

Introduction to “Working at the Margins: Labor and the Politics of Participation in Natural History, 1700–1830”**

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“Reason incurred an enormous debt for the labors of its cultivation.”¹

Georg Forster, 1791

1. Introduction: A Very Curious Cabinet

This special issue seeks to understand natural history from the perspective of those for whom making knowledge was part of making a living, and to highlight the labor regimes – free and forced, from households to plantations – that sustained natural knowledge economies in Europe and its colonies through the long eighteenth century. Natural history was a broad but increasingly systematic field of study pursued variously out of medicinal, leisurely, and imperial interests, which involved the collection, classification, and commercialization of natural objects. It is sometimes assumed, then, that natural history was practiced exclusively by European and settler elites in this period. But this is itself an image that naturalists of the educated classes carefully cultivated, and which historians have significantly revised in recent years.²

Drawing upon some of the most energetic currents in the history of science, this issue proposes that the study of labor – encompassing a range of mental and manual activities – offers a useful, comparative framework for understanding how actors of diverse social strata participated in the collective enterprise of natural history. Wary of the limitations of what has been called “salvage biography,” which risks overrepresenting the agency of subaltern actors who contributed to European scientific enterprises, a focus on the *worksapes* of natural history instead points to the rules as well as the exceptions: histories not only of naturalists’ engagement with non-elite knowledge, but also of the larger systems of slave labor, peasant farming, family inheritance, workshop

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¹ Forster 1791 [1791], Chapter XXV, on 465.

² On the many social “worlds of natural history,” see Curry et al. 2018.

production, and colonial expansion that underpinned natural inquiry through the long eighteenth century.³

The approach taken here begins, therefore, with a perspectival shift to marginal spaces and actors that were in fact central to natural history. Consider a little-known example of a well-known institution: a natural history cabinet in the mountains of the Fränkische Schweiz north of Nuremberg. Like all cabinets of the sort, this was a space teeming with naturalia, where prominent men of learning – the President of the Leopoldina Academy of Sciences, Johann Christian von Schreber, for instance, as well as savants and writers like Alexander von Humboldt and Wilhelm Heinrich Wackenroder and geologists from France and England – came to exchange ideas and objects.⁴ “His treasures are spread about in a small room,” one visitor wrote of the cabinet in 1793, “fossils, teeth, jawbones, whole heads of unknown beasts and other petrified artifacts,” noting also the supply chains of natural objects its owner facilitated to “nearly all the natural history cabinets within and without Germany.”⁵ Nearly three decades later, another visitor set the scene to verse:

<i>Indessen will ich euch gesteh'n,</i>	<i>But I must confess to you,</i>
<i>Beschreiben ist gar schwer</i>	<i>It defies description,</i>
<i>Ein Kabinet, – sollt's selbsten seh'n,</i>	<i>A cabinet, – one should see for one's self</i>
<i>Deshalb kommt nur hierher.</i>	<i>Come here, therefore.</i>
<i>Gar viele rare Stalaktit,</i>	<i>A great many stalagmites,</i>
<i>Spath, Kristal, Warzenstein,</i>	<i>Spar, crystal, sea urchin,</i>
<i>Viel Pektiniten und Fungit'</i>	<i>Pectinites and fungites besides</i>
<i>Da kommen zum Vorschein.</i>	<i>All brought to light.</i>
<i>Echiniten, Amoniten etc.</i>	<i>Echinites, ammonites etc.</i>
<i>Eisbären – Köpf, Kinnlad, Zähn,</i>	<i>Polar bear skulls, jaws, teeth,</i>
<i>Und dergleichen – iten – iten –</i>	<i>And more – ites – ites galore</i>
<i>Kann man in Meng hier sehn.</i>	<i>Can one here see.</i>

But the owner' of this most curious cabinet was not, like its visitors, a man of erudition; and the cabinet itself was said to be inside a “rickety little hut” in the highland village of Muggendorf.⁶ In fact, the collection originally belonged to Johann Georg Wunder (1726–1799), a wainwright who, with his wife and children, pursued a business in natural history alongside the family's traditional

³ On salvage biography and its alternatives, see Driver 2015, on 25–26. The workscape concept is drawn from Andrews 2008, on 123–27, and discussed in Section 3 of this Introduction.

⁴ Schreber was one of several Erlangen University professors and students who worked closely with the Wunder family. As such, both the University's natural history cabinet, which acquired Schreber's own collections after his death, and the later natural history museum in Erlangen had close ties to the Wunder family cabinet. On Schreber, the collections in Erlangen, and natural history collecting in the eighteenth century more generally, see Müller 2020, esp. 44, 175–77, 185.

⁵ “Siebenter Brief. Streitberg, am 11. August 1793,” in Köppel 1794, on 67–68, reprinted in Köppel 1816, on 67–68.

