests. The Italian entomologist Carlo Emery emphasized that his design allowed the experimenter to connect or divide rooms at will. Even his construction material—"hollow tiles, such as are used in building light walls"—reflected modern principles of flexible, modular design.<sup>85</sup>

Janet admitted that, in the absence of soil, the ants' living conditions seemed "very far from natural." But the ants told a different story: "Questioned

83. Müller-Schmölln, "Billiges und praktisches Insektarium" (ref. 21), 9.

84. Janet, "Appareil pour l'élevage" (ref. 82).

85. Quoted in W. M. Wheeler, "Small Artificial Ant Nests of Novel Patterns," *Psyche: A Journal of Entomology* 17 (1910): 73–75, on 74.

on this point, a hardy colony of *myrmica laevinodis* demonstrated that they had no desire to have earth in their abode.”<sup>86</sup> In Janet’s account, the ants figured as collaborators rather than passive subjects. They appeared so happy with their new home that Janet found no need to close the nest; the ants returned to it whenever they ventured out.

Janet, however, conducted his experiments in a laboratory; for home use, it was preferable to ensure that the ants did not roam free. Lubbock’s solution was to rest the nest over a moat of water, but that could prove clumsy and did not allow the nest to be moved easily. To give greater flexibility, Fielde used cotton towels to seal the nest’s holes while allowing air in. She controlled humidity by placing a “flake of sponge” in the darkened rooms. She also took cost into consideration. Her design used glue (later cement) to bind the glass, cutting down on the amount of costly metal and reducing the labor of construction.<sup>87</sup>

An alternative design, created by George Barth in Milwaukee, used two differently sized glass jars, one inside the other, with the space between filled with soil or sand. The main advantage of this contraption was that it provided the ant with three dimensions of freedom rather than two. The ants could build “vertically as well as horizontally,” which was “certainly more natural to the insect.”<sup>88</sup> Yet Barth’s design was never as popular as the two-dimensional alternatives, perhaps it was bulkier and harder to manipulate.

Tellingly, designs for ant nests after the turn of the century reflected the needs of a mobile, urban population. Fielde designed nests to fit into a portable carrying case (see Fig. 4), so that they could be moved from one human residence to another. Another female scientist who designed portable nests was Edith Buckingham, the first woman to earn a doctorate in zoology from Radcliffe. Buckingham modified Fielde’s design to make it even more lightweight and compact. Notably, Buckingham credited part of this design, as well as the nest’s construction, to her mother.<sup>89</sup>

Evidently, the portability of the nest mattered to Fielde and Buckingham, and it is not difficult to see why. These single women shifted their research sites frequently, accepting lab space and teaching positions where they could find them. Buckingham opened her study of “the division of labor among ants” by

86. Forel, *Le monde social* (ref. 6), 474.

87. Adele M. Fielde, “Portable Ant-Nests,” *Biological Bulletin* 7 (1904): 215–20, on 217.

88. George P. Barth, “An Artificial Ant’s Nest,” *Entomological News* 20 (1909): 113–15, on 113.

89. Edith N. Buckingham, “A Light-Weight, Portable Outfit for the Study and Transportation of Ants,” *The American Naturalist* 43 (1909): 611–14, on 612.



**FIGURE 4.** Portable case for Fielde nests. *Source:* Fielde, "Portable Ant-Nests" (ref. 122), 218.

noting that she had conducted her investigations over the course of six years at six different locations between Long Island and Maine.<sup>90</sup> Often these women's small living quarters had to serve their research needs as well. For them, compact, easily transported nests were a necessity. Nor is it surprising that these female researchers relied on female relatives for assistance. Of the women myrmecologists active at the time, few had traditional home lives. Neither Fielde nor Buckingham married (Buckingham had a female partner).<sup>91</sup> Elizabeth Bickford, who taught at Vassar, remained single, and Margaret Holliday, who taught at the University of Texas, did not marry until the age of 36 (only to die of tuberculosis five years later).<sup>92</sup>

Myrmecologists did not deny the artificiality of the conditions they were imposing on the ants. On the contrary, they faithfully reported the distress of ants displaced into an artificial nest.<sup>93</sup> A how-to article in the popular

90. Edith N. Buckingham, "Division of Labor among Ants," *Proceedings of the American Academy of Arts and Sciences* 46 (1911): 425–508, on 426.

91. Jenna Tonn, "The Woman Zoologist Who Found a Home for Her Science in Chicken Farming," *Lady Science* (14 Nov 2019), <https://www.ladyscience.com/features/edith-buckingham-zoologist-turned-chicken-farmer-dog-breeder> (accessed Mar 2021).

92. Sandra L. Singer, *Adventures Abroad: North American Women at German-speaking Universities* (Westport, CT: Praeger, 2003), 104; Margaret R. O'Leary and Dennis S. O'Leary, *The Texas Meningitis Epidemic, 1911–1913* (Bloomington, IN: iUniverse, 2018).

93. See, e.g., Wheeler, "The Compound" (ref. 4), 436.

children's magazine *St. Nicholas* in 1892 described the "wild scene of confusion" among the "horrified" ants during their capture.<sup>94</sup> A children's book even narrated the scene of capture from the ants' point of view. As one ant recounted, the "Professor" approached

with a great pane of glass in his hand, and putting it edgewise across the front door—which is in the top, you know—hammered it straight into the ground. You may imagine the fright we were in, at having this great thing come crashing down through our halls and galleries, destroying everything in its way, and dividing the house in the middle! The Professor left it there and went away, and we set to work at once to repair damages, though the glass was dreadfully in our way; but we hardly had the place in order when that terrible man came back.