⁶ The poetic account of the Wunders' “hübsches Kabinet” comes from Reiselsberger 1820, on 20–21, the same text that gave the region of Oberfranken its Romantic moniker, the “Fränkische Schweiz.”

wagon-making craft. The “cave-inspector,” as Wunder was called by local authorities, was succeeded by his son Ludwig (1771–1819) and his own wife and children. Altogether, three generations of Wunders guided travelers into the mountains of Muggendorf around the turn of the nineteenth century, curating limestone caverns and selling the natural curiosities they found there. Yet while urban savants profited from the highlanders’ stock of naturalia and local knowledge, producing one of the era’s most sensational “discoveries” of extinct megafauna, the Wunders themselves were said to live in such poverty that they must sometimes “starve.”⁷

The Wunder family vignette prompts questions about the social organization of natural history – its workaday practices, implicit labor relations, and asymmetrical exchanges – to which this issue offer answers. Spanning New Spain and the Caribbean, western and central Europe, we examine natural history as practiced within a wide range of workscapes, from urban households and engravers’ workshops to peasant farms, colonial botanic gardens, and slave plantations, including an Afterword on the work of native explorers in British India by **Tapsi Mathur**. Collectively, we analyze the “hierarchy of head and hand” – of the learned and the laboring – as reconfigured in different economies and environments.⁸ We are especially interested in contributing a new chapter to the study of the (in)visibility of marginal actors in the history of science. Yet this special issue also suggests that labor, as a unifying theme, has the virtue of understanding how a diverse set of practitioners – whether peasants or nobles, artisans or gardeners, indigenous or enslaved – navigated the uneven social terrain of natural history in the long eighteenth century.

2. Literatures: Histories of Science and Work

A chief aim of this special issue is to amplify a dialogue between the history of science and the history of work, especially as it promotes a more pluralistic account of the natural sciences. In recent years, historians of science have devoted considerable attention to what might be called the epistemic labor process.⁹ Scholars of early modern science have turned from canonical texts of the so-called Scientific Revolution and European Enlightenment to sites of “making and knowing” in the mechanical arts, like mines, manufactories, and workshops.¹⁰ Here knowledge was often embodied in the daily practices of

⁷ Baader 1797, on 134. On the Wunder family, see Illmann 2010, on 2–9. Muggendorf was well known in scientific circles across Europe for the fossil remains of a “cave bear” that Johann Christian Rosenmüller investigated there in close collaboration with the Wunders. It was first described as an *Eisbär* by Johann Friedrich Esper, as in Reiselsberger’s poem. See Rudwick 2005, on 271–275, 604–608 and Anthony 2021.

⁸ Roberts and Schaffer 2007, on xii.

⁹ For instance: Lefevre 2005; Hentschel 2008; Hecht 2012; Bangham and Kaplan 2016. On labor in eighteenth-century natural history, earth sciences, and travel, see Barnett 2019, Felten 2020, and Böttcher 2020, esp. Ch. 7 on the *Arbeitsbedingungen* of travel and collecting, as well as the *Arbeitsmodus* of travelers themselves on pp. 115–126.

¹⁰ Smith 2004; Klein and Spary 2010; Long 2011; Smith et al. 2014.

those who worked most intimately with natural forces and products. Likewise, in the modern period, it has been argued that “the power of science [...] lies in its ability to abstract and manipulate representations relevant to working world problems” in techno-economic arenas like communication, transportation, and administration.¹¹ And in the intermediate age of revolutions, Daniel Rood has recently called for a “global labor history of science” alive to the racialized division of labor that characterized Europeans’ extraction of knowledge from subjugated and enslaved people in colonial spaces.¹²

Such a history can draw upon deeper affinities between the fields it amalgamates. Both the history of science and the history of labor have undergone dramatic conceptual and geographic re-orientation in the past two decades. This parallel is partly due to the fact that their original foci – “science” and the “working class” – have common ancestry in western Europe in the early nineteenth century. “All core concepts of ‘traditional’ labour history are primarily based on experiences made in the North Atlantic region,” Andreas Eckert writes, advocating a self-reflexive global history of work that reevaluates the field’s (Marxian and Weberian) notions of free wage labor and the working-class as historically contingent artefacts. Advancing calls for a “Global Labour History,” which challenges the linear relationship between capitalism and wage labor, Eckert outlines a broad program of research into the “fuzzy boundaries” between free and unfree labor, the coexistence of multiple labor forms under capitalism (if not under a single roof), and the interplay between domestic and colonial labor regimes.¹³ The history of science has been similarly revised by global histories that challenge its own conceptual anchorage in the North Atlantic. In place of the older “colonial history” framework, laden with racist assumptions of a unilinear diffusion of knowledge from European metropole to imperial periphery, scholars have shown how those “European” sciences emerged through uneven collaborations with indigenous, enslaved, and colonized peoples. The reconfiguration of both Western and non-Western knowledges emerged through the violence of colonial and religious expansion.¹⁴

Histories of gender and invisibility are central to the dialogue we hope to amplify. Steven Shapin’s seminal article on “invisible technicians,” for instance, appeared at a moment when labor history was grappling with its own neglect of female-gendered labor, whose “domestic” or “traditional” image placed women workers outside the purview of the field’s preoccupation with working-class men and male-dominated labor movements. Shapin interpreted the

¹¹ Agar 2012, on 7. See also: Smith and Wise 1989; Wise and Smith 1989a; Wise and Smith 1989b; Wise and Smith 1990; Galison 2003.

¹² Rood 2016. See also Rood’s history of technology, labor, and race in Atlantic slavery in Rood 2017.

¹³ Eckert 2016, on 7, 15; Lucassen and van der Linden 1999, esp. 7; Lucassen 2006; Van der Linden 2008; Kocka 2010. On the “semantics of work” in transnational perspective, see Leonhard and Steinmetz 2016.