Once trapped inside the glass-paned nest, the ants were aghast:

Of course he had a full view of the other side through the pane, and I hope he felt a little ashamed of himself when he saw the dismay he had caused. To think of having the full light of day suddenly let into our underground home! How the nurses ran to snatch up the delicate infants and carry them back to the quiet darkness! The shock was enough to destroy our nerves forever, and here a whole company had to be made miserable to satisfy the curiosity of one Professor.

Note how the ant describes its own experiences in the neurological language of nerves and shock. This talking ant, traumatized by its prior experience of captivity, eliminated all need for an artificial nest: it quickly volunteered to tell "everything about our home."<sup>95</sup>

None of these architects of insect abodes judged any design better than any other in an absolute sense. Each had advantages for some purposes and not for others. Researchers agreed that the proliferation of designs was all for the good. Buckingham, for instance, sought to avoid "bias" by employing multiple methods, "partly by placing the ants in more, partly in less natural surroundings."<sup>96</sup> The lesson was that ants could thrive in a wide variety of "less natural" settings.

94. Stella Louise Hook, "A Curious Community," *St. Nicholas* 19 (1892): 841–46, on 842.

95. Hook, *Little People* (ref. 33), 169–70.

96. Buckingham, "Division of Labor among Ants," (ref. 90), 440.



## COLLECTIVE WORK

Domestic entomologists tended to stress the collaborative nature of their research, underlining their reliance on cooperation among humans, as well as between human and insect members of the household. Few historians have remarked on this aspect of entomology circa 1900, but the British novelist A. S. Byatt alludes to it in her 1992 novella *Morpho Eugenia*.<sup>97</sup> At the story's outset, William Adamson is a naturalist who has spent a decade exploring the Amazon. Now, in 1860, he finds himself a well-kept guest at the country estate of Lord and Lady Alabaster. Adamson falls in love with an Alabaster daughter, marries her, then finds himself neglected as she rapidly bears five children. It's at this point that another member of the household, a poor cousin named Matilda Crompton, invites Adamson to collaborate on a work of popular natural history, a study of insect life. The Alabaster children have joyfully discovered several colonies of ants and are eager to examine them. Joined by the children, Crompton and Adamson dedicate themselves to a prolonged and meticulous observation of the daily lives of these insects. Echoing the preoccupations of real domestic entomologists, they record how the ants organize their space, divide labor, court, mate, cooperate with friendly foreigners, and repel hostile ones. Adamson suggests that Crompton write the resulting book herself, but she insists on merely being his assistant. Nonetheless, the process of composition is intensely collaborative, to the point that Adamson and Crompton have difficulty tracing whose work is whose. Like the real-life books by the husband-and-wife naturalists George and Elizabeth Peckham, Adamson and Crompton's *The Swarming City* is written in the first person plural in a playful and intimate tone. What Byatt's novel offers to historians of science, then, is a hint about how to read our sources. She invites us to look for human stories in the margins of Victorian entomological treatises, within the frames describing domestic sites of research. Though it might appear to be a post-modern invention, the device of domestic framing was a staple of nineteenth-century natural history. Collaboration was the central theme of domestic entomology: as the foremost achievement of the insects under study *and* as the dominant mode of research and composition.

Elizabeth and George Peckham could have served as Byatt's model for the egalitarian entomologists in her novella. As an obituary for George Peckham put it, "From the time of their marriage these two are inseparably linked in all

97. Byatt, *Morpho Eugenia* (ref. 31).

phases of their work, in their researches, in their travels, in their very thoughts.”<sup>98</sup> The Peckhams portrayed themselves in their scientific publications as an inseparable pair. A chapter on “Communal Life,” for instance, introduced their 1905 study of wasps with reflections on the communal tendencies of wasps and people alike. Here is the Peckhams’ description of the conditions under which they studied *Vespa* wasps in their garden: “Intent upon their own affairs, and unsuspecting of evil, perhaps because they knew themselves to be armed against aggression, they accepted our presence, at first with indifference; but as we sat there day after day we must have become landmarks to them, and perhaps before the summer was over they considered us really a part of home.”<sup>99</sup> Here the reader glimpses the naturalists, husband and wife, through the eyes of the wasps: as a steady, benevolent creature with two heads and four eyes.

For Forel as well, entomology was a family affair. Let’s consider an extended example from one of Forel’s early experiments on the “sensory life of insects.” This took place in 1906 at his home in Chigny, before his move to the Fourmilière. His account in his 1910 *Sensory Life of Insects* provided vivid details of the Forel family’s daily routine. He began:

For many years we had been accustomed to eating outside on a veranda in the summer. In the morning, there would be jams on the table between 7:30 and 9:30, since the children left for school early, while the adults liked to rise late, so breakfast tended to be an extended meal. There was nothing sweet on the table at lunch, or no more than a dessert, which was quickly put away. In the afternoons, however, around 4 o’clock, the jams reappeared, indeed for around 45 minutes.<sup>100</sup>

Now, as anyone who knew Forel and his fascination with insects might suspect, there was a bee hive not far from this veranda. But the bees had always left the Forels in peace—until the fateful morning when a neighbor placed a jar of fresh cherry preserves on her windowsill, which stood between the hive and the Forels’ veranda and was conveniently surrounded by flowers. Once the bees had discovered the cherries, they made their way to a jar of jam left open on a windowsill of the Forels’ home, then on to a spot of jam lingering on a plate on the family’s veranda. Forel predicted that his family would be joined by

98. Quoted in Marcia Myers Bonta, *American Women Afield: Writings by Pioneering Women Naturalists* (College Station: Texas A&M Press, 1995), 75.