¹⁴ Some major works include Grove 1995; Sivasundaram 2005; Schiebinger and Swan 2005; Cañizares-Esguerra 2006; Raj 2007; Schaffer et al. 2009; Sivasundaram 2010; Tilley 2010; Chakrabarti 2020.

stubborn transparency of experimental workers in the history of science (and its historiography) as a measure of the value accorded to skilled labor.¹⁵ Earlier, Louise Tilly and Joan Scott had located the persistent social and political marginalization of women in “sex-segregated labor markets [...] that draw on and produce gender divisions of labor.” Indeed, they showed how “class” itself was first constructed as an implicitly masculine concept, which subordinated the welfare of women to that of men; and the same could be said of “science.” More recently, scholars have shown how the appropriation of reproductive labor in particular became ingrained in the very logic of capitalism and plantation slavery, naturalizing the (black) female body as an inhuman “machine for the production of new workers.”¹⁶ In the history of science, too, the “selective visibility” of certain actors and knowledges often hinged on the politics of gender and reproduction, the study of which has drawn considerable attention to the hidden work of women experimentalists, collectors, and travelers.¹⁷ Early modern empires worked hard to suppress botanical knowledge about abortifacients, which might undermine the population growth critical to their expansionist agendas.¹⁸ At the same time, colonial botanists consistently obscured the indigenous and enslaved workforces that filled Europe’s natural history cabinets and taxonomic tableaux.¹⁹ But as Lydia Barnett reminds us, “[n]ot all labor is invisible in the same way.” When eighteenth-century men of science *did* make natural-historical labor visible, their accounts often accorded with cultural norms of elite masculinity, carefully distinguishing mental and manual work.²⁰

Emphasis on the “dailiness” of knowledge production in the early modern world marks another opportunity for dialogue with histories of work that similarly stress its ubiquitous and elusive nature in the period. As most working people lacked occupational titles in seventeenth- and eighteenth-century Europe, so studies of labor in the period must be unbound by strict notions of job and employment. Most activity, both in and outside of the home, was part of making a living, Maria Ågren argues, employing a “verb-oriented method” to capture a richer spectrum of ways people documented labor (e.g. as “serving” or “helping”). Here work appears as a set of relations and dependencies, revealing how men and women often toiled alongside one another under the “two-supporter model” that prevailed prior to stricter sexual divisions of labor in the nineteenth century.²¹ Similarly unbound by “science” and its conventional actors and institutions, scholars have developed something of new normal science – an *Alltagsgeschichte des Wissens* – that explores the

¹⁵ Shapin 1989; Tilly and Scott 1987, on 7; Scott 1987; Stansell 1987. See also: Canning 1992; Canning 1996.

¹⁶ Federici 2004, on 12; Morgan 2004.

¹⁷ Bertucci 2013. On women’s participation in the natural sciences of the eighteenth and nineteenth centuries, see: Terrall 1995; Fara 2004; Gerassi-Navarro 2017. On the invisibility of women’s textile work and mathematical knowledge, see Harris 1997.

¹⁸ Schiebinger 2004, esp. 105–149.

¹⁹ Parrish 2008; Tilley 2010; Murphy 2011; Schiebinger 2017.

²⁰ Barnett 2019, on 246.

²¹ Ågren 2017, esp. 81–88. See also: Hafter 1995; Erickson 2005.

workaday activities of “ordinary” people engaged in the making of knowledge.²² The economy of “everyday” medicinal knowledge that circulated early modern households, the circulation of craft knowledge of metals in Europe’s mines, the “artisanal epistemology” of goldsmiths, alchemists, and woodworkers that defied Classical distinctions between *episteme* (knowledge) and *techné* (craft/art) – such ways of knowing, often embodied in material practices of production, now fall well within the purview of the historian of science.²³

The exchange between labor history and the history of science is perhaps most marked in studies of the early industrial period, when the coal-fired factory system accelerated the displacement, division, and discipline of labor.²⁴ In the decades around 1800, the various natural history earth sciences consolidated within cameralist and capitalist political economies, where problems of resource exhaustion and soil fertility were met with “rational principles” of labor administration.²⁵ Economists of the early nineteenth century made work the basis of material value. So, too, experimental communities in France came to believe that scientific knowledge hinged on the capacity of instruments, machines, and observers to manipulate natural forces, what John Tresch has called a “labor theory of knowledge.”²⁶ By mid-century, the values of industrial society saturated sciences from archaeology to astronomy, particularly in Britain where Wordsworth’s “Wardens of our Faculties/and Stewards of our Labour” brought work-discipline and panoptic oversight to factories and observatories alike.²⁷ As new forms of industrial capitalism imperiled the livelihood of artisans, so its likeness in science threatened the intellectual autonomy of working-class naturalists. In Lancashire around 1830, artisan botanists’ notions of “fair exchange” of specimens were formed by the experience of their increasing dependence on merchants. Independent handloom weavers thus met gentlemen botanists with the same skepticism they felt towards the “middlemen” who had driven their wages down.²⁸

This issue’s approach to natural history within the socio-economic arrangements of the long eighteenth century is informed by both traditions outlined above: one that explores the dailiness of science and work in the early modern world, another concerned with the translation of modern labor relations into scientific programs of observation, discipline, and exchange. In addition to its growing popularity as a leisurely pursuit, natural history was generally practiced within the framework of (o)economy in the eighteenth century, as reflected in

²² On the social history tradition of *Alltagsgeschichte*, see Lüdtké 1989 (or the English translation Lüdtké 1995).

²³ Smith 2004; Long 2011; Dym 2011; Smith et al. 2014; Fors 2015; Leong 2018; Hellawell 2020.

²⁴ See discussion of labor history and the discipline of scientific work in Roberts and Schaffer 2007, on xxii.

²⁵ See: Porter 1973; Withers 1994; Wakefield 2009; Jonsson 2010; Schaffer 2020; Anthony 2020.

²⁶ Tresch 2012, on 100–105. See also Sewell 1980.

²⁷ William Wordsworth, *The Prelude*, Book 5 as quoted in Thompson 1967, on 97 and Schaffer 1988, on 139; Bulstrode 2016.

²⁸ Secord 1994b, on 289.

popular appeals to “nature’s oeconomy.”²⁹ Even to its most celebrated conceptual architects, natural history’s role in medicine, manufacturing, empire, and slavery was self-evident and unproblematic. In 1790, a young Alexander von Humboldt echoed the sentiments of his generation and class in describing the transplantation of Tahitian breadfruit to the West Indies as “a more *benevolent* undertaking than had ever been attempted,” fully aware that the plant would be grown to sustain generations of enslaved laborers (emphasis original).³⁰ Employed in related projects of oeconomic administration, Humboldt later listed “the impact of food [on] the character [and] the history of navigations and wars carried out over the products of the plant kingdom” as “the factors that link the geography of plants to the political and intellectual history of mankind.”³¹ Humboldt’s identification of natural and human history marks this period apart from the later nineteenth-century creation of modern disciplines and designated spaces of natural research. By contrast, this issue engages natural history as embedded in the workscapes of its long eighteenth-century practitioners.

3. Approaches: Workscapes of Natural History

The articles in this special issue explore different relationships between working and knowing, authority and erasure, as they varied across time and space. They are particularly sensitive to the ways these relationships were reconfigured by actors of various social strata working within a diverse set of labor regimes from plantations and peasant farms to botanic gardens, households, and workshops. These spaces can be commonly understood as *workscapes* of natural history, a term we borrow from Thomas Andrews’s pioneering synthesis of labor history and environmental history. The workscape is “a constellation of ever-unfolding relationships,” Andrews writes:

not simply land, but also air and water, bodies and organisms, as well as the language people use to understand the world, and the lens of culture through which they make sense of and act on their surroundings. [...] workscapes straddle the material realities, the ways in which people have tried to perceive and direct the course of shifting realities, and the identities people have created out of these material and perceptual building blocks.³²

Historians of eighteenth-century science have already begun exploring new spaces of natural history beyond the familiar cabinet and garden, including spheres of practical activity like ships and quarries.³³ The spatial-labor approach

²⁹ On natural history’s various practical relationships to cameralism, mercantilism, oeconomy, and physiocracy, see: Koerner 2001; Cook 2007; Cowie 2011; Roberts 2014; Güttler 2015.

³⁰ Alexander von Humboldt to Paul Usteri, 27 June 1790, in Jahn and Lange 1973, on 97–98.

³¹ Humboldt and Bonpland 2009 [1805], on 71–72. On the breadfruit in plant geography and plantation botany, see Ogborn 2018 and the contribution of Williams in this issue. On Humboldt’s administrative projects, see Klein 2012a and Klein 2015.

³² Andrews 2008, on 125.

³³ Outram 1996; Parsons and Murphy 2012. See discussion of “worksites as fieldsites” in Barnett 2019.

articulated by Andrews may be especially useful to historians in explaining how these specific locales, and the work performed within them, shaped natural history's "politics of participation."

The politics of participation – of who counts as a knower – were strictly policed in Europe in the long eighteenth century, and still more severely disciplined in its colonies. Enlightenment classification schemes, which naturalized sexual and racial hierarchies, tended to subordinate "local knowledge" to the universal gaze prescribed by Linnaean taxonomy.³⁴ Later, in the nineteenth century, sober middle-class values deliberately obscured spaces of working-class science, as in the case of artisan botanists who linked "drinking and thinking" in Britain's pubs.³⁵ Throughout the long eighteenth century, then, European men of rank, education, and means defined the boundaries of natural history, whose customs drew upon and also reinforced ideas about race, gender, and social order.³⁶ Yet as this special issue emphasizes, these boundaries were neither uniform nor static, and one was rarely simply "in" or "out."

Our articles contribute to a wider geography of participation in eighteenth- and early nineteenth-century natural history. We show how the "steeply graded hierarchy of head and hand" was reconceived in different workscapes, generally steeper for colonial gardeners than for European farmers and artisans. Yet in some cases the usual division of mental and manual labor broke down altogether, as in botanic gardens in the British Caribbean where superintendents complained of having to work alongside enslaved gardeners.³⁷ It is also worth noting that the hierarchy of head and hand was amenable to learned naturalists who sometimes proved the utility of their knowledge by virtue of their proximity to laboring actors. In fact, natural history's utility in medicine, agriculture, manufacturing, and empire-building sometimes made laboring actors strikingly visible, affording certain *Praktiker* a degree of intellectual recognition within particular contexts.³⁸ It was around the turn of the nineteenth century, moreover, when European states, empires, and their scientific agents produced new administrative regimes designed to surveil and discipline working bodies, now rendered into "biopolitical citizens."³⁹ But the

³⁴ Bleichmar 2007.

³⁵ Secord 1994b. The invisibility of working actors and local informants in eighteenth-century natural history and travel is further analyzed in Burnett 2014, Barnett 2019, Böttcher 2020, esp. 342–346, 357–362, and Fagnani 2021.

³⁶ Schiebinger 1993, on 3–5. Compare discussion of the politics of participation to Secord 1994b, on 294–297.