99. Peckham and Peckham, *Wasps, Social and Solitary* (ref. 29), 2.

100. Auguste Forel, *Das Sinnesleben der Insekten* (Munich: E. Reinhardt, 1910), 324.

a swarm of bees at their next meal. Indeed, a few showed up at lunchtime, but were disappointed by the lack of sweets. There were more bees at breakfast and afternoon tea, but still “a bearable number.” “We could enjoy our tea, jams included, without being too greatly disturbed.”<sup>101</sup> The bees had clearly begun to do their research, and now Forel began to do his.

In this way, Forel transformed his family’s mealtimes into an entomological experiment. In inviting the bees to his table, Forel may have been inspired by his growing conviction that mutual feeding (trophallaxis) was the source of social cohesion in ant societies. More directly, this experiment addressed a debate at the time over insects’ capacity to learn. The neurophysiologist Albrecht Bethe in Strasbourg was, like Forel, a proponent of the idea of the plasticity of nerve fibers; like Forel, Bethe worked with ants and bees to demonstrate the capacity of lower organisms to modify their instinctive behaviors. Bethe provoked fierce criticism, however, for his experimental procedures and for the terminology he used. To his critics, his talk of the “unknown force” that oriented insects and of their “psychic qualities” smacked of vitalism.<sup>102</sup> Forel dismissed his account as “mechanistic-metaphysical dogma.”<sup>103</sup> Bethe had conducted experiments in which he shifted the location or orientation of a hive, determining the time it took for the bees to find their way back to it. On his veranda, Forel in turn conceived his own experiment on the bees’ capacity to learn. What would happen if he took the jams away?

The results “astounded” him: the bees came nonetheless, right on schedule. They proved themselves to be meticulous researchers. “Nothing could be funnier than to see how the bees searched the empty saucers inside and out.” Even without a drop of jam to lure them, they arrived daily at the Forels’ regular mealtimes. When the sweets were set out at random times, the bees swarmed incessantly; when they were set out at regular times, the bees came only at the appointed hour. Forel concluded that bees could tell time (*Swiss bees at least*).

As Forel told it, the experiment was “spoiled” when his wife took pity on the disappointed bees. “Out of sympathy with the bees my wife provided them with sugar water; as a result they soon gave up appearing only at mealtimes,

101. *Ibid.*, 326.

102. Albrecht Bethe, “Dürfen wir den Ameisen und Bienen psychischen Qualitäten zuschreiben?” *Archiv für die gesammte Physiologie* 70 (1898): 15–100, Bethe, “Die Heimkehrfähigkeit der Ameisen und Bienen,” *Biologisches Centralblatt* 22 (1902): 193–215, 216–38. For the broader debate over the status of instinct in myrmecology, see Sleight, *Six Legs Better* (ref. 3), chap. 2.

103. Forel, *Das Sinnesleben* (ref. 100), 330.

and so the experiment was spoiled.” Actually, the experiment was only just beginning.

The bees became ever better at recognizing the objects on the table, “as well as the circumstances under which jams, sugar, and cakes became available to them. They carefully observed every new object that was placed on the table and especially every person who took a place there.” By this point, the Forels were ready to end the experiment. But that proved not to be an option. “Pulling the table a few meters further back on the veranda achieved nothing, for the bees followed everywhere.” The bees proved to be excellent empiricists, carefully inspecting each dish and gradually learning to distinguish trace remains of sugar from coffee, butter, and other less palatable substances. Forel presented these results as evidence that the bees’ behavior was not a simple reaction to chemical stimuli, but instead involved a process of learning by association, a “plastic judgment” (*plastisches Urteilsvermögen*). And he cited his family members as witnesses: “All the individuals who observed these events simultaneously with me could confirm the gradual change in the behavior of the bees.”<sup>104</sup>

Forel’s confidence in his interpretations of household experiments like these depended fundamentally on his household relationships. Not only did he cite his family as witnesses. He also referenced his relationships to them as evidence of the very possibility of psychological research. Anticipating the charge of anthropomorphism, he reasoned that if a naturalist is not permitted to speculate about the mental states of ants, then he should just as well be forbidden a statement such as “My wife has a headache.” Instead one should say, “This animal mechanism, which I consider to be my wife, exhibits certain facial contortions and emits certain articulate sounds that correspond with those emitted by myself when I have a headache, but I have no right to say that she has a headache.”<sup>105</sup>

With this comparison between knowledge of a spouse’s mind and an ant’s, one comes to suspect the debt that ethology owes to nineteenth-century bourgeois family life. The founders of this field had a remarkable ability to think themselves into the minds of animals—and yet to do so without losing sight of the ultimate otherness of those non-human minds.<sup>106</sup> Forel was

104. *Ibid.*, 329.

105. *Ibid.*, 351; translated in W. M. Wheeler, *Ants: Their Structure, Development and Behavior* (New York: Columbia University Press, 1913), 508.

106. Eileen Crist describes this as the *Verstehen* method (“Naturalists’ Portrayals of Animal Life,” *Social Studies of Science* 26 [1996]: 799–838).

intensely aware of how his presence affected the insects he studied. He warned, for instance, that the observer must take care not to breathe on ants, since it scared them. He faulted other naturalists for failing to recognize the subtle forms of communication that occur between species. Reports of calculating horses and such were a case in point: “These people have been duped by their imagination and by the intuition [*sens intuitif*] of animals, who observed them better than they were observed by them. In effect, these people were entirely preoccupied with their abstract reasoning, while their supposedly brilliant horses or dogs were only observing the smallest unconscious movements of their masters.”<sup>107</sup> Communicating with animals was not all that different from communicating with people, Forel argued. “If we are to be frank, we should admit that we ourselves often judge the mental state of our neighbor by his looks, his physiognomy, his gestures, or his sounds, rather than by his words, or by his often hypocritical writings, since one only has consciousness of another through one’s self.”<sup>108</sup> Forel was cautioning against the tendency to over-emphasize the distance of human from animal psychology, associated with the British comparative psychologist Conwy Lloyd Morgan.<sup>109</sup> Familial intimacy gave the naturalist the experience of correctly inferring the state of another mind, but it also reminded him of the limits of such inferences.

The Peckhams took equal care to walk the fine line between empathy and anthropomorphism. Watching a wasp build its nest, they reflected: “Of what is Pelopaeus thinking, as humming loudly, she jams her paralyzed and benumbed victims into her little cylindrical tubes? If only we could get inside that little head!” Some of a wasp’s experiences seemed to the Peckhams easy to imagine: “the delight of health and freedom” as a wasp “soars gayly into the blue,” the “quarreling” among them for a favorite sleeping nook. But they were unable to imagine how the wasp felt when it “surrenders herself to the mysterious sway of instinct.”<sup>110</sup> Instinct marked the limits of plasticity; here it also stood for the limits of cross-species empathy. This is a logical association, given that the evidence of plasticity in insects derived largely from instances of mutual adaptation between species—from cases in which insects learned to live more efficiently with humans.

107. Forel, *Les Fourmis de la Suisse*, 2nd ed. (ref. 80), xiv.

108. *Ibid.*, xiii.

109. Conwy Lloyd Morgan, *Introduction to Comparative Psychology*, 2nd ed. (London: Walter Scott, 1903).

110. Peckham and Peckham, *Wasps, Social and Solitary* (ref. 29), 265–66.

In other words, domestic entomology was a form of intimacy between humans and between humans and insects. In this respect, it resembled other bourgeois domestic activities of the nineteenth century that cultivated and rewarded sympathetic inquiry, such as novel reading, letter writing, or portrait drawing. The intimate ideal of the bourgeois home may have inspired the empathic spirit of investigations of insect life. At the same time, the realities of middle-class family life may have reminded naturalists that other minds remained, as Fabre once put it, an “unfathomable mystery.”<sup>111</sup>

### SUBVERTING THE DOMESTIC “INSTINCT”

Adele Fielde was not like other domestic entomologists, who emphasized the collective character of their experimental labor. Fielde, a single woman, portrayed the solitariness of her scientific work as a virtue. Fielde came from a poor, Baptist family in upstate New York. While studying to become a teacher, she agreed to marry a missionary who would soon set sail for Siam. Fielde followed him there, learning upon her arrival that he had died of typhoid. Although Fielde was, according to a friend, “naturally domestic,” she seems never to have considered another marriage proposal. Instead, Fielde embarked on a life of travel, study, teaching, and writing. She came to be recognized as an expert on Chinese language and culture, the local politics of New York City and State, and, of course, myrmecology. Living as a missionary in southern China, she reported on the hardships of women’s lives in the region, including footbinding and female infanticide. For Fielde, these observations sparked outrage, a reaction that mingled racist condescension with sympathy for Chinese women.<sup>112</sup>

It was in China that Fielde became, arguably, a material feminist, committed to reforming the physical conditions of women’s domestic lives. Her reforms extended to her own living quarters. As a single woman, she reasoned that she was more valuable to the mission than the missionaries’ wives, who were busy taking care of their husbands and children. But the mission treated her more as a problem than an asset, taking her to task for unladylike behavior, such as playing cards, dancing, and smoking hashish. Most of all, she resented that the mission forced her to share a home with a married couple. She

111. Jean-Henri Fabre, *Souvenirs entomologiques*, 5. serie (Paris: Delagrave, 1897), 263.

112. Adele M. Fielde, *Woman in China* (Boston: Woman’s Baptist Foreign Missionary Society, undated).

complained that the head of the Bangkok mission had made “it impossible to me to make my house a *home*.”<sup>113</sup> To correct this, she proposed that the mission form communal “units” of single women, in which one member would shoulder the domestic work, while the others pursued the work of the mission. This was a solution perfectly in tune with the material feminism of late nineteenth-century Europe and North America, and it may be one reason why Charlotte Perkins Gilman spoke so highly of Fielde. The proposal proved influential, as missions in China increasingly did rely on single women, housed in their own communal residences. Writing circa 1900, Fielde noted with obvious pride that there were over thirty single female Protestant missionaries working in China.<sup>114</sup>

Fielde returned to the United States for several years in the 1880s. She took up the study of biology, first at the Women’s Medical College in Philadelphia, then with the supervision of members of the Philadelphia Academy of Natural Sciences, where her interests turned to invertebrates. After several years spent traveling through Asia and Europe, she settled in New York City in 1892, where she earned her living as a writer and lecturer. In the summers, she escaped the city heat to study at the Marine Biological Laboratory in Wood’s Hole, Massachusetts. This new institution was quickly becoming a leading center of experimental biology, and Fielde managed to win the respect of the scientific community there—including the myrmecologist William Morton Wheeler, who offered her advice and cited her research generously. Although the MBL was gaining a reputation for fostering romantic matches alongside research collaborations, Fielde remained unattached.