³⁷ See Williams 2021 in this volume.

³⁸ See the example of Swiss farmers in Phillips 2021 in this volume. Compare also the case of enslaved gardeners on Mauritius credited with a degree of horticultural and medicinal knowledge in the eighteenth century (Brixius 2020), or of farmers and other members of rural society in northern Italy increasingly recognized for their knowledge of "useful plants" around the turn of the nineteenth century (Fagnani 2021). Often, however, those who "extracted" useful knowledge from manual laborers used the distinction between practice and theory to reinforce their social superiority over informants, as in the case of earth sciences that developed through the management of mines and miners' knowledge in Saxony (Felten 2020).

³⁹ For instance: Foucault 1995 [1975]; Broglio 2018.

same technologies of surveillance and cultures of “improvement” that made work visible in one place might efface it in another. Especially in colonial workspaces, the marginal actors who sustained natural inquiry tended to be documented only when their knowledge was perceived as an asset or a threat to Empire, their scientific labor valued in the form of meagre remuneration – if not in their purchase as slaves.

If “science” is not only formal knowledge but also its social organization and the embodied skill of those who practiced it, then natural history is also the systems of slave labor, peasant farming, workshop production, family inheritance, and colonial expansion that sustained it in the long eighteenth century. As **J’Nese Williams** demonstrates in “Plantation Botany,” much British natural history was practiced through and in the service of plantation slavery. Colonial botanic gardens in the British Empire, conceived as Enlightened agents in socio-environmental improvement, took the form of the labor regimes that they were designed to promote with new insights into the acclimatization of useful plants. They were built and tilled variously by ill-paid Indian gardeners under the severe administration of the British East India Company, by convicts in the penal colony of New South Wales, and by enslaved laborers in the Caribbean, sometimes under the aegis of the British War Office. Gardens powered by slave labor were, therefore, a theatre in the plantation economy’s “ever present state of war,” institutions that relied upon and also reinforced the very system of human bondage that they ostensibly sought to “improve.” Williams focuses on the case of the botanic garden on the island of St. Vincent, whose records reveal the perverse ways in which the botanical labor of enslaved men like “Washington” and “Mazaran” was valued: as chattel bought and sold.

Naturalists and agronomists across Europe and its colonies developed strategies for managing and marginalizing the workers on whom their gardens and reforms relied. But the epistemic authority accorded to laboring actors varied across the social and political topography of the eighteenth and early nineteenth centuries, emphasizing also the diversity and stratification within various subaltern communities. In the second half of the eighteenth century, cultural and political shifts made it possible for the educated classes in central Europe to re-imagine peasant farmers – or at least an idealized image of them – as part of national communities. As **Denise Phillips** shows in “Socrates on the Farm,” some rural farmers, like the celebrated Jakob Guyer, were seen as models for agricultural methods championed by reformers, even if many of the “new” practices of the so-called Agricultural Enlightenment were already well-known among farmers. Guyer’s case shows how the epistemic authority of educated reformers sometimes depended on their proximity to, not distance from, men of practical experience. A remarkable illustration of this is the *Bauerngespräche*, or “farmer’s conversations,” sponsored by Zürich’s Physical Society in an effort to source knowledge from ingenious peasants. Yet the Society, run by urban patricians, also limited Guyer’s participation, illustrating the asymmetry of the urban-rural knowledge exchange in which he participated. If “philosophical farmers” could be celebrated as knowers of nature

(*Naturkennner*) in the European Enlightenment, their intellectual equivalence to men of rank did not translate to social equity.

The work of natural history was not unique to sites of practical application and colonial expansion, as in the gardens and farmlands discussed above. More familiar natural-historical activities, like the collecting and illustrating of flora and fauna, also relied upon the experience and handiwork of men and women of various classes, much of it unacknowledged.⁴⁰ In fact, as **Dominik Hünninger** demonstrates in “Invisible Labour?” some naturalists even conceptualized their “intellectual and practical engagement with natural history within the semantic field of work.” Illustrated natural histories in particular took on a workshop-like production, sometimes involving twenty or more engravers. Thus one entomologist described “a separate room” in the home of Sir Joseph Banks “for the painters and copper engravers who work here continuously and daily.”⁴¹ Ranging from aristocratic naturalists like the Count de Réaumur to little-known artisan engravers like Johann Rudolf Schellenberg, Hünninger uses visual culture to emphasize the collective nature of insect studies and challenge assumptions about the transparency of these “daily workers.” Hünninger shows how entomology’s division of labor – digging, netting, preserving, dissecting, displaying, illustrating, engraving, and painting – was coded in the tropes and allegories of its visual media. Accordingly, engravers’ own claims to authority, as practitioners who perform both the manual and mental labor of natural history, appeared in an encrypted visual language.

Homes were another workscape of natural history. In early modern Europe, the household was not only a primary unit of economic production for spinning, metal-working, and other “cottage industries,” but also a significant site of chemical experimentation, medical investigation, and natural inquiry.⁴² Here, too, the social organization of science drew from existing labor relations and the social customs associated with them. In “Natural History as a Family Enterprise,” **Alix Cooper** explores the domestic working practices and kinship structure of eighteenth-century science, showing how traditions of inquiry, research agendas, unfinished books, and other forms of “intellectual capital” were passed from fathers to sons, as in other trades. Cooper shows how in families of both large and small means the “two-supporter” model of early modern European households could extend also to scientific pursuits: wives, daughters, and sons collaborated in natural history enterprises, though in a gendered division of labor that entailed a patrilineal inheritance of physical and intellectual capital. Surveying family enterprises across Europe and North America, close readings of epistolary exchanges within the Breynes of Danzig and the Bartrams of Philadelphia reveal how family relations sustained the

⁴⁰ On farmers, fisherman, quarrymen, miners, and other marginal, rural actors in eighteenth-century natural history, see: Burnett 2014; Barnett 2019; Fagnani 2021.