In the cooler months, when Fielde was without a laboratory, she conducted her observations of ants in the boarding-house room she rented at 130 West 43rd Street. She joked in a private letter that her “new nest had to be lined with my feathers, which I plucked out of my trunk.”<sup>115</sup> In later years she would make explicit her opinion that domestic companions need not be human. As she wrote to a younger friend,

I have heaps of enjoyment in your new house; in its spaciousness and comfort, and in the fact that it is your own, after you have made it to your mind. It is good for the dear children to have through their lives the memory of a permanent home, where a tree, a toad and an ant-hill were close

113. Quoted in Warren, *Adele Marion Fielde* (ref. 45), 40 (emphasis in original).

114. Fielde, *Woman in China* (ref. 112), 11.

115. Quoted in Warren, *Adele Marion Fielde* (ref. 45), 128.

acquaintances. I have now on my table a little plant that folds up its broad, spotted leaves and goes to sleep about my bed-time and wakes up and stretches while I am eating my breakfast. It is a sort of companion.<sup>116</sup>

In the spirit of material feminism, Fielde was testing received notions of what constituted a “natural” habitat. She remarked, for instance, on the impressive ability of ants to survive to adulthood in “so unnatural an environment as is created by a glass nest and a human purveyor.”<sup>117</sup> Despite the unusual surroundings, she reported that “after a day or two of quiet residence in this abode they showed little disposition to leave it, but carried on their normal occupations with an appearance of contentment.” She also demonstrated the capacity of ants from different colonies, or even different species or genera, to form a common colony. Although such “mixed nests” were not “found in nature,” they could be produced “artificially.” Forel had done so by depriving the ants of their organ of smell. Fielde added a second method: “educating the ants in ant-odors unlike their own.” If they were brought together soon enough after birth, she found, unrelated ants would “live amicably together,” and ants “of the most diverse lineage sometimes snuggled one another.”<sup>118</sup> Far from trying to suppress the “artificial” effects of human manipulation, she emphasized them. She noted that the ants grew increasingly tame in the course of their captivity, gradually emerging from their hiding places and tolerating her touch without biting. This was, she made clear, a process of mutual adaptation to unfamiliar living conditions. At stake was the question of which elements of domestic life were instinctive and which were learned.

From this perspective, it is significant that Fielde’s scientific publications underscored her status as a single woman. In fact, she cast her independence as an advantage, much as she had done in her missionary work. Other domestic entomologists wrote of their experiments as family affairs, but Fielde insisted on the benefits of working solo:

All the ants employed in the experiments recorded by me have been under my constant care and my frequent observation. No person beside myself has

116. Letter from Fielde to a daughter-in-law of Mrs. William Cauldwell, 1914, quoted in Stevens, *Memorial Biography* (ref. 42), 146.

117. Adele M. Fielde, “A Study of an Ant,” *Proceedings of the Academy of Natural Sciences of Philadelphia* 53 (1901): 425–49, on 436.

118. Adele M. Fielde, “Artificial Mixed Nests of Ants,” *Biological Bulletin* 5 (1903): 320–25, on 321.



ever had access to them. They have spent the summers, from the first of June to the end of September, at the Marine Biological Laboratory, Woods Holl [sic], Mass., and the remainder of every year in New York City.<sup>119</sup>

That the ants received her undivided attention helped to legitimate her observations. To be sure, she described the virtues of her observational methods in conventionally feminine terms, emphasizing her patience and attention to detail “during five years of fairly constant observation.”<sup>120</sup> But only an unmarried, childless woman could have applied these virtues to caring for non-human creatures.

Fielde went so far as to claim that the study of ant behavior demanded documentation of the life history of each individual ant. This, she explained, was because “every ant acts on personal experience and individual memory.” Learning from experience was, of course, the foundation of behavioral plasticity. Fielde even recommended keeping some ants in solitary confinement, since “only when ants are segregated from the pupa-stage, and full record kept of every experience of theirs in meeting other ants, can the investigator truthfully declare that ants behave in a certain manner in the presence of other ants.”<sup>121</sup> Just as Fielde’s own solitary status served the cause of constant observation, so did imposing solitude on ants eliminate disturbing factors.

Fielde built the virtues of patient, meticulous, long-term observation into the “artificial” nest design for which she became famous. The “Fielde nest” was the first genuinely portable apparatus for myrmecological experiments. It was relatively lightweight and free of soil. As she explained when she introduced it in print in 1900: “In order to keep ants under continued observation, and at the same time to change occasionally the domicile of the observer, it is necessary to have portable nests.”<sup>122</sup> Her experimental apparatus for the study of the domestic lives of ants was tailored to facilitate her personal experiment as an independent, mobile, single woman.

Fielde’s nest design was widely admired and copied. Wheeler described it as “superior to any other that I have used.” He added approvingly, “The ventilation of the chambers is excellent, the closest inspection of the ants is possible, and the nests are easily handled, transported, and cleaned.” However, he also cautioned

119. Adele M. Fielde, “Power of Recognition Among Ants,” *Biological Bulletin* 7 (1904): 227–50, on 232.

120. Adele M. Fielde, “The Progressive Odor of Ants,” *Biological Bulletin* 10 (1905): 1–16, on 15.

121. *Ibid.*, 15.

122. Adele M. Fielde, “Portable Ant Nests,” *Biological Bulletin* 2 (1900): 81–85, on 81.

that this style of nest was more demanding of the observer: “It requires closer attention than the Janet nest in order that the requisite amount of moisture may be maintained, but this slight disadvantage is outweighed by numerous advantages.”<sup>123</sup> For amateur use, the Fielde nest was not an ideal choice. Anna Comstock, a leading figure in the Nature Study movement, likewise advised: “The Fielde nest is better adapted for a serious study of ants, but it is not so well adapted for the schoolroom as is the Lubbock nest.”<sup>124</sup> In these assessments, Wheeler and Comstock confirmed Fielde’s own assessment of her virtues as an observer. The design of her experimental apparatus reflected her capacity for “closer attention” and the priority she placed on the “closest inspection of the ants.”

Fielde was neither surprised nor troubled by the fact that many of her experimental results could not be replicated by others. “Perhaps I am the only person who knows that some centuries from now my name will linger in the scientific world because of my discoveries of the distribution and localization of the sense of smell in ants. These discoveries, made in 1901, have not been confuted nor confirmed by any other worker. No one during the last decade has undertaken the prolonged, unhurried, painstaking experiments necessary either to the contradiction or confirmation of my published statements.”<sup>125</sup> This patient and meticulous style of observation had been characteristic of natural history in the seventeenth and eighteenth centuries, as Lorraine Daston and Marisa Bass have demonstrated.<sup>126</sup> However, by the late nineteenth century, this manner of work was firmly gendered feminine, offering few rewards to male scientists. Fielde staked her scientific authority on the value of these feminine virtues to the new science of animal behavior. In doing so, she aligned her unconventional lifestyle choices with the science of the future. She submitted herself to the judgment not of the present but of “some centuries from now.”

## WHEN ENTOMOLOGISTS LEFT HOME

Fielde’s portable nests allowed entomology to thrive in a wider variety of households than ever before, even as they challenged the assumption that any

123. Wheeler, “The Compound” (ref. 4), 528.

124. Comstock, *Handbook of Nature-Study* (ref. 81), 421.

125. Quoted in Stevens, *Memorial Biography* (ref. 42), 262; undated, but apparently written near the end of her life.

126. Daston, “Attention and the Values of Nature” (ref. 13), Marisa Bass, *Insect Artifice: Nature and Art in the Dutch Revolt* (Princeton, NJ: Princeton Univ. Press, 2019).

one form of domestic existence was more natural than another. It is an irony of history, then, that the foremost champion of this apparatus, William Morton Wheeler, staked his career on taking entomology out of the home. As Charlotte Sleight has argued, Wheeler was on a mission to reconstitute entomology as a professional academic discipline.<sup>127</sup> He worked hard to distance himself from practitioners of domestic entomology, whom he regarded as amateurs. These included George Peckham, the principal of the school in Milwaukee where Wheeler briefly taught physiology, before being appointed professor of applied biology at Harvard in 1908. Wheeler attacked amateur entomology in gendered terms as a “collecting mania,” akin to that of “little girls passionately fond of collecting useless buttons and business cards” and of “the fashionable lady who stores her house with old crockery.”<sup>128</sup> For Wheeler, professionalizing entomology meant dissociating it from everything domestic and feminine.

Wheeler is remembered today above all as the originator of the idea of the insect colony as “superorganism.” From his studies of the social insects Wheeler concluded, contra Herbert Spencer, that “natural” societies are cooperative rather than competitive. Ants fascinated Wheeler above all as harbingers of evolutionary trends that humans should strive to avoid. What he shared with experimenters like Forel and Fielde was the impulse to push back against social arrangements that might seem inevitably “natural.” In his view, human societies were no more “rational” than ant colonies, and the “best proof” of their irrationality was “to be found in the family, which by common consent constitutes the primitive basis of our society, just as it does among the insects, and the bonds which unite the family are and will always be physiological and instinctive.”<sup>129</sup> In this judgment Wheeler aligned with material feminists like Charlotte Perkins Gilman. Yet his prescriptions were at odds with theirs. Rather than trying to free women from the oppression of a domestic existence, he called on elite men to guard themselves against the influence of women and domesticity.

Even so, Wheeler’s home life was never irrelevant to his research. Shortly after his father’s death in 1884, when Wheeler was 19, he invited his friend Carl Akeley to live with him and his mother in Milwaukee. Akeley too was on his way to an illustrious scientific career, famous as the designer of exhibits at the Field Museum and the American Museum of Natural History. Wheeler’s

127. Sleight, *Six Legs Better* (ref. 3), 70.

128. Quoted in *ibid.*, 122.

129. W. M. Wheeler, *Social Life among the Insects* (New York: The Science Press, 1922), 505.

account of their life together emphasized that they were “never even on the verge of a quarrel”:

We converted a barn on my mother’s place into a shop and here he worked at least during the evenings for several years . . . Till October 1, 1890, when I left Milwaukee for good, Akeley and I had spent so many happy hours together that the parting was painful . . . when my eyes grew weary with the microscope I repaired to his shop and read to him while he worked or more rarely he read to me.<sup>130</sup>

Such homosocial bonds remained essential to Wheeler’s personal and professional life.

Despite his distaste for domestic life, Wheeler did in fact choose to marry and procreate, and he remained a family man to his death. His wife, Dora Bay Emerson, held degrees in chemistry and teaching, although these qualified her for no more than gracious hospitality in her husband’s eyes. He made his son, Ralph, a collaborator in his research, but not his daughter, Adeline, who served as his chauffeur.<sup>131</sup> As Sleight notes, “Wheeler and his friend David Fairchild spent a lot of time encouraging their sons in entomology.”<sup>132</sup> As Wheeler’s son, Ralph, once put it in a letter to his father, the women of the house had no understanding for the men’s behavior: they “ascribe to malice or impatience some of the things you and I do through oversight or shyness.” His mother and sister were, nonetheless, growing accustomed to their neglect: “I believe they no longer expect those marks of kindness to themselves that they once did.”<sup>133</sup>

In Wheeler’s view, a scientist’s success hinged on escaping the domesticating effect of family life. As he wrote in 1927,

Of active, industrious young men, there seem to be two types. One of them accepts a given environment and is not only satisfied with its routine and constantly recurring human contacts but prefers it to any change. These young men are apt to marry early and to become the conservative and contented *fond* of our society. Those of the other type, probably endowed with a more unstable if not more vivid imagination and with a peculiar

130. Quoted in George Howard Parker, “Biographical Memoir of William Morton Wheeler, 1865–1937,” *National Academy of Sciences Biographical Memoirs* 19, no. 6 (1938): 203–41, on 208.