⁴¹ Johann Christian Fabricius (1784), as quoted in Hünninger in this issue.

⁴² On the significance of homes in early modern sciences, see: Shapin 1988; Cooper 2006; Harding 2014; Terrall 2015; Guerrini 2016; Werrett 2019. See also Brunner 1968, van Dülmen 1990, and Eibach 2011 on the concept of “das ganze Haus” and the household as a social and economic unit.

continuity of projects through generations.⁴³ In some cases, the kinship structure of science opened opportunities for artisan printers and collectors, as for educated women like Albertine de Saussure or Jeanne Baret, who navigated the strictures of family life to botanize in the Swiss Alps and across the Pacific.

In New Spain, natural history performed “the work of the Empire.” As **Anna Toledano** argues in “Forgotten Botany,” the Viceregal Botanical Garden founded in Mexico City in 1788 was designed as an agent of “taxonomic colonialism.” Ground plans show how the gardens themselves were divided into twenty-four beds, each representing one of the classes in Linnaeus’s *Systema Naturae*, in emulation of gardens designed by Linnaeus and his followers in Uppsala and Cambridge. But efforts to universalize European taxonomies were stifled by the fact that the Garden was always also an American institution staffed by Creole and native workers. In fact, the show of imperial strength in the Garden’s conquest of local nature, and especially of indigenous Nahuatl nomenclature, was precisely what made it a fragile institution. Hence the double-meaning of the article’s title: like the indigenous knowledge it sought to erase, the Garden was itself forgotten after Mexican Independence in 1821. To understand this agnotological process, Toledano presents a history of “the complex social fabric of the garden,” which highlights the role of Creole students and native gardeners in its efforts to extend European hegemony.⁴⁴ The garden’s political instrumentation is evidenced by the very obscurity into which it fell after the departure of the Spanish authorities who designed but did not cultivate it. By contrast, many home-grown natural history collections and museums continued to thrive in Latin America, exhibiting a new politics of knowledge and nomenclature befitting the age of revolutions.

4. Themes: Placing Epistemic Authority

The history of scientific work is closely linked to that of scientific authority. Natural philosophers of the seventeenth century devised social, material, and literary technologies that obscured the work and place of experimentation to establish its credibility.⁴⁵ By the eighteenth century, many educated Europeans believed, with the encyclopedists Diderot and D’Alembert, that “most of those engaged in the mechanical arts have embraced them only by necessity and *work only by instinct*. Hardly a dozen among a thousand can be found who are in a position to express themselves with some clarity upon the instrument they use

⁴³ Compare to Pearsall 2008, which argues that “family feeling” in eighteenth-century letters was not simply a convention or style of the period, but a practice of managing financial uncertainty and establishing credit, mediating hierarchies and political disputes, and coping with displacement and loss.

⁴⁴ On agnotology, the study of ignorance, in eighteenth-century botany, see Schiebinger 2004, on 226–241.

⁴⁵ Shapin and Schaffer 1985, esp. 76–79.

and the things they manufacture.”⁴⁶ Thus learned men demarcated the realm of philosophical knowledge (the domain of the savant) from that of practical know-how (the domain of the artisan). In natural history, too, when Buffon and other naturalists of his ilk wished to fashion themselves as “improving experts,” they determined “to create a new value for mental labor, one in which the superiority of mind over hand was emphasized.”⁴⁷ Some savants emphasized their conceptual labor to claim intellectual ownership: so the French mathematician La Condamine asserted his propriety over South American surveying stations, as over Spanish, native, and mestizo collaborators who allegedly performed non-conceptual labor “that did not entitle an individual to public recognition.”⁴⁸ The eighteenth century witnessed many such variations of “self-appointed mental workers” whose own labor claimed intellectual and social priority. “The very status of reliable knowledge in early modern Europe seemed often to hinge on its denial of cunning, technique and use,” Lissa Roberts and Simon Schaffer have written, while noting how the same “mental workers” often made their knowledge indispensable to states, empires, and markets.⁴⁹

In cameralists’ quest for knowledge useful to state-run mines and manufactories in Scandinavia and Germany, as in mercantilists’ plunder of the “green gold” that financed the Dutch, British, and French empires, natural scientists sometimes recognized a degree of practical expertise among Europe’s laboring and “low-born” as amongst black and indigenous informants throughout the colonies. But the “epistemic mercantilism” carried out by European naturalists also exhibited various strategies for marginalizing the local networks on which it relied.⁵⁰ As Kathleen Murphy writes of the eighteenth-century British Atlantic, colonial agents and settlers “represented such expertise merely as the raw materials out of which they fashioned new natural knowledge,” effacing individual knowers within homogenized knowledge communities.⁵¹ In travel writings of the period, indigenous guides and informants often figured as “bodily extensions of traveling scientists.” By summiting peaks and collecting specimens in their stead, Julia Böttcher writes, servants and assistants expanded European travelers’ “field of observation beyond their physical limits,” but were nonetheless subsumed by them in publications attributed to a single author.⁵² These accounts are consistent with the three-tiered division of scientific labor that Daniel Rood has described in the Atlantic world around

⁴⁶ D’Alembert 2009, emphasis added. See Bertucci 2017, on 7. As Bertucci observed, this particular passage was originally published in Denis Diderot’s *Prospectus* of 1750, but then reprinted in Jean-Baptiste le Rond D’Alembert’s *Preliminary Discourse* to the *Encyclopédie* in 1751. See also Ash 2010 on early modern claims to expertise, as distinguished from other practitioners by virtue of theoretical knowledge.

⁴⁷ Spary 2000, on 32–33.

⁴⁸ Safier 2008, on 44, 49–50.

⁴⁹ Roberts and Schaffer 2007, on xxiii.

⁵⁰ Bauer 2009, on 4.

⁵¹ Murphy 2011, on 30.

⁵² Böttcher 2020, on 345. Cf. 361–362 on such “asymmetrical labor relations” among European travelers and their collaborators.

the turn of the nineteenth century. As European and Creole naturalists saw it, “experiential knowledge” was to be (1) harvested from indigenous and enslaved people as raw, unrefined material, (2) processed by credible “guarantors and translators of suspect nonwhite natural knowledge,” and (3) finally divested of its dubious locality by virtue of its integration within taxonomic schemes and theoretical frameworks.⁵³

Crucially, though, the stark division of labor that separated head and hand, or “raw” and “unrefined” knowledge, belied a more complex picture of participation in the sciences. Helpful here are new histories that explore the ranks of such figures as *artistes* and “Naturforscher-Techniker” who deliberately combined erudition and experience, uniting philosophical and practical spheres, though not without significant resistance to the social mobility they represented. Claims to intellectual authority by woodcutters, metallurgists, pharmacists, and the like were, as Paola Bertucci has argued, fundamentally political acts.⁵⁴ Recent scholarship has also textured the “gentlemanly trust model” by which historians have conventionally understood epistemic authority in early modern science. Often, one’s credibility derived largely from their social standing, that is, from the ability to inhabit gentlemanly culture and embody its codes of conduct. Yet the natural-philosophical authority accorded to English seamen, for instance, challenges “a restrictive mono-model that locates trust in one sociocultural category and allows us to appreciate the multiple, and sometimes competing, claims to epistemological authority.” By exploring other “doers” in addition to seamen (like miners or husbandman), Philippa Hellowell argues, “[we can] collapse the boundary between thought and action, and head and hand, and can potentially open up the historiographical categories surrounding the different sorts of workers, and their associated modes of experience and expertise.”⁵⁵

Competing claims for authority echo through the workscapes of natural history in this special issue, too. Here, an expansive approach to natural history’s “doers” includes those who worked gardens and fields, and whose knowledge of nature was bound up in daily rhythms and seasonal cycles of work and subsistence, alongside the more conventional categories of collector and draftsman. Emphasizing the socially and geographically contingent nature of natural history’s division of labor, our articles reveal how different sites of (knowledge) production prescribed different conditions of possibility for participation, visibility, and authority.

Consider the distinct ways in which epistemic authority was recognized among, and sometimes claimed by, manual laborers on either side of the Atlantic. In **J’Nese Williams’s** study of the St. Vincent botanic garden, the cruel logic of plantation botany meant that the horticultural know-how of the enslaved gardener Washington was recognized and recorded only in the course of legal disputes over his ownership. Skill could also be recognized tacitly, as when the garden’s superintendent described the “great loss” that the death of

⁵³ Rood 2016, on 256–257.

⁵⁴ Klein 2012a; Klein 2012b; Klein 2016; Bertucci 2017, esp. 22.

⁵⁵ Hellowell 2020, on 49, 33–34. See also Shapin 1994.

another enslaved worker, Mazarán, would be for the institution. These records show how indispensable such actors were to botanical practice in the British Caribbean. The degradation and violence of plantation botany bears no likeness to the discipline to which artisanal draftsmen and engravers were subjected in Europe; but here too, in the workshops of Germany and Switzerland, production itself determined the possibilities for one's recognition as a maker of natural knowledge. **Dominik Hünninger** shows how engraver Johann Rudolf Schellenberg made the work of entomology highly visible, albeit in the form of winged putti wrangling larger-than-life insects. Schellenberg's plates illustrate how an artisan might use their craft as an instrument of self-assertion, or *Eigensinn* – a medium through which to evidence their own extensive knowledge and skill.⁵⁶ In Schellenberg's plates, moreover, labor was often given a leisurely gloss, reflecting the artisan's own social aspirations. **Alix Cooper** similarly shows how the woodworking skills that one Georg Knorr learned from his father ultimately provided an avenue to recognition among naturalists. That Knorr's name found a place in contemporary lexica of *Gelehrten* shows how the more labor-intensive handiwork of natural history (the cranking of printing presses and carving of copper plates) was not strictly demarcated from the learned world of exchanging, displaying, and classifying specimens. In Europe and its colonies, botanical skill and artisanal technique sometimes allowed both free and forced laborers a degree of social traction, though social mobility, too, was largely determined by the relative coercion of the labor relations in which they operated.⁵⁷

Another factor in the relative authority of gardeners, farmers, and other laborers was the degree to which intellectual and administrative authorities perceived “local knowledge” as a resource or a threat. It has been argued that Linnaean taxonomy in particular flattened regional diversity, resulting in “local blind spots” and a strict hierarchy that privileged the global gaze of European naturalists over the allegedly partial sight of *other* knowledge communities.⁵⁸ The conventions of natural-historical illustration further obscured the many places and people involved in collecting, just as portraiture emphasized the supposedly solitary act of a naturalist's taxonomic endeavors.⁵⁹ Yet these arguments should be read in dialogue with the “hyperlocalism” evident in regional botanical monographs and earth histories around 1800.⁶⁰ Indeed, a widespread emphasis on local knowledge and indigeneity in natural history was often implicated in larger processes of erasure, commoditization, and globalization. In the Indian Ocean world, where Western empires sought to assert

⁵⁶ On *Eigensinn* in the history of everyday life, see: Lütke 1994; Lütke 1995.