131. *Ibid.*, 217. An unnamed child appears in a photograph of an ant nest in a publication of Wheeler’s from 1906, serving merely to indicate the scale of the image. Wheeler, “On the Founding of Colonies by Queen Ants,” *Bulletin of the American Museum of Natural History* 22 (1906): 33–105, plate IX.

132. Sleight, *Six Legs Better* (ref. 3), 112.

133. *Ibid.*, 91.

defence reaction, or subconscious dread of being owned by people and things, soon exhaust the possibilities of their medium, like fungi that burn out their substratum, and become dissatisfied and restless till they can implant themselves in fresh conditions of growth.<sup>134</sup>

This speculation is characteristic of Wheeler's disdain for the domestic sphere. Resisting its pull, he implied, was a mark of scientific genius. The ants taught him what needed to be resisted: "The facts certainly compel even those who, like myself, are neither feminists nor vegetarians, to confess that the whole trend of evolution is towards an ever increasing matriarchy, or gynarchy and vegetarianism."<sup>135</sup> Needless to say, Wheeler was not content to let evolution take its course. The conviction that instincts are "plastic" was as foundational to his efforts to professionalize entomology as it was to his myrmecological interpretations.

Wheeler pinned his hopes for scientific progress on the "anti-social" drive of a male minority. "For obvious biological reasons," he wrote, "the female is the social sex par excellence, whereas the male was originally and throughout the evolution of the Arthropod and Chordate phyla, except in a few cases, amphibians and birds, the unsocial sex. In many animals, in fact, he might more properly be called the antisocial sex."<sup>136</sup> Wheeler was all too aware that, in the modern world, "antisocial" males were an endangered minority. The majority of men lived "in collaboration with the women," contributing merely to the reproduction of the social structure. There was only a "very small class" of "less social individuals whose dominance was manifested mainly in the . . . great cultural values (sciences, arts, technologies)" as well as in the "great cultural illusions (philosophies, theologies, social utopias)." Wheeler thus cast science as a fundamentally antisocial activity and the scientist as an antisocial creature. Note too his implicit suggestion that intellectual evolution is driven by the male sex drive. Wheeler once hinted that the philandering Nobel-Prize winner John Watson was his model for the productive liberation of the male libido.<sup>137</sup>

It may come as a surprise, therefore, that Wheeler did offer his support to female scientists, namely Fielde and Buckingham. On closer analysis, this is not surprising in the least. Neither Fielde nor Buckingham married. In Wheeler's eyes, they must have appeared as allies in his fight to wrest science free of

134. Parker, "Biographical Memoir of Wheeler" (ref. 130), 207.

135. Wheeler, *Social Life among the Insects* (ref. 129), 70.

136. Quoted in Sleigh, *Six Legs Better* (ref. 3), 91.

137. *Ibid.*, 94.

the feminized domestic sphere. In fact, Fielde shared with Wheeler a disdain for “family men.” She once mocked an acquaintance as “an intense family man and therefore something of a bore. Disposed to always date events by domestic incidents; for instance ‘it was the year my Lillie had the whooping cough . . .’”<sup>138</sup> Fielde’s condescension toward “family men” likely had a feminist thrust, but it was not unrelated to Wheeler’s mockery of “conservative and contented” young bridegrooms.

With Wheeler, then, we have arrived at the end of the age of domestic entomology. By the time of his death in 1937, the analysis of insect behavior had been transformed from a household hobby into a field of expert science, and glass-sided nests remained popular primarily as children’s toys. Circa 1900, however, Wheeler was the exception that proved the rule. His contempt for family life reflected the circumstances of entomology in his youth. The vehemence with which he protested the influence of femininity and domesticity on science was an indicator of how much work was required to uproot entomology from the domestic sphere.

## CONCLUSION

This essay began by noting two shifts that took place between 1880 and 1920 that, at first glance, seem to have nothing in common. The first was the decline of a popular nineteenth-century genre that featured animals’ nests and dens as mirrors of bourgeois domestic norms. This was superseded by dramatic popular accounts of the behavior of insects living in “artificial” or “experimental” conditions in human homes. The second shift was conceptual: the mind sciences moved away from talk of “educability,” referring to the degree to which mind and behavior could be trained to new norms, and toward “plasticity,” the degree to which the nervous system could adapt to changing environmental conditions. I have argued that these shifts were related: the idea of plasticity developed in step with the practice of domestic entomology, which surged in popularity in these decades. Members of human households (or, as Forel would have it, “colonies”) contemplated their reflections in the eyes of insect colonies housed in glass. Domestic entomology transformed the nature of the family from a dictate of tradition into a question for research. It opened up to scrutiny the modes of interdependence that bound together a household

138. Quoted in Warren, *Adele Marion Fielde* (ref. 45), 86.

or colony. The mutual adaptability of human and insect members of a household challenged the assumption that there was anything natural or instinctive about domestic arrangements.