⁵⁷ Consider the argument in Brixius 2020 that enslaved gardeners' knowledge of cultivation “determined a slave's hierarchal rank” on Mauritius and sometimes made possible a degree of social mobility.

⁵⁸ Bleichmar 2007. See also Murphy 2011. The emphasis on local knowledge in the Linnaean program is discussed in: Rausing 2003; Jonsson 2013, on 57–62; Hodacs 2016; Hodacs et al. 2018, esp. 13–15.

⁵⁹ Bleichmar 2011, esp. 386–392.

⁶⁰ On the “hyperlocalism” of natural history around 1800, see Yale 2016, on 4 and Jardine 1999, on 479.

themselves within an “already existing world of commerce,” bankers, merchants, craftsmen, and other “skilled workmen” were indispensable to European “negotiations with local Asian groups.” As Kapil Raj writes, “Indian painters and draftsmen were now employed on a massive scale in these colonial institutions for executing maps, landscapes, and some of the great herbals of the late eighteenth and early nineteenth centuries.”⁶¹ In Europe, the importation of spices, medicines, and cash crops from colonies and overseas markets prompted a veritable craze for “indigenous” naturalia, particularly amongst naturalists and physicians in landlocked central European states that now had to compete with an emerging global economy.⁶²

In colonial spaces the very imposition of European scientific agendas required local knowledge, resources, and institutions. As **Tapsi Mathur** writes of British India, imperial surveillance consisted in its ability to “evacuate particularity and impose the abstraction of the British statute mile that saw its apogee in a map”; and maps, in turn, depended on the work of Indian explorers and surveyors.⁶³ Colonists’ reliance upon and erasure of local populations had many variations. On St. Vincent, as **J’Nese Williams** shows, the botanic garden’s superintendent attributed the abundance of gardens kept by enslaved workers to nature itself, but then adopted their practices as his own. In Guatemala, even the “localist epistemology” of Bourbon reformers, whose “geographic reports” privileged specific “territories of intervention,” coded natives as *naturales* subject to the same discipline they wished to impose on local environments.⁶⁴ Turning north to New Spain, **Anna Toledano** shows how the very erasure of local knowledge relied upon the “presence” of native labor. Ledgers of the botanic garden in Mexico City reveal that native gardeners (remunerated yet listed alongside pack mules) were indispensable to its imperious designs. Yet the garden’s instability as a system of colonial power is also underscored by the fact that its Creole students and managers were generally sympathetic to the medicinal utility of Nahuatl taxonomy – and to the Mexican independence movement.

In some cases, natural history’s laborers were not effaced altogether but idealized and instrumentalized. In central Europe, educated reformers tended to emphasize peasant expertise in agriculture precisely because of its local utility. Here, as Denise Phillips shows, the “local knowledge” of the lower orders was not injurious to the credibility of the patricians who marshalled it. Instead, some agricultural reformers even claimed to have gotten their expertise straight “from the mouths of farmers.” Around the turn of the nineteenth century, in fact, as the Latinate culture of the Old Regime’s “learned estate” gradually gave way to the more expansive sociability of a “learned world,” many natural history societies began to admit artisans, gardeners, and other

⁶¹ Raj 2007, on 30, 58–59.

⁶² Cooper 2007, esp. 12–14.

⁶³ Mathur 2018, on 57.

⁶⁴ Brockmann 2020, on 2–5, 15, 30–31.

men of practical experience.⁶⁵ This reconfiguration gave considerable space to particular farmers whom reformers viewed as valuable, and individually differentiated, sources of knowledge, but whose carefully constructed image also reflected the ambitions of a bourgeois-aristocratic coalition coming into power. In the very act of recognizing the “philosophical” merit of agronomic experimentation amongst the farmers of Bern, reformers reconfigured rural actors as expressions of their own ideas about order and enlightenment, glossed over with the pastoralism of Haller or the primitivism of Rousseau.

Such sources may ultimately reveal more about learned views of labor than they do about laborers’ own lives. Yet we are inspired by those who insist on understanding natural history in working spaces, if not on workers’ own terms; and on asking, from this standpoint, to what extent educated gentlemen might have been “regarded as just another link (albeit a very useful one) in their own networks.”⁶⁶ In the same vein, **Denise Phillips** captures the spirit of this issue in interpreting the farmer Guyer as a “useful guide to [...] the multivocal traces of rural people that always jostled alongside elite claims to epistemic priority.”⁶⁷ We hope this special issue, in turn, will offer a useful guide for further inquiry into the multivocal workspaces of natural history.

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⁶⁵ On the expanding ranks of the “learned world” of German natural history, see Phillips 2012, on 60–72.

⁶⁶ Secord 1994a, on 407.

⁶⁷ Phillips in this issue.

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