I have argued that these trends reflected and contributed to material feminism, the movement to redesign the household to achieve greater equality for women and domestic servants. In keeping with material feminism, domestic entomology emphasized the contributions of women and children to scientific labor. Entomologists, however, were less responsible about crediting domestic servants. Only Fabre did so consistently; Lubbock and Forel, only on occasion. Forel called publicly for improvements in the status of domestic servants in *The Sexual Question*, but it is unclear whether he implemented these measures in his own home.<sup>139</sup> Still, domestic entomology raised the status of domestic labor, blurring the line between scientific research and household work. From this perspective, it is telling that Wheeler made household labor an explicit target of his contempt. In an exchange about the evolutionary threat of the “social force,” Wheeler’s good friend, the botanist David Fairchild, echoed Wheeler’s hostility, complaining of the “emotional force which makes me afraid even to offend the chambermaid when she wants to come in and interrupt me and sweep this room[.] I’ve about come to the conclusion that I am as truly a slave as though I were bound by shackles.”<sup>140</sup> Writing from his faux-colonial estate in Coconut Grove, Florida, this remark belies the gender, race, and class bias that bound these two privileged men together.

Insect societies thus taught different lessons to different researchers. Fielde and Forel, despite their racist politics, were convinced that they had demonstrated the potential of ants of different “races” to live together amicably. In the eyes of Frisch and Wheeler, by contrast, the result of mixing ant “races” was warfare and slavery.

Domestic entomology shared the selective iconoclasm of material feminism, including its racial and class biases. This affinity was apparent at the time, as Gilman’s admiration for Fielde suggests, and as Forel’s *The Sexual Question* confirms. And yet, unlike Fielde and Forel, Darwinian feminists like Gilman and Schreiner seem to have defended strenuously against sympathy for the

139. He does mention in his autobiography an “old maid-servant” who lived with his family “as a sort of pensioner . . . and was more like a relation than a servant,” but expressions like this were often no more than self-congratulatory tropes of nineteenth-century bourgeois self-presentation. Auguste Forel, *Out of my life and work*, trans. Bernard Miall (New York: Norton, 1937), 49.

140. Quoted in Sleight, *Six Legs Better* (ref. 3), 91.

“lower” organisms. In the eyes of the material feminists, the role of entomology was to document the instinctive behaviors that feminism would have to resist. They could not imagine that the *practice* of entomology might contribute to a more intentional form of domesticity. In Gilman’s “The Yellow Wall Paper,” for instance, confinement to the home compels the narrator’s identification with the creature “creeping” behind the pattern of the wallpaper.<sup>141</sup> Gilman’s feminism was premised on escaping an evolutionary past that, she believed, lived on in both the bourgeois home and insect societies.

Gilman’s legacy in turn survives in the fiction of A. S. Byatt. *Morpho Eugenia* ends with Crompton and Adamson fleeing the country estate on a ship bound for the Amazon. The ending thus mirrors the opinion of a naturalist whom Adamson encountered in the jungle, who was convinced of the ill effects “of the very high elaboration of the social instinct which developed . . . from the family, the relations of mother and child, the protective gathering of the primal groups.”<sup>142</sup> Notably, Byatt has not tried to hide her personal distaste for domestic life, admitting in an interview that her “greatest terror” is “simple domesticity”: “I had this image of coming out from under and seeing the light for a bit and then being shut in a kitchen, which I think happened to women of my generation.”<sup>143</sup> Note her subterranean imagery: the home as ant colony. Yet the novel’s only alternative is a vague colonial fantasy of escape. What if Crompton and Adamson had instead channeled their rage at Victorian hypocrisy into an experimental multispecies household of their own?

This question resonates at a moment when COVID-19 has made it difficult for those of us lucky enough to have homes to escape from them. Until the pandemic forced many scientists and intellectuals to work from home, it seemed intuitive that the home and the laboratory represent two mutually exclusive domains of existence. Being a scientist would seem to depend on a spatial divide between the messy entanglements of private life and the controlled space of scientific experimentation. The lab is the site of the scientific production of novelty; the home, by contrast, is the site of social reproduction. The functions of these two spaces could not be more different: the laboratory

141. Malinowska, “Gilman’s Fungal Female Animal” (ref. 41), 271, discussing Charlotte Perkins Gilman’s “The Yellow Wall Paper” (1892).

142. Byatt, *Angels and Insects* (ref. 31), 51.

143. Interview with A. S. Byatt by Sam Leith, *The Guardian*, 24 April 2009. On Sylvia Plath’s poetic use of bees to illustrate her own ambivalence about domesticity, see Janine Rogers and Charlotte Sleight, “‘Here is my Honey-Machine’: Sylvia Plath and the Mereology of the Beehive,” *The Review of English Studies*, New Series 63 (2012): 293–310.



innovates, the home conserves. This essay has sought to historicize that contrast between the innovative character of the laboratory and the conservative character of the home, by returning to the moment in the late nineteenth century when the conservative force of the home first became a target of feminist critique.

The essayist Helen MacDonald noted early on in the pandemic that people seemed to be spending a great deal of their time in isolation watching internet videos of animals. She speculated that a focus on animals might create “a space for us to imagine the new world that will come when this crisis is over, a space that might allow us not only to rethink how we relate to the natural world but to one another.”<sup>144</sup> It is in this spirit that I have invited readers to visit the experimental multispecies households of the turn of the twentieth century. My hope is that the example of domestic entomology can help to defamiliarize our own domestic spaces, encouraging a more deliberate and reflexive attitude to the household experiment that we call sheltering in place.

#### ACKNOWLEDGEMENTS

For helpful feedback on earlier drafts, the author would like to thank Lorraine Daston, Evan Hepler-Smith, Anin Luo, Abigail Lustig, Lynn Nyhart, Richard Prum, Charlotte Sleight, Nasser Zakariya, and members of the History of Science, Medicine, and Technology Program at the University of Wisconsin, Madison.

144. Helen MacDonald, “Animals are Rewilding our Cities,” *New York Times*, 15 Apr 2020.